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National Testing of the Nursing-Kids Intensity of Care Survey for Pediatric Long-term Care

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ABSTRACT

Purpose: The purpose of this study is to test the Nursing–Kids Intensity of Care, a measure of the intensity of nursing care needs, defined as the quantity and type of direct and indirect care activities performed by caregivers in a national sample.
Design and Methods: A 40-item tool previously tested in a small sample was psychometrically tested on a sample of 116 children with complex medical conditions by 33 nurse raters across 11 pediatric sites.
Results: The Nursing-Kids Intensity of Care tool demonstrated components of usability, feasibility, inter-rater, test-retest and internal consistency reliability and construct validity in the national study sample.
Conclusions: Additional testing to further establish psychometric sufficiency and expanded use to quantify the intensity of nursing care needs of children with complex medical conditions in pediatric long-term care settings is recommended.
Practice Implications: This novel measure could assist the nursing administrators, educators and staff of pediatric long-term care facilities assess the intensity of care needs of their residents.

Purpose

The number of children with chronic, complex medical conditions (CMC) has increased substantially over the past decade due to medical advances and increased survival (Hall, 2011). In the United States (US), there are an estimated 11 million children with special needs of whom as many as 29,000 reside in a pediatric long-term care facility (Caicedo, 2015; Cohen et al., 2011; Friedman & Kalichman, 2014; Hall, 2011). There are an estimated 100 pediatric long term care facilities in the U.S. (Larson, Cohen, Murray, & Saiman, 2014). The care needs of these children are distinct and dependent on the nature of each child's physical, functional, and developmental status and need for invasive, supportive or assistive devices and care (Cohen et al., 2011; Friedman & Kalichman, 2014). For example, assistive orthotic devices, frequent respiratory suctioning, gastro-enteral feedings, behavioral therapy, or palliative care may be needed. Underlying medical diagnoses of children with CMC may include cystic fibrosis, oncologic diseases, congenital anomalies, multi-system disorders and other conditions that determine these special needs (Cohen et al., 2011; Friedman & Kalichman, 2014). Consequently, planning and providing sufficient care services and appropriate human and material resources are challenging and dependent on many factors, including the intensity of each child's care needs. Nursing intensity was defined as the direct and indirect patient care activities performed by caregivers and included factors that had an impact on the level of work required to perform those activities.

Unfortunately, nursing needs of the children with CMC are not well described, inconsistent definitions are used, and have been measured with tools designed for adults (Navarra et al., 2016). The development and testing of a measure to help quantify the characteristics and intensity of nursing care needs is an important precursor to care planning and appropriate allocation of resources. The Nursing-Kids Intensity of Care Survey (N-KICS) was designed to begin to address this gap and assess intensity of nursing care for pediatric residents of long-term care (LTC) facilities with CMC and its initial development, testing and use were recently reported (Navarra et al., 2016). In brief, in an iterative process pilot testing and item identification was performed followed by field testing and data collection at three sites. Results of testing the N-KICS at three pediatric LTC facilities confirmed an acceptable standard

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for limited reliability and validity and feasibility by interrater reliability and face validity when used for clinical and research purposes.

However, additional testing of the N-KICS with larger, varied samples was needed and a logical next step to confirm generalizability and determine whether expanded use is warranted and ascertain if the tool is useable and feasible for widespread clinical use. Therefore, the primary aim of this study was to assess components of validity and reliability of the N-KICS for children with CMC in a national sample of pediatric LTC settings and the secondary aim was to test the usability and feasibility of the instrument.

Methods and Procedures

Study Design and Setting

Testing of the N-KICS was conducted at clinical affiliates of the Pediatric Complex Care Association (PCCA, http://pediatriccomplexcare.org) by registered nurses (RNs) and nurse managers caring for children with CMC in pediatric LTC facilities. Facilities met the following criteria: minimum of 25 licensed beds, provision of care to children requiring long-term care (average stay of at least 2–3 months), willingness to collaborate, and commitment to have data collected by RNs who worked in a pediatric LTC facility for a minimum of one year. Recruitment of clinical sites occurred during the Annual PCCA Conference (2014) using focus group meetings to describe the nature and purpose of this study to potential participants. The annual PCCA educational conference includes presentations on evidence based practices, research, innovative programs, services and practices to improve care for the pediatric complex care population. Attendees include nurses, administrators, physicians, social workers, educators, and occupational, speech and physical therapists. Additionally, flyers describing the study were distributed during the PCAA meeting to recruit sites not participating in focus groups. PCCA attendees provided contact information to the research team if they were interested in volunteering to test the N-KICS tool. Word-of-mouth also yielded additional participants who contacted the study team after learning of the study through their personal and professional networks, including the PCCA's research committee. We sought to recruit a convenience sample for this exploratory study of 10–15 sites, or 10–15% of an estimated 100 such facilities in the US.

In each facility, the N-KICS tool was used by two nurse clinicians to score patient records and one nurse manager to provide a subjective rating. Inclusion criteria for the two nurse clinicians per site were RN staff members who provided direct clinical care to pediatric patients with CMC who had similar education (diploma, baccalaureate, masters) and duration of work experience (<5 years, 5–10 years, or >10 years).

Medical records selected to be scored by N-KICS included pediatric residents 21 years of age or younger with an expected length of stay in the pediatric LTC facility for ≥60 days and had not experienced a significant change in condition over the last 30 days. The sample size of pediatric residents at each site was determined using the following criteria: facilities with ≤100 beds included a sample of at least 10 residents and facilities with >100 beds sampled 10% of their total resident population. These criteria were chosen as the tool was designed to measure ongoing intensity representative of nursing care needs over the previous 30 days, rather than acute changes in care needs, in this long-term care population. Sites were instructed to randomly select records for review after establishing the record met inclusion criteria. Demographic information of children was not collected from medical records.

N-KICS Measures

Nursing intensity was defined as the direct and indirect care activities (such as administering medications, performing wound care and providing family education, coordination of services, respectively), performed by caregivers and included factors that had an impact on the level of work required to perform those activities. The theorized dimensions of nursing intensity included: severity of illness, complexity of care, patient dependency and time needed to provide care. The initial development and pilot testing of the tool has been described elsewhere (Navarra et al., 2016). Briefly, N-KICS is a 40 item pen and paper tool that asks nurses to select the number (range 1 through 4) best representing a pediatric resident's care needs during the past 30 days. Definitions for each care need and corresponding score values (including writing in "not applicable") were provided on the tool. The possible range follows content mapping and content expert review in which items were assigned different ranges; by example vital signs is scored 2–4, whereas escort for school attendance is scored 1–4 and stoma care is scored as 1 or 2, to enable quantification of unequal intensity (*Appendix* Nursing-Kids Intensity of Care Survey (N-KICS) Tool). For all items, higher scores suggest increased nursing care needs; the possible range of the composite score was 19–104. The time to complete each evaluation was estimated to be 15 to 20 min. In prior testing this tool demonstrated inter-rater reliability (Pearson's correlation coefficients ≥0.85), face, construct and content validity by content mapping, expert panel and statistical significant relationships between subjective and objective ratings ($p < 0.05$).

Data Collection and Procedures

The Institutional Review Board of Columbia University Medical Center approved this study. After identification of participating sites and completing any facility specific institutional review board approvals, the participants received one-on-one and small group training via teleconferences that included individualized sampling strategy clarification for sites. A tutorial for scoring the N-KICS tool, study logistics and data management was also provided. Participants reached 100% scoring reliability through training with the principal investigator using examples cases prior to use in the field. To characterize the study sites and participants each site completed an information sheet that included facility size; geographic location; and nurse clinicians' education and duration of experience in pediatric LTC.

The nurse raters were instructed to select the medical records as follows. To assure that there is no bias in which children are scored, we requested they be selected by sampling from an alphabetized list or by a list of their sequential medical record numbers. For example, if they needed to score 10 children and have 100 beds, select every 10th child from the list.

At each site, two nurse clinicians independently used N-KICS to assess the care needs of the same children. Each child's care needs were assessed twice by each nurse, with an approximate one-week interval between assessments. To establish translational construct validity, that is how well the construct is translated by face and content validity, the nurse manager also independently rated the intensity of care needs of the children (once) by using the N-KICS tool and subjectively categorizing each child's care needs into one of three groups: low, average, or high intensity of care needs (DeVon et al., 2007). All these data were collected between February and July of 2015.

In addition to the field testing, a follow up 1.5 h interactive session was conducted with conference participants during the PCCA Annual Conference in November 2015 to ascertain their perceptions on ease of use; applicability to them; duration to complete; and intent to use. Conference participants were provided with information on the study and informed if they choose to participate that would indicate consent and their information would be included as additional study data. To simulate the use of N-KICS for medical record review two case study vignettes were designed by two physicians trained in research and familiar with the pediatric LTC population. These case studies were pretested with the research team and following minor modifications to the case studies they were presented at PCCA and tested using the N-KICS by administrators, direct care providers and other staff from a variety of pediatric LTC, clinic, and care settings attending the session to

Table 1
N-KICS item-analysis and scale internal consistency.

Item	Scale reliability (α) when item removed			
	Time 1 Rater 1 (n = 116)	Time 1 Rater 2 (n = 105)	Time 2 Rater 1 (n = 114)	Time 2 Rater 2 (n = 106)
Vital signs	0.76	0.69	0.74	0.73
Weight	0.77	0.70	0.74	0.74
Observation	0.77	0.70	0.74	0.74
Bathing	0.75	0.69	0.73	0.73
Mouth care	0.75	0.70	0.73	0.73
Functional status - ambulation/mobility	0.75	0.70	0.72	0.73
Escort for school attendance	0.77	0.70	0.74	0.73
Escort for clinic visits	0.76	0.70	0.74	0.74
Nutritional support with meals	0.76	0.70	0.73	0.73
Nutritional support with bottle feeds	0.76	0.69	0.73	0.74
Nutritional interventions	0.77	0.70	0.73	0.73
Intake and output	0.77	0.72	0.74	0.73
Elimination – diapers	0.77	0.71	0.74	0.74
Elimination – urinary catheter	0.76	0.70	0.74	0.75
Stoma care (GT/JT- gastrostomy/jejunostomy)	0.76	0.69	0.73	0.72
Ostomy care (check stoma, skin condition, fecal matter, adherence of pouch)	0.76	0.70	0.74	0.74
Pulse oximetry monitoring	0.74	0.67	0.71	0.72
Respiratory support-non-invasive: CPAP, BIPAP, O_2 therapy	0.75	0.68	0.71	0.73
Respiratory support-invasive ventilator with endotracheal tube or tracheotomy	0.75	0.68	0.71	0.72
Respiratory care – suctioning (oral, nasal and or trachea)	0.74	0.68	0.71	0.70
Respiratory – trachea care	0.74	0.68	0.71	0.71
Respiratory care – chest therapy	0.74	0.68	0.72	0.72
Neurologic – seizure disorder	0.76	0.70	0.74	0.74
Infection control	0.77	0.70	0.74	0.75
Pain management	0.77	0.70	0.73	0.74
Family/resident education	0.76	0.72	0.73	0.73
Medications (given PO, GT, NG)	0.75	0.69	0.72	0.74
Medications (given via IV/central line)	0.77	0.72	0.74	0.74
Medications - inhaled	0.75	0.69	0.71	0.73
Mobility devices	0.76	0.69	0.73	0.74
Standing program (older children)	0.77	0.71	0.74	0.74
Positioning therapy (infants)	0.77	0.70	0.74	0.73
Skin care – pressure ulcers	0.77	0.71	0.74	0.74
Skin care - cast care	[a]	[a]	[a]	[a]
Skin care - burns	[a]	[a]	[a]	[a]
Laboratory collection and monitoring	0.77	0.71	0.73	0.73
Diabetes/glucose monitoring	[a]	0.72	0.74	0.74
Hearing, speech & vision	0.76	0.70	0.73	0.74
Behavior	0.77	0.71	0.73	0.74
Palliative support	0.76	0.71	0.73	0.74
Total scale	0.77	0.70	0.74	0.74

[a] Denotes item dropped from analysis secondary to no observations. Note: sample size differs due to two missing responses between Time 1 and Time 2 for Rater 1 and 1 missing response between Time 1 and Time 2 for Rater 2.

further ascertain the usability, feasibility and planned and potential use of the N-KICS tool.

Data Analysis

Statistical analysis was performed using STATA/MP software (version 12.1, 2011, StataCorp LP, College Station, TX). All data were checked for missing data and completeness, which were confirmed to be non-problematic. Therefore, no data imputation was performed. Total scores were computed per child per nurse clinician rater at both time one and time two (approximately one week apart). Demographic data and intensity scores were descriptively analyzed and bivariate analyses were used to compare scores between nurse clinician raters. Test-retest reliability was examined with Pearson correlations between time one and time two (one week interval) for each nurse clinician rater. Inter-rater reliability was examined with Pearson correlations between the two nurse clinicians with comparable education and experience who rated each child's care needs comparing the composite N-KICS scores between the RNs. Internal consistency reliability was examined by calculating the Cronbach's alpha statistic. Construct validity was explored to examine if there was correlation in the hypothesized direction of the tool by examining the relationship between the nurse managers' subjective rating of low, average, or high intensity and the composite score a nurse clinician rated the same child's care needs. (Waltz, Strickland, & Lenz, 2005; Westen & Rosenthal, 2003).

Results

Eleven pediatric LTC sites participated, representing all U.S. census regions, predominantly the Northeast (n = 5; 45.5%), followed by the South (n = 3; 27.3%), Midwest (n = 2; 18.2%) and West (n = 1; 9%). The average bed size of the facilities was 60 (range 26–97 beds). Thirty-three nurse raters (including both clinician and managers) participated; of the 28 of who provided complete demographic information the majority had >10 years of experience (48%), followed by 5–10 years (27%) and <5 years (24%), and 75% attained a bachelors, 14% a masters and 11% an associate degree. These 33 Raters across 11 sites scored 116 unique medical records at two times, completing a total of 464 surveys, 11 surveys were missing some item level data, and no data were imputed.

Table 2
Construct validity by nurse manager subjective and nurse objective ratings.

	Time 1 Rater 1	Time 1 Rater 2	Time 2 Rater 1	Time 2 Rater 2
Total number categorized as "High" by nurse manager	Number scored "High" (≥54.5)			
51	58	69	54	67
Total number categorized as "Standard"/"Low" by nurse manager	Number scored "Low/Standard" (<54.5)			
65	58	47	62	49
Pearson chi χ^2	21.87*	8.53*	21.13*	10.47*

* Significant at $p < 0.001$.

Reliability and Validity

The mean composite intensity scores of the residents sampled and scored by the nurse clinicians using N-KICS ranged from 18 to 80 ($M = 53.93$, $SD = 13.07$) and 26–82 ($M = 53.55$, $SD = 12.43$), at time one and two respectively. Inter-rater reliability between the two raters at each site was calculated using the composite N-KICS scores of 116 children and demonstrated statistically significant correlations by Pearson's correlation coefficient at both time one ($r = 0.87$, $p < 0.05$) and time two ($r = 0.89$, $p < 0.05$). Test–retest reliability correlations by Pearson's correlation coefficient were conducted using the total composite scores from both T1 and T2. Statistical significance the first ($r = 0.95$, $p < 0.05$) and second ($r = 0.97$, $p < 0.05$) groups of raters was demonstrated for each site.

The N-KICS scale demonstrated internal consistency reliability (Cronbach's alpha >0.70), adequate for new tool standards (Waltz et al., 2005), (Table 1). Item-analysis was conducted to ascertain the effect of eliminating individual items on the scale internal consistency. This analysis indicated that with exception of two items, burn and cast care, all items should be retained, as there was no appreciable effect on total scale reliability (AERA, 2014; Waltz et al., 2005).

Construct validity was examined after dichotomizing composite scores as "high" or "low/standard" using the median score of the sample as the cutoff point (≥54.5)/(<54.5). Similarly, the subjective intensity ratings provided by the nurse managers were dichotomized as "high" or "low/standard". Bivariate analysis (χ^2) demonstrated statistically significant associations between the composite scores from each set of raters and time periods and the nurse managers' subjective rating as shown in Table 2.

Usability and Feasibility

Participants of the national testing reported that the N-KICS tool was clear, understandable and easy to use, demonstrating face validity. Time to complete the medical record review and N-KICS tool was approximately 10–15 min. A few definitions and related scoring criteria required clarification when applied in these diverse settings. For example, the type of the caregiver (nurse, licensed aide) who escorts the child to the clinic or school varies by site and intensity of care needs; this care component is not specified on the current tool. Several sites also noted that chest physiotherapy was performed by skilled nurse providers, requiring time, as opposed to the use of a specialized oscillatory vest (ABI) which is the definition of chest physiotherapy in N-KICS. Participants also commented that wound care related to surgical procedures signifies intensity of nursing care not captured on the tool, and that such care differs from wound care related to pressure ulcers which is captured on the tool. Clarification of the definition of intermittent versus continuous pulse oximetry monitoring was also requested by some nurse clinician raters as children may be monitored continuously for several hours, but only during overnight hours.

Sixty respondents seeing and using the tool for the first time during the session at the PCCA annual conference suggested that a user manual or guideline with definitions of terms that would accompany the tool would be beneficial and foster consistent use in lieu of the training provided by the research team. Similar to the national testing cohort, these participants also suggested that some definitions (e.g., type of caregiver escort for children) required clarification. There was consensus that N-KICS is different than an acuity tool that assesses a child's severity of illness. Based on participant feedback potential uses for the N-KICS tool were identified as: 1) an RN scheduling tool to cohort residents by intensity score; 2) an educational tool for novice nurses; and 3) an administrative tool to benchmark care needs and to promote appropriate resource allocation. Lastly, participants were asked if they would like to use N-KICS in their workplace and 78% responded affirmatively.

Discussion

To our knowledge this study is the first extension of testing conducted on this novel tool. The N-KICS demonstrated inter-rater, test-retest and internal consistently reliability in a national convenience sample of 116 children with CMC by 33 nurses from 11 sites. Construct validity was established by the association between the nurse manger subjective rating of intensity and the nurse clinicians' objective scored intensity. With the exception of two items, burn and cast care, all items contributed to overall scale reliability and should be retained; however, clarification of definitions for several items may further improve reliability. In comparison to other results (Navarra et al., 2016) this finding indicates a more parsimonious tool may have acceptable psychometric properties for widespread use.

While several components of the instrument were examined, additional psychometric testing is needed to fully assess the instrument's reliability and validity, including factor analysis, to identify the underlying constructs of care measured, content validity to assess whether the tool is relevant to all diverse settings providing care for children with CMC, and discriminant validity testing to assess if the items or tool measures something other than intensity, such as acuity.

The contribution of these study findings is the advancement of a measure that quantifies the intensity of nursing care needs in a highly-specialized population and setting, children with CMC in LTC. The pediatric population with CMC is a designated priority population for healthcare delivery improvements (Agrawal, 2015; Schwalenstocker et al., 2008). Despite prioritization, there is limited evidence of the most effective an efficient delivery of care models for this vulnerable population (Cohen et al., 2011). Thus, beyond the research implications and in the context of the growing population in both numbers and intensity, along with increased focus on fiscal restraint and reimbursement, the potential importance of this measure to benchmark intensity internally or externally is notable. The lack of standardized measures makes these comparisons impossible and thus difficult to assess resource demand and utilization as well as strategize the best care delivery models (Schwalenstocker et al., 2008). Policy implications include use of the N-KICS tool internally to better manage resources as well as externally to add to process and staffing measures tied to public and private reimbursement for care.

Limitations

In this study pediatric resident information was not collected; therefore we are unable to discern if the tool is equally valid and useful across all pediatric age groups or if the distribution of residents studied at these sites represents the distribution of residents in other facilities. Data extracted from medical records depend on the quality and consistency of those trained to use the tool and rely on the completeness and accuracy of data entered in the medical record. We were unable to test the reliability of the data collected from the medical records by those using the tool. Though all U.S. census regions were represented this is a

small, convenience sample. Despite the need for further testing, given the findings of this current study we believe the information is highly relevant and timely for current nursing practice.

Clinical Implications

The N-KICS provides a comprehensive assessment of the nursing intensity of care needs for children with CMC in pediatric LTC settings. The tool is easy to use and can be completed by a nurse or nurse manager in 10–15 min. This study supports reliability and validity of the N-KICS tool in this sample and setting; potential users should consider the population and setting in which they intend to use the tool. It is composed of 40 items, such as infection control needs, respiratory care, assistance with feeding, and family education, that provide an assessment of a child's intensity of care needs over the course of 30 days. Once the assessment information is collected and tabulated, the information can be used at the point of care. End-users reported high level support and broad interest for use of N-KICS as a clinical tool, continuing education and training tool for nurses, and administrative tool. Potential uses include an adjunct to staffing decision tools, a training tool for novice nurses and nurses new to the setting to develop clinical competencies and efficiencies, and an administrative tool to allocate resources as such as additional nursing or non-nursing personnel if needed, supplies or equipment.

Conclusion

N-KICS tool has demonstrated components of reliability and validity in a national, convenience sample. Additional testing to further establish psychometric sufficiency and expanded use to quantify the intensity of nursing care needs of children with CMC in pediatric LTC settings is recommended.

Conflicts of Interest and Source of Funding

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Appendix A. Supplementary Data

Supplementary data to this article can be found online at http://dx.doi.org/10.1016/j.pedn.2017.08.026.

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