

Article

## Development and psychometric characteristics of the pediatric inpatient experience survey (PIES)

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### Abstract

**Objective:** To study the psychometric properties of the Pediatric Inpatient Experience Survey (PIES), a mail and phone survey for parent reporting of family-centered aspects of inpatient care experiences.

**Design:** Two waves of cross-sectional survey data were collected by mail and phone in 2009 to design a measurement instrument with good psychometric characteristics. Additional cross-sectional data from a mail administration in 2011 confirmed the measurement domains.

**Setting:** Free-standing pediatric hospital in the northeastern USA.

**Participants:** A convenience sample of English-speaking parents of hospitalized children, stratified by patient type (medical versus surgical) and previous stays at this hospital (yes versus no), constituted the instrument design phase. Four hundred and seventy-nine (63%) of those approached agreed to participate and were randomly assigned to mail or phone survey administration. Four hundred and one of these respondents completed the first wave of the survey and 354 respondents completed the second wave. A shortened instrument was mailed to parents randomly selected from patient discharge records. Data from 929 parents (response rate: 36.2%) were used for confirmatory analysis of the created measurement domains.

**Main outcome measures:** The main outcome measures of this psychometric validation study were individual item performance, test–retest reliability, internal consistency, and construct validity.

**Results:** The resulting survey includes 61 items with 35 rating items with satisfactory test–retest reliability loading on eight domains. The factor structure was supported by Cronbach's alpha and confirmatory factor analysis. The survey supported construct validity in distinguishing between medical versus surgical and first time versus previous hospital stay groups known to differ with regard to satisfaction. Comparing mail and phone administrations, differences in scores were exacerbated in domain scores and showed the need for mode adjustment.

**Conclusion:** PIES shows satisfactory test–retest reliability, internal consistency, and construct validity. A new domain measuring emotional connectedness to staff and the hospital is highly correlated with overall satisfaction.

**Key words:** pediatric inpatient experience, validity, reliability, quality of care, family-centered care

## Introduction

Emphasis on the evaluation of safety and quality of medical care in the 21st century has expanded from more traditional health outcomes (e.g. mortality, medication errors etc.) to subjective evaluations by patients and their families. In medical care for adult patients, these evaluations are now regularly included as benchmarking measures and in pay-for-performance contracts [1–3]. In the USA, a portion of public insurance funding for adult care hospitals is now directly dependent on the rating hospitals receive on the Hospital Consumer Assessment of Healthcare Providers and Systems Survey (H-CAHPS®) [4, 5] under the Patient Protection and Affordable Care Act of 2010 [6, 7]. The Centers for Medicaid and Medicare Services publicly report data from this survey [8]. Private insurance companies have also started to use ‘alternative quality contracts’ based on global budgets, covering the ‘entire continuum of care for a defined population of enrollees each year’ [9] to lower medical spending while improving healthcare quality; measures of patient experience and satisfaction are now increasingly included in these contracts.

Both the H-CAHPS® and the recently developed pediatric H-CAHPS® [10] are validated tools for measuring inpatient experiences and are designed to provide benchmark data across hospitals. However, these and other existing pediatric instruments do not adequately reflect the increased importance of family-centeredness that is conceptually at the core of improving healthcare quality [6]. In addition, data from high-performing hospitals suggest that the response scales in these surveys are not sensitive enough to show change. Few inpatient experience surveys have been rigorously evaluated for their psychometric properties [10–12], including performance under different data collection modes (e.g. phone interview versus self-administration), and focus on satisfaction rather than patient experience. The direct actionability from patient satisfaction survey results is limited compared with reports of more objective patient experiences, such as the reported frequency of desirable behaviors of the care team, due to the complex interaction of expectations and experiences underlying patient satisfaction ratings [13].

Drawing from existing survey instruments [11, 14–26] and relevant conceptual and research literature [27–30], we developed a new survey tool intended to answer the need for survey items that (i) measure universal aspects of a pediatric inpatient experience that correlate strongly with parents’ overall satisfaction with care, (ii) can be validly answered by parents, (iii) provide actionable information so as to inform improvement initiatives, (iv) are sensitive to change and (v) can be collected via multiple data collection modes (e.g. mail and phone) with minor or no mode effects. This article describes the development, and psychometric testing, of the Pediatric Inpatient Experience Survey (PIES).

## Methods

PIES was developed and tested in three phases. A pilot instrument of 104 items was developed in Phase 1. Phase 2 involved psychometric testing and refinement and resulted in a shortened survey of 61

items. The measurement scales developed during psychometric testing encompassed 35 rating questions from the 61 questions in total. Additional validity testing using this shorter instrument was completed in Phase 3. The study was classified as quality improvement rather than human subject research by our Institutional Review Board, and was therefore considered exempt.

### Phase 1: PIES development

A multidisciplinary committee of 15 physicians, nurses, administrators and survey methodologists from an urban free-standing pediatric hospital in the northeastern USA oversaw the development of the questionnaire and ensured content validity. We first conducted an extensive review of previously published patient experience measures [11, 13–26, 31] and family-centered care literature to identify the most common and salient themes. Common themes across measurement tools included quality of nurses’ and physicians’ care, communication regarding care, the discharge process, hospital facilities and pain management. We analyzed prior data from the hospital’s existing patient satisfaction survey, originally developed by Homer *et al.* [31] to identify items that had the greatest ‘predictive validity’ (i.e. those most correlated with parents’ overall rating of care quality), and thus should be retained in the new survey. Finally, we included additional items to measure the patient- and family-centeredness of care, such as parental participation in care decisions, and their level of ‘emotional satisfaction’ with the hospital and its staff. The construct ‘emotional satisfaction’ was derived from the research findings of the Gallup® organization (Human Sigma® concept) regarding factors most predictive of customer loyalty and satisfaction [32].

An initial draft survey was reviewed by two focus groups of parents of children recently discharged from the hospital. The parents provided feedback regarding the ease of completing the survey, clarity of wording and concepts being measured, appropriateness of survey content, and other suggestions for improving the tool. The revised draft was then tested in 12 cognitive interviews to assure that questions were understandable and elicited the intended information. The resulting survey (the preliminary PIES) consisted of 104 items assessing 13 thematic dimensions (Supplementary material, Table S1) as well as patient/family demographics. At this stage, we included a larger item set to allow for empirical selection of those that performed well psychometrically. Most items were closed-ended and had a 5-, 6- or 7-point Likert response scale as well as ‘yes/no’ or nominal response formats. Four open-ended items gave respondents opportunities to provide more detailed comments known to be important for identifying specific opportunities for quality improvement [33].

### Phase 2: psychometric testing and refinement

For reliability and validity testing of the preliminary PIES, we recruited a large convenience sample of English-speaking parents/guardians of children receiving inpatient care (the validation sample). Recruitment occurred just prior to discharge between November 2008 and June 2009 (63% of the families that were approached consented to participating in the study), and was stratified by patient type (medical versus

surgical) and the number of previous hospital stays at this hospital (none versus one or more) to ensure adequate representation. Participation rates were not significantly different across the stratification groups. Following the verbal consent process, while in the hospital, participants completed the Family-Centered Care Scale (FCCS), a measure of their nursing care experience (data reported elsewhere) [16] and received a parking voucher and a \$10 gift card. Participants were then randomly assigned to complete PIES 5 days after discharge by one of two data collection modes, either phone or mail. Participants completed all parts of the study in the same data collection mode assigned during recruitment. Phone interviews were completed by staff trained in standardized interviewing [34]. Up to eight reminder calls and phone interview attempts were made for mail and phone survey respondents, respectively. To assess test–retest reliability, participants completed PIES a second time approximately 2 weeks later, receiving a \$20 gift card after completion of the first survey, and an additional \$40 after completion of the second.

All psychometric analyses were conducted using STATA 12.1 [35]. Respondents in the validation sample who returned at least the first of the two questionnaires were included in analyses. To evaluate item performance in the preliminary PIES, we examined response distribution characteristics, including means and standard deviations, the presence of floor and ceiling effects (<30% of the respondents chose minimal or maximal score), and rates of missing values.

#### Reliability

We examined item and domain-level test–retest reliability using intra-class correlation coefficients (ICC), with values >0.75 considered excellent, 0.40–0.75 fair to good and <0.40 poor [36]. We also used Wilcoxon sign-rank tests and effect sizes (*d*) to detect differences in test and retest scores, with *d* = 0.20 considered small, *d* = 0.50 moderate and *d* = 0.80 large [37]. Internal consistency reliability among items intended to measure the same thematic area was assessed using Cronbach's alphas, with values between 0.70 and 0.80 considered satisfactory in non-clinical applications [38].

#### Validity

Exploratory factor analysis (EFA) of the preliminary PIES using principal axis factoring with orthogonal rotation was conducted to assess the dimensionality and structural validity across all rating items in the preliminary PIES. We examined the scree plot of initial eigenvalues and compared a range of factor solutions to determine the best number of factors based on data fit and conceptual interpretability (Supplementary material, Figure S1). Items with factor loadings of <0.50, a generally accepted threshold indicating a poor fit of the item on a factor, were candidates for deletion.

Based on the results of all item-level analyses, we shortened the instrument to 61 items, including demographic questions. These items would serve as a core set of questions, to which additional 'modules' assessing more specialized aspects of care (e.g. surgical care experience, emergency room care etc.) could be attached on a rotating basis. EFA was used to determine the factor structure among the remaining 35 rating items. Using the resulting domain structure of the shortened PIES, we computed domain-level scores by following the current H-CAHPS® scoring methodology [39]. Scores from 0 to 100 represented the percentage of items in the domain that were answered with the best possible answer among all items in the domain answered by the respondent. We assessed domain performance by examining mean scores and score distributions, floor or ceiling effects, correlation with overall care quality ratings (using Spearman correlation coefficients),

and mean score differences between mail and phone administrations (using Mann–Whitney *U* tests).

We also tested domain-level construct validity by (i) comparing scores across groups that were expected to differ (known-group validity) and (ii) examining correlations between domain scores and overall quality of care ratings. Based on prior studies, we hypothesized that PIES domain scores should differ based on patient type (medical versus surgical) [40], with parents of surgical patients having higher satisfaction scores than parents of medical patients. Differences were also expected with regard to the number of prior hospital stays (none versus any) [41], with first-time families scoring higher than those with multiple stays. We compared mean domain scores between groups using the Mann–Whitney *U* test.

To shorten the instrument, items were considered for deletion if they showed little response variance, higher rates of missing values, strong correlations with other items indicating potential redundancy, or lower reliability or validity. We also used answers to the open-ended questions to determine items for inclusion. Parental and hospital staff perceptions of item importance, as indicated in focus groups, interviews and meetings, were also taken into account.

#### Phase 3: confirmatory testing

In Phase 3, we tested the fit of the factor structure identified in Phase 2 by using confirmatory factor analysis (CFA) of data collected from a different parent sample. This sample was constructed from weekly random samples of 40 inpatient discharges drawn from the same pediatric hospital between January and July 2011 (confirmatory sample). Due to lack of additional funding, this sample received PIES via mail only and one reminder postcard 1 week later; no incentives were given. Model fit was evaluated using the  $\chi^2$  statistic, comparative fit index (CFI; >0.90 acceptable, >0.95 excellent) and root mean square error of approximation (RMSEA; <0.08 acceptable, <0.05 excellent) [42].

Results for individual items remaining in the final PIES version are expressed as the percentage of respondents in the most positive response category for each given question, the top-box score. This measure was used to evaluate the hospital's performance in the validation and the confirmatory samples. Domain scores represent the percentage of items within a domain that respondents answered with the top-box score among all answered items within the domain. This methodology allows the assignment of a domain score to respondents who might not have answered all items in a domain or for whom not all items were applicable.

## Results

### Participants

Phase 1 focus group participants (*N* = 10) were mostly mothers (90%), of white non-Hispanic race and ethnicity (70%), with at least some college education (100%) and whose children had experienced at least one prior stay in this hospital (70%). Areas of special importance to these parents were coordination in admission and discharge processes as well as the quality of communication between all parties involved in the care (i.e. parents, nurses and physicians). Parents indicated that they would like to evaluate attending and trainee physicians independently, so we included two sets of items evaluating physicians.

For psychometric testing of the initial 104-item PIES in Phase 2, 479 parents from a convenience sample agreed to participate, 401 (84%) completed the first survey and 354 (72%) completed both survey administrations. On average, respondents needed 34.9 min

**Table 1** Patient and parent respondent characteristics—Phases 2 and 3

Characteristics	Phase 2 Validation sample ( $n_1 = 402$ ) $n$ (%)	Phase 3 Confirmatory sample ( $n_2 = 929$ ) $n$ (%)	P-value
<b>Hospitalized child characteristics</b>			
Male <sup>a</sup> ( $n_1 = 402$ ; $n_2 = 929$ )	226 (56.4%)	494 (54.3%)	0.48
Hispanic ethnicity ( $n_1 = 391$ ; $n_2 = 916$ )	30 (7.7%)	88 (9.6%)	0.38
<b>Race (multiple selections possible) (<math>n_1 = 392</math>; <math>n_2 = 916</math>)</b>			
Caucasian/White	320 (81.6%)	726 (79.3%)	0.15
African-American/Black	34 (8.7%)	71 (7.8%)	0.54
Asian	24 (6.1%)	73 (8.0%)	0.23
Other	19 (5.0%)	30 (3.2%)	0.11
<b>Health insurance (<math>n_1 = 391</math>; <math>n_2 = 891</math>)</b>			
Public insurance	60 (15.4%)	131 (14.7%)	0.74
Private insurance	330 (84.3%)	759 (85.2%)	
No insurance	1 (0.3%)	1 (0.1%)	
Mean length of stay in days <sup>a</sup> (SD) ( $n_1 = 401$ ; $n_2 = 929$ )	6.1 (12.20)	3.9 (10.45)	<0.001
<b>Age at admittance<sup>a</sup> (<math>n_1 = 401</math>; <math>n_2 = 929</math>)</b>			
Neonate (1–30 days)	13 (3.2%)	24 (2.6%)	0.26
Infant (30 days to <1 year)	49 (12.2%)	96 (10.3%)	
1–4 years	94 (23.4%)	271 (29.2%)	
5–12 years	143 (35.7%)	307 (33.1%)	
13 years or older	102 (25.4%)	231 (24.9%)	
Chronic health condition ( $n_1 = 368$ ; $n_2 = 921$ )	227 (61.7%)	455 (49.4%)	<0.001
<b>Child's health (<math>n_1 = 394</math>; <math>n_2 = 926</math>)</b>			
Excellent	136 (34.5%)	385 (41.6%)	<0.001
Good	136 (34.5%)	359 (38.8%)	
Average	44 (11.2%)	111 (12.0%)	
Fair/poor	78 (19.8%)	71 (7.7%)	
Medical service (compared with surgical service) ( $n_1 = 396$ ; $n_2 = 929$ )	209 (52.8%)	441 (47.5%)	0.07
<b>Complex diseases<sup>a</sup> (multiple categories possible) (<math>n_1 = 401</math>; <math>n_2 = 929</math>)</b>			
Neuromuscular	24 (6.0%)	42 (4.5%)	0.25
Cardiovascular	46 (11.5%)	81 (8.7%)	0.11
Respiratory	17 (4.2%)	33 (3.6%)	0.60
Renal	16 (4.0%)	31 (3.3%)	0.52
Gastrointestinal	11 (2.7%)	36 (3.9%)	0.28
Hematologic and immunologic	11 (2.7%)	6 (0.7%)	<0.01
Metabolic	11 (2.7%)	18 (1.9%)	0.35
Malignancy	15 (3.7%)	27 (2.9%)	0.44
Other	34 (8.5%)	74 (8.0%)	0.76
<b>Respondent characteristics</b>			
<b>Relationship to child (<math>n_1 = 399</math>; <math>n_2 = 915</math>)</b>			
Mother	329 (82.4%)	778 (85.0%)	0.23
Father	69 (17.3%)	134 (14.6%)	
Other adult relative	1 (0.3%)	3 (0.3%)	
<b>Education (<math>n_1 = 398</math>; <math>n_2 = 911</math>)</b>			
8th grade or less	3 (0.8%)	9 (1.0%)	0.32
Some high school	15 (3.8%)	18 (2.0%)	
High school graduate or GED	43 (10.8%)	92 (10.1%)	
Some college or 2-year degree	99 (24.9%)	214 (23.5%)	
4-Year college graduate	124 (31.2%)	276 (30.3%)	
More than 4-year college	114 (28.5%)	302 (33.2%)	
<b>Number of guardians child lives with (<math>n_1 = 399</math>)</b>			
Two	332 (83.2%)	N/A <sup>b</sup>	N/A
One, other	67 (16.8%)		
<b>Language spoken at home (<math>n_1 = 398</math>)</b>			
English	375 (94.2%)	N/A <sup>b</sup>	N/A
Other	23 (5.8%)		

<sup>a</sup>Based on information from medical record; all other characteristics are self-reported by the respondent.

<sup>b</sup>The questions were not included in the survey administered to the confirmatory sample.

(SD = 10.0) to complete the initial 104-item version of the survey on the phone. Most respondents were female, of Caucasian race, had at least some college education, and had private insurance (Table 1).

Over half of the pediatric patients had a chronic health condition and nearly 40% had a hospitalization in the 6 months preceding the survey. The high percentage of parents with college education, as well

as the age distribution of the pediatric patients, was representative of the hospital's patient population.

African-American respondents completed both surveys less frequently than Caucasians (odds ratio [OR] = 0.21, CI 0.11–0.43,  $P < 0.001$ ) or those of Hispanic ethnicity (OR = 0.43, CI 0.21–0.86,  $P < 0.05$ ). However, on the FCCS at recruitment, African-Americans and Hispanics reported similar satisfaction with care compared with respondents of other races or ethnicities, suggesting that the effect of attrition bias on our study results should be minimal.

In Phase 3, 929 parents from a random sample of families completed the shortened 61-item final PIES version (response rate: 36.2%). Compared with the Phase 2 sample, Phase 3 participants tended to have lower severity of illness, fewer chronic health conditions, shorter hospital stays, higher ratings of overall patient health and fewer hospital stays in the 6 months preceding the survey (Table 1). When comparing ICD-9 diagnostic codes [43], the Phase 3 sample had lower rates of endocrine, nutritional, metabolic and hematologic disorders compared with the validation sample (Supplementary material, Table S2) [44].

### Psychometric properties

In EFA of Phase 2 data, we found that an 8-factor solution, explaining 67% of common variance across items, appeared to be the best factor structure. Items intended to measure the same thematic domain generally loaded together on a distinct factor. The 8-factor structure was corroborated by CFA of the confirmatory sample data (Supplementary material, Table S3). The model fit was acceptable (CFI = 0.90;  $\chi^2$  (506) = 2038.31,  $P < 0.001$ ; RMSEA = 0.057), indicating that dimensionality across PIES items was generalizable and fit the prediction.

Internal consistency reliability within the identified factors was satisfactory for all but the 'Communication about Medications' domain, which had a Cronbach's  $\alpha$  of 0.55. Test-retest reliability was also lower for this domain (ICC < 0.50), as well as for the Admission domain, compared with other domain scores that had moderate to good test-retest reliability (Table 2).

Domain scores for the Phase 2 sample ranged from 49.4 to 73.8% (Table 3), and contained a low percentage of missing values (0.3–2.3%). Domain score distributions were negatively skewed, especially for 'Patient Comfort', with 64% of the sample reporting the maximum possible score. Correlations between domain scores and the overall quality of care ratings were moderate to high, with correlations being greatest for 'Emotional Satisfaction', 'Partnership with Nurses', 'Partnership with Physicians', and 'Patient Comfort' (Table 3). Correlations between different PIES domains were in general also highest among these four domains (0.47–0.71) (Supplementary material, Table S4). The domain least correlated with any other domain was 'Identification of Attending Physician'. PIES domains assessing nursing care and parent involvement in care have been previously reported to show strong convergence with FCCS scores, supporting construct validity of those PIES domains [16].

In comparing the two different administration modes, we found that a substantial proportion of items (40%) in the final PIES showed significant but small mean differences between mail and phone administrations, with phone tending to elicit higher ratings (analyses not shown). While mode effects were small in terms of effect sizes at the item level, domain-level scores amplified the differences since phone respondents were more likely to choose the best possible rating (Table 3). Domain score mode differences were greatest (>10%

**Table 2** Domain-level psychometric reliability characteristics in the PIES validation sample: test-retest reliability and internal consistency

Dimension	Overall mean (SD)—test	Overall mean (SD)—retest	P-value (Wilcoxon signed-rank test)	Effect size, <i>d</i>	ICC	Cronbach's alpha ( <i>n</i> = 396)
Partnership with nurses ( <i>n</i> = 352)	69.4 (30.1)	69.0 (31.6)	0.78	0.02	0.73	0.89
Partnership with physicians ( <i>n</i> = 352)	65.7 (31.7)	66.0 (32.3)	0.32	−0.01	0.67	0.88
Identification of attending physician ( <i>n</i> = 346)	49.4 (50.1)	51.2 (50.1)	0.52	−0.04	0.50	N/A
Patient comfort ( <i>n</i> = 347)	74.6 (37.3)	72.5 (37.4)	0.20	−0.03	0.50	0.70
Communication about medications ( <i>n</i> = 240)	57.9 (39.1)	61.5 (42.0)	0.06	−0.07	0.42	0.55
Admission ( <i>n</i> = 348)	58.8 (40.4)	59.1 (40.7)	0.67	−0.01	0.43	0.70
Discharge and home care preparation ( <i>n</i> = 351)	64.7 (37.5)	65.6 (38.6)	0.20	−0.002	0.59	0.89
Emotional satisfaction ( <i>n</i> = 350)	62.9 (40.6)	64.1 (40.7)	0.35	−0.03	0.60	0.86

**Table 3** Descriptive statistics, mode differences and correlation with overall rating for PIES domains

PIES domains	Mean (SD)	% of Respondents with minimum value	% of Respondents with maximum value	Median (interquartile range)	% Missing values	Phone–mail mean difference ( <i>P</i> )	Correlation with overall rating
Partnership with nurses ( <i>n</i> = 395)	69.5 (29.9)	3.5	27.9	78 (56–100)	0.25	4.6 (0.17)	0.53
Partnership with physicians ( <i>n</i> = 395)	65.7 (31.4)	6.1	24.3	75 (44–100)	0.25	5.6 (0.12)	0.47
Identification of attending physician ( <i>n</i> = 387)	49.4 (50.1)	50.7	49.3	0 (0–100)	2.27	2.3 (0.65)	0.22
Patient comfort ( <i>n</i> = 391)	73.8 (38.0)	16.4	63.9	100 (50–100)	1.26	12.1 (0.004)	0.47
Communication about medications ( <i>n</i> = 296)	58.8 (39.2)	23.3	40.9	50 (50–100)	0.76	7.9 (0.10)	0.33
Admission ( <i>n</i> = 389)	58.9 (40.5)	25.5	43.2	50 (0–100)	1.77	10.7 (0.008)	0.36
Discharge and home care preparation ( <i>n</i> = 393)	65.5 (37.5)	15.0	41.7	83 (33–100)	0.76	14.7 (0.0002)	0.38
Emotional satisfaction ( <i>n</i> = 392)	62.8 (40.9)	21.9	45.2	75 (25–100)	1.01	16.1 (0.0001)	0.56



point difference) for 'Emotional Satisfaction', 'Discharge and Home Care Preparation', 'Patient Comfort', and 'Admission'.

In testing the ability of PIES domain scores to differentiate groups expected to have differing scores, we found, as hypothesized, that nearly all domains showed significantly higher scores for surgical compared with medical patients, and for first-time patients compared with patients with prior stays (Table 4). As expected, scores for the 'Identification of Attending Physician' domain tended to be higher among non-first-time patients.

### Parents' experiences with care

Parents' experiences with care at this hospital are shown for items in the order they appear in the final PIES for both the Phase 2 validation sample and the Phase 3 confirmatory sample (Table 5). Since answers from the confirmatory sample are based on a random sample of patients discharged from the hospital, we can assume that these responses are more likely to represent experiences of the total patient population. A very high percentage of parents reported that nurses and physicians were always courteous (84.4 and 86.3%) and explained things in a way parents could understand (83.3 and 81.2%). Similarly, most parents trusted the knowledge and skills of physicians (84.2%), less so for nurses (75.2%) and reported more frequently that physicians listened carefully to what parents had to say (81.1% compared with 78.3% for nurses). Similar percentages of parents reported that staff did everything to control their child's pain and always explained what new medicines were for (84.3 and 82.6%). Less than half of parents reported that their concerns or complaints were promptly addressed by nurses (46.2%), and only a little more than half felt that nurses provided them with enough help with their child's daily care (57.7%). Less than half of the parents also reported that they were always told about the side effects of new medicines (45.8%). It was also only slightly easier for parents to let nurses, compared with physicians, know about any concerns they had (46.2 versus 40.7%)

About two-thirds of parents reported good communication among nurses (67.3%), physicians (63.5%), and between nurses and physicians (65.4%), were able to identify the physician in charge of their child's care in this hospital's teaching environment (62.6%), felt that they were kept

informed about test results and their child's treatment (65.7%), and felt that they were included in planning and decision-making (66.3%).

Experiences with the admission process was the part of hospital stays rated lowest by parents, with only 58.6% reporting that the admission process was well organized and 30.2% responding that staff provided a reason for delays. Even though nearly three quarters of parents reported knowing what problems to watch out for at home (70.9%), who to call if they had questions (68.0%), how to deal with their child's potential pain at home (73.3%), and how to give new medicines at home (76.8%), only 61.5% felt that they were well prepared to leave the hospital and care for their child at home. Overall, an average of about two-thirds of parents were always satisfied during their stay with regard to the hospital delivering on its promises (58.2%), having a reputation that could be trusted (74.9%), staff treating the parents and child the way they wanted to be treated (66.0%), and staff having a positive attitude toward their work (69.4%).

Table 3 displays the average domain scores summarizing individual items. The domains with the lowest scores were 'Main Physician', 'Communication about Medications' and 'Admission', potentially highlighting areas for quality improvement. 'Patient Comfort' had the highest mean score, followed by 'Partnership with Nurses'.

### Discussion

Patient evaluations of hospital care experiences are now regularly included as benchmarking measures and in pay-for-performance contracts, and they have recently been shown to have high correlations with more traditional measures of clinical care quality [7, 45, 46].

This report describes the development, refinement and psychometric testing of the PIES, a survey instrument focused more on objective parent-reported experiences rather than solely on satisfaction during a child's hospital stay. PIES builds on previous measures by including both domains that are universally found in other patient experience measures (e.g. nursing care, physician care, the admission and discharge processes, quality of communication, and others) and domains that address more current priorities, such as family-centered care and how emotionally connected parents feel to staff and the hospital.

**Table 4** Mean comparisons of PIES domains by patient type and previous inpatient stays

Dimension	Overall mean (SD)	Surgical patients mean (SD)	Medical patients mean (SD)	Effect size, <i>d</i>	<i>P</i> -value (Wilcoxon–Mann–Whitney test)	First-time patients mean (SD)	Multiple times patients mean (SD)	Effect size, <i>d</i>	<i>P</i> -value (Wilcoxon–Mann–Whitney test)
Partnership with nurses ( <i>n</i> = 395)	69.5 (29.9)	71.3 (28.6)	67.8 (31.0)	0.11	0.37	73.9 (28.5)	66.5 (30.4)	0.25	0.012
Partnership with physicians ( <i>n</i> = 395)	65.7 (31.4)	71.6 (28.6)	60.3 (32.8)	0.34	0.001	69.7 (30.6)	63.1 (31.5)	0.21	0.029
Identification of attending physician ( <i>n</i> = 387)	49.4 (50.1)	59.0 (49.3)	40.7 (49.2)	0.37	0.0003	45.2 (49.9)	52.4 (50.1)	−0.14	0.16
Patient comfort ( <i>n</i> = 391)	73.8 (38.0)	77.0 (36.0)	70.8 (39.6)	0.16	0.128	76.7 (36.7)	71.9 (38.7)	0.12	0.20
Communication about medications ( <i>n</i> = 296)	58.8 (39.2)	58.4 (38.4)	59.1 (40.0)	−0.02	0.825	63.5 (38.8)	55.9 (39.0)	0.20	0.10
Admission ( <i>n</i> = 389)	58.9 (40.5)	66.8 (38.9)	51.7 (40.7)	0.37	0.0002	62.3 (40.5)	56.6 (40.4)	0.14	0.16
Discharge and home care preparation ( <i>n</i> = 393)	65.5 (37.5)	70.5 (34.9)	60.9 (39.2)	0.24	0.020	65.1 (39.0)	65.9 (36.3)	−0.02	0.85
Emotional satisfaction ( <i>n</i> = 392)	62.8 (40.9)	67.6 (38.5)	58.3 (42.6)	0.22	0.028	67.3 (40.3)	59.7 (41.0)	0.19	0.035

**Table 5** Respondents choosing top-box percentage of rating items by domains for validation and confirmatory sample

Domains and items	Number and percentage of respondents choosing the top-box	
	Validation sample	Confirmatory sample
<b>Partnership with nurses</b>		
Were courteous and respectful to parents and child	82.7 (332/401)	84.4 (779/923)
Listened carefully to what parents had to say	70.8 (283/400)	78.3 (723/923)
Explained things in a way parents could understand	76.5 (306/400)	83.3 (770/924)
Parents felt confidence and trust in knowledge and skill of nurses	63.3 (253/400)	75.2 (694/923)
Was easy for parents to let nurses know about any concerns	71.4 (267/374)	46.2 (343/743)
Addressed parents' concerns or complaints promptly	60.0 (189/315)	67.6 (505/747)
Parents felt nurses had good communication among themselves	57.7 (228/395)	67.3 (621/923)
Parents felt physicians and nurses worked well together	58.2 (231/397)	65.4 (604/923)
Gave enough help with child's daily care	60.4 (157/260)	57.7 (515/893)
<b>Partnership with physicians</b>		
Were courteous and respectful to parents and child	88.0 (337/383)	86.3 (797/924)
Listened carefully to what parents had to say	78.1 (300/384)	81.1 (744/918)
Explained things in a way parents could understand	78.2 (301/385)	81.2 (748/921)
Parents felt confidence and trust in knowledge and skill of physicians	78.9 (302/383)	84.2 (775/921)
Was easy for parents to let physicians know about any concerns	56.2 (208/370)	40.7 (309/760)
Parents felt physicians had good communication among themselves	52.5 (221/396)	63.5 (583/918)
<b>Physicians did not make parents confused by telling different things</b>		
Parents were kept informed about test results and treatment	43.5 (156/359)	53.0 (426/804)
Parents were included in planning and making decisions	58.5 (234/400)	65.7 (606/923)
Parents were included in planning and making decisions	56.7 (224/395)	66.3 (611/922)
<b>Identification of Attending Physician</b>		
Parents clearly knew which physician was in charge of child's care	49.4 (194/393)	62.6 (575/919)
<b>Patient Comfort</b>		
Staff did everything to control child's pain	76.9 (266/346)	84.3 (691/820)
Staff was attentive to child's comfort during tests and procedures	71.5 (274/383)	72.5 (670/924)
<b>Communication about medications</b>		
Staff told parents what new medicines were for	76.9 (230/299)	82.6 (568/688)
Staff told parents about side effects of new medicines	40.0 (118/295)	45.8 (313/683)
<b>Admission</b>		
Admission process was well organized	56.7 (220/388)	58.6 (541/923)
Staff provided reason for delay in admitting or seeing child	33.6 (75/223)	30.2 (120/397)
<b>Discharge and home care preparation</b>		
Parents and child were well prepared to leave hospital	64.0 (254/397)	61.5 (569/925)
Staff prepared parents to care for child at home	58.0 (217/374)	61.2 (540/883)
Parents knew what problems they should watch out for	68.9 (261/379)	70.9 (627/884)
Parents knew who they should call if questions or concerns	71.3 (271/380)	68.0 (600/882)
Staff prepared parents to deal with child's potential pain at home	64.0 (197/308)	73.3 (554/756)
Staff prepared parents to give child new medicines at home	69.8 (210/301)	76.8 (541/704)
<b>Emotional satisfaction</b>		
Hospital delivers on its promises	53.2 (210/395)	58.2 (527/905)
Hospital has a reputation that can be trusted	72.3 (287/397)	74.9 (681/911)
Staff treated parents and child the way they wanted to be treated	63.8 (254/398)	66.0 (602/913)
Staff have a positive attitude toward their work	63.1 (251/398)	69.4 (635/915)

Results of item- and domain-level analyses suggest satisfactory test-retest reliability and internal consistency for nearly all PIES domains. Based on these findings, the 35 rating items of the final 61-item PIES represent a reliable, multi-dimensional survey tool that can measure the most salient aspects of a parent's experience with their child's hospital stay. This survey was designed to be used as a core questionnaire, with additional 'modules' assessing specific topics (such as the care provided in the emergency department or in intensive care units) added on a rotating basis. This approach reduces survey length and respondent burden while providing necessary detailed information important for quality improvement assessment.

In addition, compared with item distributions found using the 3-point response scale in the hospital's prior survey, PIES items, with their longer response scales, showed fewer ceiling effects and more normal distribution (analyses not shown); this theoretically

allows for more sensitive measurement of change that could not be tested in this cross-sectional non-interventional study design.

We found small differences at the item level between different data collection modes. As expected, data from phone surveys showed higher average ratings when compared with data from mail surveys [47]. The top-box domain scoring methodology increased these effects as previously reported by Elliott *et al.* [48]. A mode adjustment should therefore be developed if using both modes to collect data or if data collected using both modes are compared.

The survey results are similar overall to results found in studies using patient satisfaction surveys to evaluate inpatient pediatric care from a parent's point of view, both in the USA and in Europe [11, 19, 22, 31, 49]. Domain scores show that about two-thirds of the parent participants report to have had a good experience throughout their child's inpatient stay; however, large standard deviations

show that there remains room for patient experience improvement. Ratings are generally highest with regard to the partnership with nurses and physicians and patient comfort, especially with regard to courtesy and kindness of the nursing staff [22, 50]. Parents continue to not feel supported in their child's care, presenting additional opportunities for quality improvement [31, 50].

Our study revealed lower experience scores for admission and discharge process similar to prior studies such as that by Homer *et al.* [31] suggesting problems of a more systemic nature.

### Limitations

Our study has a number of limitations. First, we developed and tested PIES at a single urban free-standing pediatric hospital, limiting the generalizability of our findings at this point in time. Testing in multiple institutions across the USA has only recently been completed. Secondly, the survey was only available in English and, therefore, responses might be less representative of families who are not English-speaking. Thirdly, the response rate of 36.2% for the confirmatory sample could open the results to potential nonresponse bias. Unfortunately, this is a fairly typical response rate for patient experiences surveys in the USA [48]. Fourthly, the domain on communications about medications failed to achieve the recommended minimum of Cronbach's alpha of 0.70, despite the fact that item and domain distributions were generally less skewed than those found with the prior survey. Test-retest reliability was generally good, indicating promise for detecting change over time. The extension of response scales should make PIES more amenable to measure change, an important survey characteristic given the rise of benchmarking and pay-for performance requirements, and the need to evaluate effects of quality improvement activities. Future studies should explore whether the survey instrument can be further shortened to a smaller number of theoretically important and well-performing questions.

### Conclusion

We have developed a comprehensive 8-domain 61-item survey, known as PIES to assess parental experiences with inpatient pediatric hospitalizations. PIES generally provides items and domains with acceptable reliability (test-retest and internal consistency) and validity (content and known-group validity), with known properties for paper and phone data collection. Even though the survey focuses on measuring experiences rather than satisfaction, it includes a novel domain, parental emotional satisfaction, which shows a strong relationship to global rating questions. Less skewed item distributions show promise for measuring change over time and an improved ability to assess the impact of quality improvement initiatives using PIES compared with other tools. The quality of PIES has been acknowledged through full endorsement from the National Quality Forum as a child health quality measure (NQF# 0725) [51]. Future validation work will include the administration of PIES at different hospitals and in different languages.

### Supplementary material

Supplementary material is available at *INTQHC* online.

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### Conflict of interest statement

None declared.

### References

- Addink RW, Bankart MJ, Murtagh GM *et al.* Limited impact on patient experience of access of a pay for performance scheme in England in the first year. *Eur J Gen Pract* 2011;17:81–6.
- Merlino JI, Raman A. Health care's service fanatics. *Harv Bus Rev* 2013;91:108–16; 150.
- Wolosin R, Ayala L, Fulton BR. Nursing care, inpatient satisfaction, and value-based purchasing: vital connections. *J Nurs Adm* 2012;42:321–5.
- Hargraves JL, Hays RD, Cleary PD. Psychometric properties of the Consumer Assessment of Health Plans Study (CAHPS) 2.0 adult core survey. *Health Serv Res* 2003;38:1509–27.
- O'Malley AJ, Zaslavsky AM, Hays RD *et al.* Exploratory factor analyses of the CAHPS<sup>®</sup> Hospital Pilot Survey Responses across and within medical, surgical, and obstetric services. *Health Serv Res* 2005;40:2078–95.
- DuPree E, Anderson R, Nash IS. Improving quality in healthcare: start with the patient. *Mt Sinai J Med* 2011;78:813–9.
- Farley H, Enguidanos ER, Coletti CM *et al.* Patient satisfaction surveys and quality of care: an information paper. *Ann Emerg Med* 2014;64:351–7.
- Giordano LA, Elliott MN, Goldstein E *et al.* Development, implementation, and public reporting of the HCAHPS survey. *Med Care Res Rev* 2010;67:27–37.
- Song Z, Safran DG, Landon BE *et al.* The 'Alternative Quality Contract,' based on a global budget, lowered medical spending and improved quality. *Health Aff (Millwood)* 2012;31:1885–94.
- Toomey SL, Zaslavsky AM, Elliott MN *et al.* The development of a Pediatric Inpatient Experience of Care Measure: Child HCAHPS(R). *Pediatrics* 2015;136:360–9.
- Garratt AM, Bjertnaes OA, Barlinn J. Parent experiences of paediatric care (PEPC) questionnaire: reliability and validity following a national survey. *Acta Paediatr* 2007;96:246–52.
- Latour JM, Hazelzet JA, van der Heijden AJ. Parent satisfaction in pediatric intensive care: a critical appraisal of the literature. *Pediatr Crit Care Med* 2005;6:578–84.
- Ammentorp J, Mainz J, Sabroe S. Determinants of priorities and satisfaction in pediatric care. *Pediatr Nurs* 2006;32:333–40. 48.
- Ammentorp J, Mainz J, Sabroe S. Parents' priorities and satisfaction with acute pediatric care. *Arch Pediatr Adolesc Med* 2005;159:127–31.
- Bragadottir H, Reed D. Psychometric instrument evaluation: the pediatric family satisfaction questionnaire. *Pediatr Nurs* 2002;28:475–82.
- Curley MA, Hunsberger M, Harris SK. Psychometric evaluation of the family-centered care scale for pediatric acute care nursing. *Nurs Res* 2013;62:160–8.
- Goldstein E, Farquhar M, Crofton C *et al.* Measuring hospital care from the patients' perspective: an overview of the CAHPS Hospital Survey development process. *Health Serv Res* 2005;40:1977–95.
- Heyland DK, Rucker GM, Dodek PM *et al.* Family satisfaction with care in the intensive care unit: results of a multiple center study. *Crit Care Med* 2002;30:1413–8.



19. Latour JM, van Goudoever JB, Duivenvoorden HJ *et al.* Construction and psychometric testing of the EMPATHIC questionnaire measuring parent satisfaction in the pediatric intensive care unit. *Intensive Care Med* 2011;**37**:310–8.
20. Latour JM, van Goudoever JB, Duivenvoorden HJ *et al.* Perceptions of parents on satisfaction with care in the pediatric intensive care unit: the EMPATHIC study. *Intensive Care Med* 2009;**35**:1082–9.
21. McPherson ML, Sachdeva RC, Jefferson LS. Development of a survey to measure parent satisfaction in a pediatric intensive care unit. *Crit Care Med* 2000;**28**:3009–13.
22. Miceli PJ, Clark PA. Your patient—my child: seven priorities for improving pediatric care from the parent's perspective. *J Nurs Care Qua* 2005;**20**:43–53; quiz 4–5.
23. Moutzoglou A, Dafogianni C, Karra V *et al.* Development and application of a questionnaire for assessing parent satisfaction with care. *Int J Qual Health Care* 2000;**12**:331–7.
24. Schaffer P, Vaughn G, Kenner C *et al.* Revision of a parent satisfaction survey based on the parent perspective. *J Pediatr Nurs* 2000;**15**:373–7.
25. Ygge BM, Arnetz JE. Quality of paediatric care: application and validation of an instrument for measuring parent satisfaction with hospital care. *Int J Qual Health Care* 2001;**13**:33–43.
26. Budreau G, Chase L. A family-centered approach to the development of a pediatric family satisfaction questionnaire. *Pediatr Nurs* 1994;**20**:604–8.
27. Cleary PD, Edgman-Levitan S, Roberts M *et al.* Patients evaluate their hospital care: a national survey. *Health Aff (Millwood)* 1991;**10**:254–67.
28. Hall JA, Dornan MC. Meta-analysis of satisfaction with medical care: description of research domain and analysis of overall satisfaction levels. *Soc Sci Med* 1988;**27**:637–44.
29. Hendriks AA, Vrieling MR, Smets EM *et al.* Improving the assessment of (in)patients' satisfaction with hospital care. *Med Care* 2001;**39**:270–83.
30. Mack JW, Co JP, Goldmann DA *et al.* Quality of health care for children: role of health and chronic illness in inpatient care experiences. *Arch Pediatr Adolesc Med* 2007;**161**:828–34.
31. Homer CJ, Marino B, Cleary PD *et al.* Quality of care at a children's hospital: the parent's perspective. *Arch Pediatr Adolesc Med* 1999;**153**:1123–9.
32. Fleming JH, Asplund J. *Human Sigma: Managing the Employee-Customer Encounter*. New York, NY: Gallup Press, 2007.
33. Huppertz JW, Smith R. The value of patients' handwritten comments on HCAHPS surveys. *J Healthc Manag* 2014;**59**:31–47.
34. Fowler FJ, Mangione TW. *Standardized Survey Interviewing: Minimizing Interviewer-Related Error*. Newbury Park, CA, London: Sage, 1990.
35. StataCorp. *Stata Statistical Software - Release 12*. College Station, TX: Stata Corp LP, 2011.
36. Fleiss J. *Reliability of Measurements. The Design and Analysis of Clinical Experiments*. Hoboken, New Jersey: John Wiley, 1986,2–31.
37. Cohen J. Statistical power analysis. *Curr Dir Psychol Sci* 1992;**1**:98–101.
38. Bland JM, Altman DG. Cronbach's alpha. *BMJ*. 1997;**314**:572.
39. CMS. Calculation of HCAHPS Scores: From Raw Data to Publicly Reported Results. 2011 [cited 2013 06/23/2013]. <http://www.hcahpsonline.org/Files/Calculation%20of%20HCAHPS%20Scores.pdf> (23 June 2013, date last accessed).
40. Rogut L, Newman LS, Cleary PD. Variability in patient experiences at 15 New York City Hospitals. *Bull N Y Acad Med* 1996;**73**:314–34.
41. John J. Patient satisfaction: the impact of past experience. *J Health Care Mark* 1992;**12**:56–64.
42. Bentler PM, Bonnett DG. Significance tests and goodness of fit in the analysis of covariance structures. *Psychol Bull* 1980;**88**:588–606.
43. CDC/NCHS. International Classification of Diseases, Ninth Revision, Clinical Modification (ICD-9-CM). <http://www.cdc.gov/nchs/icd/icd9cm.htm>: CDC/NCHS; 2011 (18 March 2012, date last accessed).
44. Feudtner C, Levin JE, Srivastava R *et al.* How well can hospital readmission be predicted in a cohort of hospitalized children? A retrospective, multicenter study. *Pediatrics* 2009;**123**:286–93.
45. Isaac T, Zaslavsky AM, Cleary PD *et al.* The relationship between patients' perception of care and measures of hospital quality and safety. *Health Serv Res* 2010;**45**:1024–40.
46. Jha AK, Orav EJ, Zheng J *et al.* Patients' perception of hospital care in the United States. *N Engl J Med* 2008;**359**:1921–31.
47. Cheldelin LV, Dunham S, Stewart V. NICU patient satisfaction: how you measure counts. *J Perinatol*. 2013;**33**:324–6.
48. Elliott MN, Lehrman WG, Goldstein EH *et al.* Hospital survey shows improvements in patient experience. *Health Aff (Millwood)* 2010;**29**:2061–7.
49. Solheim E, Garratt AM. Parent experiences of inpatient pediatric care in relation to health care delivery and sociodemographic characteristics: results of a Norwegian national survey. *BMC Health Serv Res* 2013;**13**:512.
50. Elisabeth Williams GW. Paediatric inpatient setting: an evaluation of parental perspectives. *Br J Nurs* 2013;**22**:630–3.
51. NQF. Find Measures. 2011 [cited 2014 06/05/2014]. [www.qualityforum.org/Qps/QpsTool.asp](http://www.qualityforum.org/Qps/QpsTool.asp).