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Abstract

Purpose

The purpose of this study was to evaluate the use of the Engaging Parents in Education for Discharge (*e*PED) iPad application on parent experiences of hospital discharge teaching and care coordination. Hypotheses were: parents exposed to discharge teaching using *e*PED will have 1) higher quality of discharge teaching and 2) better care coordination than parents exposed to usual discharge teaching. The secondary purpose examined group differences in the discharge teaching, care coordination, and 30-day readmissions for parents of children with and without a chronic condition.

Design/Methods

Using a quasi-experimental design, *e*PED was implemented on one inpatient unit (n = 211) and comparison group (n = 184) from a separate unit at a pediatric academic medical center. Patient experience outcome measures collected on day of discharge included Quality of Discharge Teaching Scale-Delivery (QDTS-D) and care coordination measured by Care Transition Measure (CTM). Thirty-day readmission was abstracted from records.

Results

Parents taught using *e*PED reported higher QDTS-D scores than parents without *e*PED (p = .002). No differences in CTM were found between groups. Correlations between QDTS-D and CTM were small for *e*PED (r = 0.14, p 0.03) and non-*e*PED (r = 0.29, p < .001) parent groups. CTM was weakly associated with 30-day readmissions in the *e*PED group.

Conclusion

The use of *e*PED by the discharging nurse enhances parent-reported quality of discharge teaching.

Practice implications

The *e*PED app is a theory-based structured conversation guide to engage parents in discharge preparation. Nursing implementation of *e*PED contributes to optimizing the patient/family healthcare experience.

Keywords

Pediatric, Parent, Discharge teaching, Readmission, Parent engagement, iPad application

High quality comprehensive preparation for discharge is essential for optimal recovery of children at home after hospitalization (Diaz-Caneja, Glendhill, Weaver, Nadel, & Garralda, 2005; Institute of Medicine, 2010; Toomey et al., 2015; Lerret, 2009; Lerret and Weiss, 2011). According to the National Academy of Medicine (Institute of Medicine, 2010), a key activity for promoting the health of children is improving the discharge transition process. Nurses play a central role in discharge preparation, which involves the three inter-related processes of discharge planning, discharge coordination, and discharge teaching (Weiss et al., 2015). The 'Framework of Pediatric Hospital Discharge Care' emphasizes the importance of a conversational approach to addressing the goals, needs and plans for hospital discharge with family members involved in the care of the child at home (Berry et al., 2014).

Traditionally, discharge teaching has been unidirectional (Candela et al., 2018), with the nurse providing information to parents and instruction and/or demonstration of skills needed for home management. Tools to facilitate information transfer with parents are often limited to review of checklists, printed information and resources for who to contact for potential problems. Technology based strategies have emerged as another mechanism for parents to receive disease specific information related to their child's health care needs (Hall & Bierman, 2015). Teach-back is now a commonly used approach to verifying patient understanding of discharge instructions (Kornburger et al., 2013; Markley et al., 2013; White, Garbez, Carroll, Brinker, & Howie-Esquivel, 2013). Research relevant to discharge teaching has produced evidence about the content of the instruction. However, the skills of the nurses conducting discharge teaching are equally important for achieving patient and parent outcomes, including readiness for hospital discharge and preventing hospital readmission (Weiss et al., 2007; Weiss et al., 2011). In basic nursing education, preparation regarding discharge is more strongly focused on what to teach rather than teaching methods for engaging patients and families in ways that lead to retention of information, application and problem solving in the home environment (Candela, Piacentine, Bobay, & Weiss, 2018).

Assessment of discharge teaching and care coordination needs begins on admission but is a priority as discharge nears. Discharge teaching and care coordination should include parent input and engagement (Candela et al., 2018) to identify the unique and individual needs of patients and their families (Berry et al., 2014; Toomey et al., 2015). The individuality and uniqueness of patient and family needs at hospital discharge is most critical for children with medical complexity and chronic health conditions (Berry et al., 2011; Berry et al., 2013; Lerret et al., 2015). For example, parents of

hospitalized transplant recipients who reported being unprepared to implement hospital discharge instructions (Glick, Farkas, & Nicholson, 2017) had difficulty managing their child's complex care needs at home (Lerret, 2009;Lerret and Weiss, 2011 ; Lerret et al., 2015).

While disease-specific guidelines are used to prepare parents for the child's medical care and treatment needs at home after discharge, little research has been conducted to establish evidence-based practices for pre-discharge teaching methods. Nurses need effective resources to assist them in the process of engaging the parent in the preparation for discharge so that it is individualized, and the parent experience of discharge is optimal. To address this gap, we developed the *Engaging Parents in Education for Discharge* **(***e*PED) iPad application (app).

This study investigates the use of an interactive teaching method guided by the *e*PED, an innovative app, to address specific content elements of importance to family self-management at home after the child's discharge from the hospital. The goal of the *e*PED app was to provide a tool for the discharging nurse to facilitate the teaching methods and improve the quality of parent discharge preparation. Ultimately, improving discharge preparation should improve post-discharge outcomes including a reduction in emergency department use and hospital readmission.

The purpose of this study was to evaluate the use of *e*PED in preparing for hospital discharge on parent experiences of hospital discharge teaching and care coordination. There were two primary hypotheses:

(1) Parents exposed to discharge teaching using *e*PED will have higher quality of discharge teaching scores than parents exposed to usual discharge teaching.
(2) Parents exposed to discharge teaching using *e*PED will report better care coordination than parents exposed to usual discharge teaching.

A secondary purpose was to examine differences in the discharge teaching and care coordination outcomes for parents of children with and without a chronic condition and the association of discharge teaching and care coordination to readmissions within 30 days post discharge within *e*PED and non-*e*PED groups. The secondary hypotheses are:

(3) Parents of children with a chronic condition will report higher quality discharge teaching and care coordination than parents of children without a chronic condition.
(4) Quality of discharge teaching and care coordination will be inversely associated with readmission within 30 days for parents who receive teaching with the app.

Theoretical framework

The program of research and specifically the discharge teaching method used in the *e*PED app was guided by two conceptual frameworks and a teaching method: (1) Tanner's Reflective Practitioner Theory (Tanner, 2006), (2) The Individual and Family Self-Management Theory (Ryan and Sawin, 2009) and (3) The “Teach-Back” method to support health literacy (Kemp, Floyd, McCord-Duncan, & Lang, 2008; Peter et al., 2015). Tanner's theory proposes that reflective nurses notice problems, interpret child/family behavior, respond with appropriate action, read the family's response to nursing actions, and adjust their actions accordingly (Tanner, 2006). Integral to this process is the nurses' recognition of

individual and family health-related values and beliefs as outlined in the Individual and Family Self-Management Theory (IFSMT) (Ryan and Sawin, 2009). The IFSMT acknowledges the responsibility assumed by the individual and family for healthcare daily functioning and how nurses collaborate with families to help them learn the care needed for self-managing their health condition (Ryan and Sawin, 2009). Teach-Back is an educational tool that uses an iterative face-to-face approach when teaching families and asking them to recall, demonstrate or restate what they learned (Kemp et al., 2008; Peter et al., 2015; Ryan and Sawin, 2009). The Teach-back approach was extended to include "think forward", to facilitate the nurse to proactively consider or elicit potential challenges families may encounter after hospital discharge (Sawin et al., 2017). The integration of these frameworks informed the content, as well as the process for this innovative *e*PED teaching tool that was specifically designed to guide an interactive conversation between the parent and discharging nurse.

*e*PED Application

The foundation of the app was modeled after research conducted by Sawin et al., (2017) that utilized a longer conversation guide to engage parents at the time of discharge teaching (Sawin et al., 2017). The initial tool included theory-based discharge questions in the form of an iPad app for nurses to use in preparing families for discharge and self-management for their child at home (Sawin et al., 2017). The original app was the Family Self-Management Discharge Preparation Implementation (FSM-DPI) with nine domains (home care, child's care, practice, medications, watching child, recovery, child development, family adjustments, and parent support) informed by the Individual and Family Self-Management Theory (Sawin et al., 2017). The app was piloted by nurses at a pediatric hospital on the day of hospital discharge (Weiss et al., 2017). Overall, the quality of discharge teaching was high. However, nurses involved in the study recommended a shorter version to improve feasibility for use in routine nursing practice. Based on nurse feedback, the FSM-DPI was refined from nine to five domains (1) signs and symptoms, 2) medications, 3) appointments and results, 4) recovery and 5) thinking forward to family adjustment) and renamed the Engaging Parents in Education for Discharge (*e*PED) app (See Fig. 1 for a sample screen from the *e*PED app).

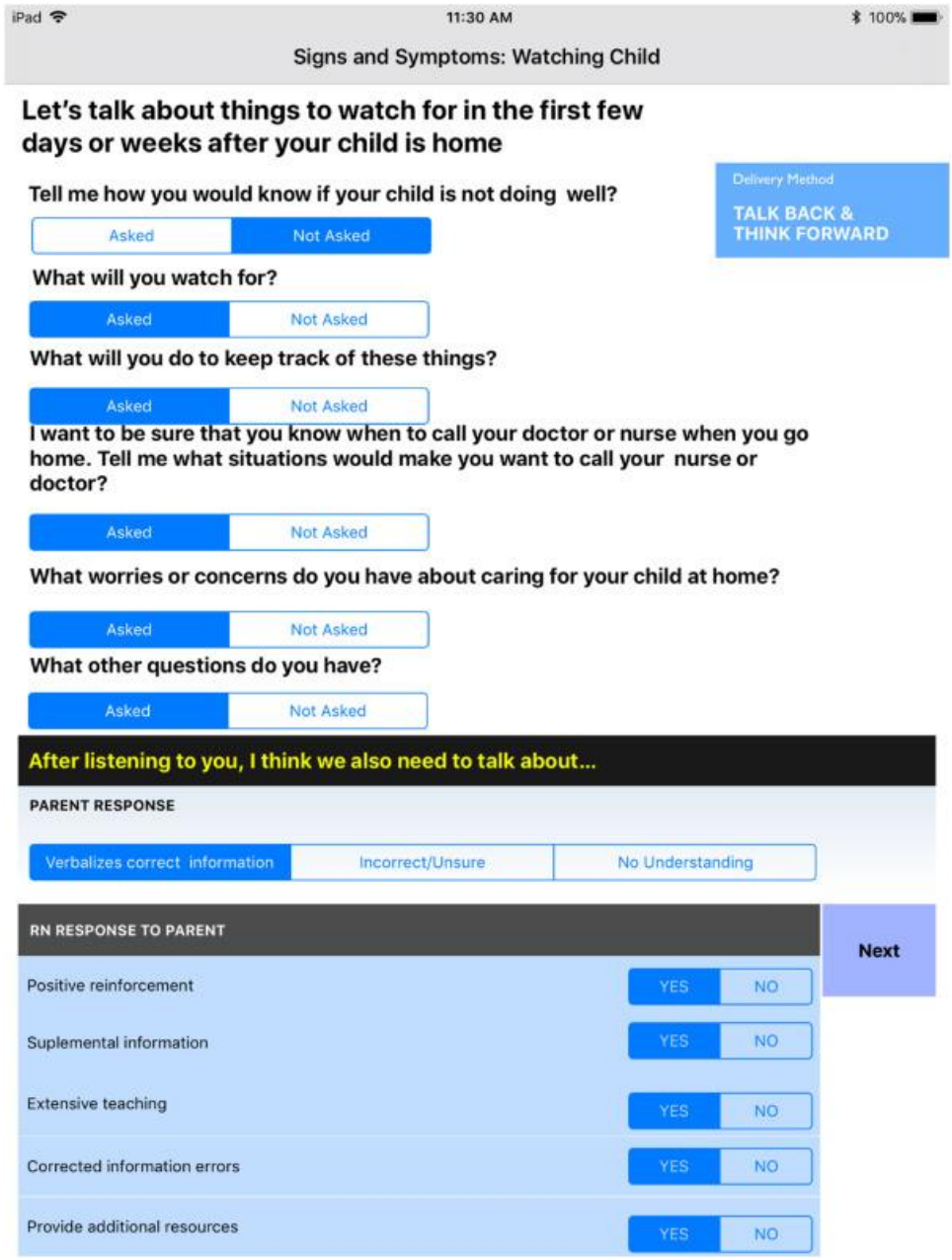

Fig. 1. Sample screen of the *e*PED app.

With the *e*PED app, the nurse focuses on understanding the risks and complexities as well as the strengths of the family in managing the child's condition and the transition between hospital and home. The outcome of highly engaged and structured discharge communication can identify risks, activate resources and reinforce parent strengths. The *e*PED app guides the nurse through the five domains by providing specific open-ended questions to assess, confirm, and encourage parents before going home, eliciting specific plans and potential concerns, gaps in knowledge and opportunities for additional teaching.

Methods

Design

A quasi-experimental pre-post two group design was used to evaluate the effect of *e*PED on parent experiences of hospital discharge measured as their perception of quality of discharge teaching and care coordination. The discharging nurse used the *e*PED app to guide the discharge teaching session with parents on the day of discharge, followed by collection of parent-reported measures of quality of discharge teaching and care coordination prior to hospital discharge. The non-*e*PED group received the current standard of care.

Subjects and Sample.

The study's convenience sample consisted of parents of hospitalized children (*n* = 395) who were preparing for discharge home from two separate units within a free-standing pediatric academic medical center with Magnet designation in the Midwestern United States. Data were collected between August 2018 and January 2019. *e*PED was implemented on a 24-bed surgical unit and a 24-bed medical care unit served as the comparison group. Parents were included if they were 18 years of age or older, could speak and read English, and agreed to participate in the use of *e*PED to guide discharge conversations and for data collection for the study's outcome measures. Parents were excluded if the hospitalized child was older than 18 years of age.

Measures

Quality of discharge teaching

The 18-item Quality of Discharge Teaching Scale (QDTS) is comprised of two subscales: (1) Content and (2) Delivery. To reduce participant burden, only the 12-item delivery subscale (QDTS-D) was used to measure quality discharge teaching by nurses assigned to the family throughout the hospitalization (Weiss et al., 2008). This subscale reflects the way nurses teach, not the content (Weiss et al., 2017). The delivery subscale includes items about listening to and answering specific questions and concerns, expressing sensitivity to personal beliefs and values, teaching in a manner that the parent could understand and at times that were good for parents, providing consistent information, promoting confidence in ability to care for the child and in knowing what to do in an emergency, and decreasing anxiety about going home. The Cronbach's alpha reliability for this subscale in a sample of parents of hospitalized children is high at 0.86 (Lerret and Weiss, 2011). Response categories range from “not at all” (0) to “always” (10). The scale score is reported as the mean of item scores (Weiss et al., 2008). Higher scores reflect parent's perception of receiving higher quality of discharge teaching.

Care coordination

The Care Transition Measure (CTM) is a 15-item measure with four key domains to measure care coordination (Coleman et al., 2002). The CTM was developed for the adult patients, but was adapted for use with parents of hospitalized children (Lerret and Weiss, 2011; Lerret et al., 2015). The four domains include transfer of information, preparation of patient/caregiver, self-management support, and empowerment to address preferences (Coleman et al., 2002). The tool has high Cronbach's alpha reliability estimates in adult (0.93) (Coleman, Mahoney, & Parry, 2005) and pediatric (0.89 to 0.95) populations (Lerret and Weiss, 2011; Lerret et al., 2015). The response categories are “strongly disagree” (1) to “strongly agree” (4). Parents can also respond with a “Don't Know/Don't Remember/

Not Applicable". The mean score for each respondent is linearly transformed to a 0–100 scale. The total score represents the overall quality of the care transition. Lower total scale scores are indicative of a poorer quality transition where higher scores indicate a better transition (Coleman et al., 2002).

Characteristics of the child and family

A limited number of child/family characteristics obtained by parent self-report were used to describe the sample: parent age and sex, child age and sex, number of hospitalizations in previous year, type of insurance, number of medication(s) that the parent is responsible for administering post discharge and type of case (medical or surgical). The presence of a chronic condition of the child was collected by parent report from a list of chronic conditions (Table 1). Chronic condition was coded for analyses as 1 = one or more chronic condition, or 0 = no chronic conditions. Emergency department visits and hospital readmission within 30-days of discharge to the same pediatric medical center were abstracted from the electronic record.

Table 1. Sample characteristics.

	***e*PED (n = 211)**	**Non-*e*PED (n = 184)**
	Mean, SD (range)	**Mean, SD (range)**
Child age (years)	9.18, 4.83 (2, 21)	9.73, 5.02 (2, 20)
Child gender	n (%)	n (%)
Male	114 (54)	84 (45.7)
Female	96 (45.5)	98 (53.2)
Missing	1 (0.5)	2 (0.1)
Child ethnicity		
Hispanic/Latinx	29 (13.7)	21 (11.4)
Non-Hispanic/Latinx	177 (83.9)	161 (87.5)
Missing	5 (2.4)	2 (1.1)
Child race		
White	143(67.8)	113(61.4)
Black	43 (20.4)	42 (22.8)
Asian	5 (2.4)	3 (1.6)
Multiple	13 (6.2)	17 (9.2)
Native Alaskan/American	7 (3.3)	5 (2.7)
Indian	0	4 (2.2)
Missing	0	0
Parent/caregiver age	35.73, 8.82 (18,59)	36.63, 8.58, (14,64)
Parent/caregiver gender		
Male	35 (16.6)	34 (18.5)
Female	174 (82.5)	149 (81)
Missing	2 (0.9)	1 (0.5)
Parent marital status		
Married	140 (66.4)	102 (55.4)
Single	58 (27.5)	56 (30.4)

Divorced	9 (4.3)	21 (11.4)
Widowed	0	2 (1.1)
Domestic partnership	3 (1.4)	3 (1.6)
Missing	1 (0.5)	0
Parent ethnicity		
Hispanic/Latinx	25 (11.8)	14 (7.6)
Non-Hispanic/Latinx	183 (86.7)	170 (92.4)
Missing	3 (1.4)	0
Parent race		
White	155 (73.5)	128 (69.6)
Black	38 (18)	38 (20.7)
Asian	5 (2.4)	1 (0.5)
Multiple	4 (1.9)	4 (2.2)
Native Alaskan/American Indian	0	5 (2.7)
Missing	9 (4.3)	8 (4.3)
Reason for hospitalization		
Surgical	165 (78.2)	19 (10.3)
Medical	46 (21.8)	165 (89.7)
Missing	0	1 (0.5)
Chronic conditions		
Asthma	28 (13.4)	47 (26.3)
Blood disorder	0 (0)	2 (1.1)
Cancer	2 (0.9)	0 (0)
Congenital heart disease	8 (3.8)	7 (3.9)
Diabetes	2 (0.9)	27 (15.1)
Gastrointestinal disorder	16 (7.7)	34 (18.9)
Kidney disease	5 (2.4)	1 (0.6)
Liver disease	2 (0.9)	1 (0.6)
Neurological disease	10 (4.8)	16 (8.9)
Rheumatological disorder	1 (0.5)	2 (1.1)
Scoliosis	7 (3.3)	7 (3.9)
Other	17 (8.1)	28 (15.6)
Chronic condition (grouped)		
0 (none)	115 (54.5)	50 (27.2)
1 or more	96 (45.5)	134 (72.8)
Utilization		
Readmission within 30 days	10 (4.7)	13 (7.0)

Procedures

Approval was obtained from the Institutional Review Board of the study hospital. Eligible participants received an information sheet regarding study related procedures from the bedside nurse. The study was deemed no more than minimal risk and received IRB approval with a waiver to obtain signed consent. Data were collected on the day of hospital discharge and by electronic records abstraction at 30 days post-discharge. Nurses on the implementation unit received training in use of the *e*PED app via an online module and in collection of the parent-reported measures. Comparison unit nurses were trained in collection of parent-reported measures only.

The inpatient nurses on both the implementation and comparison units explained the project to families on the day of discharge. Families who agreed to participate received instruction from the nurses for completing parent experience questionnaires (QDTS-D, CTM) on the study-provided iPad. The questionnaires were completed independently by the parent before hospital discharge. Upon completion of the questionnaires, parents closed the survey on the iPad and returned the iPad to a member of the inpatient staff. Clinical nurses on the implementation unit executed and documented use of the *e*PED app during hospital discharge education.

The data from the *e*PED app was entered via the iPad into a REDCap database by the nurse. Child and parent demographics as well as parent experience questionnaires were entered via the iPad by the parent into a REDCap database. Utilization data, ED visit and readmission in the first 30-days following hospital discharge, was collected by the designated study team research coordinator via medical record abstraction.

Data analysis

The analyses were performed in the platform R (R Core Team, 2019). Descriptive statistics were used to describe the sample and compare between *e*PED implementation and non-*e*PED comparison units. The Cronbach alpha (α) was used to assess the reliability of the QDTS-D and CTM scales in the study population. For continuous outcomes, we used General Linear Models (GLM) that included *t*-tests. The significance level was set at $p < 0.05$. *t*-Tests were performed to identify if there was a mean difference in the QDTS-D and the CTM between parents of the children from implementation who received teaching guided by the *e*PED app and parents of children from the comparison unit who did not receive teaching guided by the *e*PED. Because of the differences in types of patients on the implementation (surgical case types) and comparison (medical case types) units, we examined differences between patients with and without chronic conditions within each unit (*e*PED implementation and non-*e*PED comparison) separately, rather than comparing across units; *t*-tests were used to examine these differences. For the same reason, we examined the relationship of QDTS-D and CTM with subsequent readmission within 30 days post-discharge using logistic regression for parents/patients discharged from *e*PED and non-*e*PED units separately.

Results

Our sample included 211 parents from the *e*PED implementation unit and 184 parents from the comparison unit. Parents were primarily female (82%) and married (61%) with a mean age of 36.18 years (*SD* = 8.70). Child sex was evenly distributed between male (49%) and female (51%) with a mean age of 9.46 years (*SD* = 4.93). Additional characteristics are detailed in Table 1.

The Cronbach alpha (Cronbach, 1951) was used to assess the inter-item correlation, and McDonald's Omega (McDonald, 1999) was used to assess reliability of the QDTS-D and CTM scales in the study population (Raykov, 2012). Both QDTS-D and CTM scales had high Cronbach's alpha inter-item correlation estimates in this sample ($\alpha = 0.91$ and $\alpha = 0.98$), and high McDonald's Omega reliability ($\omega = 0.91$ and $\omega = 0.97$). Scale scores for parents with both *e*PED and non-*e*PED were skewed near the high end of both scales. QDTS-D scores exceeded 9 out of 10 for the entire sample (mean = 9.48, *SD* = 0.84), indicating very high-quality teaching. CTM scores were also near the upper end of the scale (mean = 3.77, *SD* = 0.55) indicating positive parent reports of transitional care coordination.

Testing of the primary hypotheses evaluated differences between parents exposed to *e*PED and parents receiving usual discharge teaching on the parent's discharge experience, specifically their perceptions of the quality of discharge teaching (hypothesis 1) and care coordination (hypothesis 2). QDTS-D scores were significantly higher for parents exposed to the *e*PED app (mean = 9.59, *SD* = 0.65) than parents not exposed to the app (mean = 9.33, *SD* = 1.0, *p* = 0.002), though effect size (Cohen d) was small (*d* = 0.32). CTM scores were not statistically different between parent groups (mean = 3.77, *SD* = 0.60 for *e*PED, and mean = 3.74, *SD* = 0.49 for non-*e*PED parents). *t*-Test results are provided in Table 2. Parents with higher QDTS-D tended to score higher on CTM, though the correlations were small for the *e*PED parent group (*r* = 0.14, *p* = 0.03) and in the non-*e*PED group (*r* = 0.29, *p* < 0.001).

Table 2. Comparison of parent experience outcomes for *e*PED and non-*e*PED Parent Groups.

	***e*PED group** **Mean (*SD*)** **Range**	**Non-*e*PED group** **Mean (*SD*)** **Range**	**Test Statistics (*t*-test)** ***t, df, p, d***
QDTS-D	9.59 (0.65) 4.0,10	9.33 (1.0) 4.8, 10	−3.09, 306.1, 0.002, 0.32
CTM	3.77 (0.60) 1,4	3.74 (0.49) 1,4	−0.58, 385.4, 0.56, 0.05

Note. Quality of discharge teaching scale delivery (QDTS-D),[22] care transition measure (CTM)[23].

Hypotheses 3 evaluated the differences in QDTS-D and CTM for parents of children with and without chronic conditions within *e*PED and non-*e*PED groups. There were no statistically significant differences identified between *e*PED and non-*e*PED groups or between chronic and non-chronic participants (Table 3).

Table 3. Parent experience outcomes (QDTS-D and CTM) for parents of children with and without a chronic condition.

g		***e*PED parent group**	**Non-*e*PED parent group**		
Parent Experience Outcome	**Child has Chronic Condition(s)**	**Mean, *SD***	**Test statistics** ***t, df, p, d***	**Mean, *SD***	**Test statistics** ***t, df, p, d***

QDTS-D	Yes No	9.53, 0.56 9.65, 0.72	1.31, 202.6, 0.19, 0.18	9.28, 1.05 9.45, 0.83	1.09, 108.3, 0.28, 0.16
CTM	Yes No	3.73, 0.70 3.80, 0.50	0.82, 167.7, 0.41, 0.12	3.77, 0.43 3.67, 0.63	−1.05, 64.2, 0.29, 0.21

Note. QDTS-D: Quality of Discharge Teaching Scale Delivery,[22] CTM: Care Transition Measure[23].

For hypothesis 4, logistic regression was used to evaluate QDTS-D, CTM and chronic condition as predictors for one or more readmission for each *e*PED and non-*e*PED groups separately (Table 4). For the *e*PED group, controlling for other predictors in the model, the strongest and only significant predictor of readmission was the CTM score. As CTM increases by one point (on a 4-point scale), the chance of having at least one readmission decreases by 55% (OR = 0.45). None of the three predictor variables made a unique statistically significant contribution to the model for readmission in the non-*e*PED group.

Table 4. Logistic regression of 30-day readmission on QDTS-D, CTM, and Chronic Condition for *e*PED and non-*e*PED parent groups.

Implementation group	**Predictors**	**Slope (SE)**	***p*-value**	**OR (95% CI)**
*e*PED	(Intercept)	−1.04 (4.85)	0.83	0.35 (0.00, 506.8)
	QDTS-D	0.07 (0.49)	0.88	1.08 (0.51, 3.67)
	CTM	−0.80 (0.32)	0.01	0.45 (0.24, 0.89)
	Chronic condition	0.69 (0.66)	0.29	1.99 (0.56, 7.98)
Non-*e*PED	(Intercept)	−7.14 (3.71)	0.05	0.0008 (0.00, 0.37)
	QDTS-D	0.36 (0.36)	0.32	1.43 (0.79,3.30)
	CTM	0.16 (0.63)	0.80	1.17 (0.43, 5.80)
	Chronic condition	1.29 (0.77)	0.09	3.65 (0.98, 23.88)

Note. QDTS-D: Quality of Discharge Teaching Scale Delivery, CTM: Care Transition Measure.

Discussion

The *e*PED app was developed to enhance the ability of the nurse to provide optimal discharge teaching to parents of hospitalized children by engaging parents at the time of discharge. The app includes aspects of “think-forward” teaching, assesses parental knowledge, skills and abilities, and guides the nurse to provide appropriate and individualized responses to the family (i.e. positive reinforcement, further teaching, additional resources, etc.) (Sawin et al., 2017). The purpose of this study was to evaluate outcomes of the use of *e*PED with parents of hospitalized children on two pediatric inpatient units.

The results of the study support the positive influence that the use of the *e*PED had on the quality of discharge teaching. While parents rated the quality of discharge teaching delivery as high using both *e*PED and usual care (non-*e*PED) discharge teaching methods, it was higher for parents who

received discharge teaching with the *e*PED app. This finding provides evidence of room for improvement even in hospital environments where quality of discharge teaching is well-rated by parents. Use of *e*PED in hospitals with different acuity levels of pediatric care or without Magnet status may result in wider variability of discharge teaching scores. Optimizing the patient/family experience (Shermont, Pignataro, Humphrey, & Bukoye, 2016; Wood et al., 2017) is a priority for healthcare systems in the current era of performance measurement and value-based care, yet nurses often feel unprepared to teach (Lahl, Modic, & Siedlecki, 2013). Having the *e*PED app available to facilitate discharge teaching provides a structure to assist the nurse in applying evidence-based teaching strategies that promotes the nurse's confidence as an effective teacher. The use of the *e*PED app holds promise for use in fostering engagement with parents, which is an essential extension of the trusting relationship that develops through the interactive teaching-learning process (Association, A. N, 2016; Leslie & Lonneman, 2016).

The parent perception of care coordination was not significantly different between the parents receiving *e*PED instruction and usual care discharge teaching. A potential explanation may be the timing of administration of the CTM and the wording of the questions. The wording on the CTM limits the parent's reflection to the day of discharge. Care coordination plans typically take place throughout the hospitalization; thus, the parent response may not be reflective of all care coordination efforts. Future enhancements to the *e*PED app may include expansions to more clearly address care coordination efforts. Although typically administered post discharge, in this study, the CTM was completed by the parents prior to leaving the hospital (Coleman et al., 2002). Perceptions of the transition in care from hospital to home may change as the post-discharge realities are experienced. Furthermore, the sample of chronic condition patients enrolled in this study had a broad range of diagnoses and the reason for admission that may or not have been related to the chronic condition. In subsequent studies it will be important to link the reason for readmission to the underlying chronic condition to better understand parent's perception of the care coordination experience.

As in prior studies (Lerret and Weiss, 2011; Lerret et al., 2015), parents with higher QDTS-D scores had higher CTM scores, though the correlations were weak. There are some similarities in item domains including signs and symptoms, medications, appointments and recovery. The fact that the *e*PED impacted QDTS-D but not CTM suggests that improving care coordination requires a different approach than improving discharge teaching and involves other disciplines. It is also notable that the measures were reliable in this patient population, similar to previous use of the measures in pediatric discharge studies (Lerret and Weiss, 2011; Berry et al., 2014). Both the quality of discharge teaching and care coordination are factors associated with adverse experiences following discharge including readmission in several studies (Auger et al., 2015; Auger, Kenyon, Feudtner, & Davis, 2014; Weiss et al., 2008). In some cases, readmission may be avoided with appropriate discharge preparation that includes empowering and educating the family on proper care and necessary monitoring after leaving the hospital. Reducing hospital readmissions reduces healthcare cost especially in children with chronic and complex health conditions (Kornburger, Gibson, Sadowski, Maletta, & Klingbeil, 2013; Markley et al., 2013). The *e*PED app assists the nurse to identify and teach to the unique and individual needs of patients and their families, which is the recommended approach for improving parent engagement (Diaz-Caneja et al., 2005; Toomey et al., 2015; Lerret, 2009; Lerret et al., 2014). Moreover, the app

moves patient education forward beyond a unidirectional information approach to an individualized, interactive engagement in preparing for discharge.

The design of the study using a surgical and a medical unit as the implementation and comparison units respectively did not allow for evaluation of the impact of the *e*PED on readmissions, as the two units represented different patient populations with high variation in diagnosis, reason for hospitalization, and rates of readmission. Examining the relationships of the parent experience measures of quality of discharge teaching and care coordination within the *e*PED and non-*e*PED groups, CTM was a significant predictor of likelihood of readmission in the *e*PED group only. Care transition interventions are important aspects of care and readmission avoidance in families with a child with a complex chronic condition (Lerret et al., 2015; Weiss et al., 2017).

This study has several limitations. The cross-sectional study design precluded evaluation of change over time, which would have enhanced the comparison of outcomes. The sample represented one medical and one surgical unit at a single pediatric hospital, precluding comparisons on important outcomes for healthcare utilization. These units were chosen as they had the resources to support the study-related procedures. Inclusion of a wider variety of patients would provide larger variability in the sample and increase the generalizability of the results. As typical with pediatric research, more mothers than fathers participated in the study. We were not able to collect information on the characteristics such as years of experience of the nurses that used the *e*PED app. The level of experience or years of working as a RN may have an influence on the nurse's skill and/or confidence with discharge teaching. The nurse characteristics should be included in future studies. Training for the comparison unit nurses regarding collection of family experience data (quality of discharge teaching and care coordination) may have influenced the study results by increasing the nurse's awareness of discharge needs and importance of discharge preparation and by stimulating the nurses to improve discharge preparation even though they were not using the *e*PED app. A potential source of bias is that the inpatient clinical nurse who completed the intervention was the assigned nurse for the day. Even though the parent completed the survey independently, the responses may have reflected the parent perspective of the individual nurse in addition to their response to use of *e*PED. Alternatively, the QDTS-D and CTM measure parent experience during the entire hospitalization and may not only reflect on the use of the *e*PED app. These issues will need to be clarified in a larger intervention study.

Conclusions

Healthcare systems are complex, and nurses play an integral role in the patient's experience from admission to discharge. The outcomes of this study indicate the importance of engaging parents in teaching using a theory-based structured conversation guide such as the *e*PED app. Quality of discharge teaching delivery was higher for parents who participated in the interactive discharge teaching process, guided by the *e*PED app. This novel practice innovation aligns with health system priorities for engaging patient and families in their care and optimizing the patient/family experience. The results of this study are foundational for future efforts to improving the quality of discharge education using an innovative app, family engagement and discharge experience, and mitigating post-discharge risks for adverse child outcomes.

Enhancements are needed to better understand the role of the *e*PED app used by nurses during discharge education with families. Refinement of the *e*PED app needs to clearly address teaching needs related to care coordination. The concept of care coordination should be explored further to focus on populations with complex and/or chronic conditions. Future work may also include the integration of parent-reported experience and other outcomes including quality of life. All these enhancements in a larger trial will contribute to improving the discharge experience and optimal use of healthcare resources.

CRediT authorship contribution statement

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