Preventing Dehydration-Related Hospitalizations: A Mixed-Methods Study of Parents, Inpatient Attendings, and Primary Care Physicians

abstract

OBJECTIVE: The goal of this study was to identify the proportion of dehydration-related ambulatory care–sensitive condition hospitalizations, the reasons why these hospitalizations were preventable, and factors associated with preventability.

METHODS: A cross-sectional survey of primary care providers (PCPs), inpatient attending physicians, and parents was conducted in a consecutive series of children with ambulatory care–sensitive conditions admitted to an urban hospital over 14 months.

RESULTS: Eighty-five children were diagnosed with dehydration. Their mean age was 1.6 years; most had public (74%) or no (17%) insurance, and were nonwhite (91%). The proportion of hospitalizations assessed as preventable varied from 12% for agreement among all 3 sources to 45% for any source. Parents identified inadequate prevention (50%), poor self-education (34%), and poor quality of care (38%) as key factors. PCPs identified parents providing insufficient home rehydration (33%), not visiting the clinic (25%), and not calling earlier (16%) as reasons. Inpatient attending physicians cited home rehydration (40%), delays in seeking care (40%), and lacking a PCP (20%) as contributors. Physicians (PCPs and inpatient attending physicians) were more likely than parents to describe the admission as inappropriate (75% vs 67% vs 0%; P < .01). Parental dissatisfaction with their child’s PCP and a history of avoiding primary care due to costs or insurance problems were associated with significantly higher odds of preventable hospitalization.

CONCLUSIONS: Up to 45% of dehydration-related hospitalizations may be preventable. Inadequate parental education by physicians, insufficient home rehydration, deferring clinic visits, insurance and cost barriers, inappropriate admissions, poor quality of care, and parental dissatisfaction with PCPs are the reasons that these hospitalizations might have been prevented.

Dehydration-related hospitalizations are common and costly, at 73,936 hospital discharges and $562 million in costs per year.¹² Dehydration-related hospitalizations are classified as preventable, and are considered an ambulatory care–sensitive condition (ACSC) because they potentially can be avoided with timely, effective outpatient care.³

A study of all pediatric hospitalizations due to ACSCs revealed that dehydration/gastroenteritis was the second most common ACSC, after asthma.⁴ Despite the conclusion that ACSC hospitalizations can be prevented with timely, efficient outpatient care, the study identified, according to specific diagnoses, substantial
variability in the reasons hospitalizations were preventable. For example, admissions for seizures and urinary tract infections were assessed as less avoidable than those due to asthma, dehydration, and skin conditions. In addition, medication-related reasons were the most common reason for preventable asthma hospitalizations, but were less important for several other ACSCs. Given this variability among ACSC diagnoses, the substantial proportion of ACSC admissions for dehydration, and the limited research on specifically how dehydration-related hospitalizations can be prevented, the goals of the current study were to identify: (1) the proportion of ACSC hospitalizations due to dehydration assessed as avoidable by the parents, primary care providers (PCPs), and inpatient physicians (IAPs) of hospitalized children; (2) the reasons why these hospitalizations may have been preventable; and (3) the factors associated with preventability.

METHODS
A detailed description of the study methods is available elsewhere. A summary of relevant methods and a description of analyses are presented in the following sections.

Definitions
Consistent with previous works, the term “preventable” is used to describe any hospital admission that was considered to be preventable according to at least 1 of the sources interviewed (parents, PCPs, or IAPs).

Participants
Participants were included in the study by using the following criteria: (1) children (≤18 years old) with an ACSC primary diagnosis of dehydration, vomiting, or diarrhea; and (2) admission to the inpatient service during a 20-month period (May 1997–December 1998). Children were excluded from the study for the following reasons: (1) direct admission to the PICU; (2) the parents were unavailable for interview during the hospital stay, such as in cases under investigation for suspected neglect or abuse; and (3) hospitalization was for conditions in which the primary diagnosis listed was not dehydration, vomiting, or diarrhea. A daily review of the inpatient-service census was conducted to identify children admitted for dehydration, with cross-referencing and confirmation through inspection of medical records.

Data Collection and Questionnaire
Baseline sociodemographic data were abstracted from each child’s medical record. The child’s age, admission diagnosis, name of the regular pediatrician (if the child had one), name of the IAP, type of insurance, child’s race/ethnicity (as per the parent/legal guardian), educational attainment of the parent/legal guardian (referred to as the parent), and combined monthly family income were recorded.

The parent of each admitted child completed a questionnaire, in English or Spanish, that was orally administered by a trained, bilingual Latina research assistant. For parents whose primary language was other than English or Spanish and who had limited English proficiency, the research assistant administered the questionnaire with the assistance of a medical interpreter from the hospital’s interpreter services. A 4-month pilot study was conducted to refine the final questionnaire. Parents were also asked why their child was admitted and whether they believed anything could have prevented the hospital admission. If parents assessed the hospitalization as preventable, they were then asked to specify the reason(s). Parents who reported that the child had visited a physician or the parents had spoken to a physician before the hospitalization were asked to assess their general satisfaction with the physician’s care. When the parents reported that their child had no regular health care provider, they were asked where the child was taken for checkups, vaccinations, and acute care. All parents were asked to assess whether their child had easy access to health care, whether health care costs or problems with health insurance ever kept them from obtaining needed medical care, and whether they ever experienced difficulties in obtaining medications for their child due to excessive costs or because the medications were not covered by their health insurance.

Attempts were made to conduct a brief in-person or telephone interview with the PCP (for children with a regular physician) and IAP of each hospitalized child. Physicians were asked to assess if the child’s hospitalization was preventable and to provide detailed reasons for their assessment. When the physician could not initially be contacted for an interview, a minimum of 10 subsequent efforts to conduct an interview were made over at least 1 month. When the PCP also was the IAP, an assessment of preventability was recorded only for the PCP.

Two researchers independently coded how each source assessed the preventability of a given hospitalization. All reasons for the physician assessment were then independently categorized. The independent coding and categorizations of the 2 researchers were compared, and any disagreements were discussed and settled by consensus. There were no cases in which consensus could not be reached.
Analyses

Bivariate analyses were performed by using the χ² test or Fisher's exact test (for comparisons with low expected cell counts) for categorical variables, and Wilcoxon’s 2-sample test for continuous variables; a 2-tailed \( P < .05 \) was considered statistically significant. Sociodemographic and health-services use characteristics and the preventability of hospitalizations of patients with dehydration, consistent with previous research, were compared with the characteristics and hospitalizations of 469 children admitted with other ACSCs at the same hospital during the same time interval; the goal was to examine whether characteristics of dehydration-related hospitalizations differ from those of other ACSC hospitalizations. “Don’t know” responses to the question regarding the preventability of a hospitalization were coded as missing. To assess interobserver agreement on the preventability of the dehydration-related hospitalizations, \( \kappa \) coefficients were calculated by using SAS software (SAS Institute, Inc, Cary, NC), and interpreted using the scale of Landis and Koch. Multivariable analyses were performed using stepwise logistic regression, with an initial \( \alpha \)-to-enter of .15, and a final \( P < .05 \). The dependent variable was the preventability of the dehydration-related hospitalization (dichotomized as yes/no), according to at least 1 source. The independent variables chosen for analysis were those used in the previous research on preventable pediatric hospitalizations. In cases in which an independent variable was defined in multiple ways, separate models were run for each definition. All variables found to be significant in the stepwise regression were included in a final model that further adjusted for children’s insurance coverage, poverty status, and parental educational attainment. All statistical analyses were performed using SAS version 8.2 software.

Informed Consent and Institutional Review Board Approval

Written informed consent was obtained from the parent of every participating child. The Boston Medical Center institutional review board approved the study.

RESULTS

Dehydration was the second most frequent ACSC diagnosis, accounting for 15% of all hospitalizations. A total of 85 dehydration-related hospitalizations, from among 554 ACSC hospitalizations, fulfilled initial study enrollment criteria. No parents refused to participate in the study. Children admitted for dehydration were significantly younger than those admitted for other ACSCs, with a mean age of 1.6 versus 4.8 years (Table 1). The 2 groups did not significantly differ in health insurance coverage, with three-quarters of children insured by public coverage. More than 85% of children were either African American or Latino. No significant intergroup differences existed in race/ethnicity, parental educational attainment, family income, the child having a regular pediatrician, or the parent contacting the PCP (by telephone or office visit) before admission. In both groups, most children had a regular physician, and most parents reported being satisfied with their child’s care and having easy access to care. A minority reported ever having difficulty obtaining medical care for their child because of cost or insurance problems, or difficulty obtaining a child’s medication.

Preventability of Dehydration-Related Hospitalizations

One-quarter of parents assessed their child’s dehydration-related hospitalization as preventable, compared with 33% of PCPs and 19% of IAPs (Table 2). The proportion of hospitalizations assessed as preventable by parents or PCPs did not significantly differ from the proportion assessed as preventable for other ACSCs. IAPs were significantly less likely to assess dehydration-related hospitalizations as preventable, compared with other ACSCs, at 19% versus 34% (\( P < .01 \)). The proportion of dehydration-related hospitalizations assessed as preventable varied depending on the source, ranging from as low as 12% for agreement among all 3 sources (parents and the 2 physician groups) to as high as 45% for any of these 3 sources. Illustrative cases of agreement and disagreement are provided in Fig 1.

Reasons for Preventability of Dehydration-Related Hospitalizations

Parent/Patient-Related

The most common reasons cited for preventability of dehydration-related hospitalizations differed according to the assessing source (Table 3). Nearly three-quarters (71%) of PCPs cited a parent/patient-related reason, a significantly greater proportion than the 28% of parents and 38% of IAPs citing a parent/patient-related reason. In contrast, 57% of parents and 46% of IAPs reported a physician-related reason, compared with 23% of PCPs, although these differences were not statistically significant.

Inadequate prevention (more fluids at home), parents not adequately educating themselves, and delay in or not bringing the child in for follow-up care were
TABLE 1 Selected Features of Children Admitted for Dehydration, Compared With Children Admitted for Other ACSCs

<table>
<thead>
<tr>
<th>Feature</th>
<th>Dehydration (n = 85)</th>
<th>Other ACSCs (n = 469)</th>
<th>P</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mean age, y (range)</td>
<td>1.6 (0–18)</td>
<td>4.8 (0–18)</td>
<td>&lt;.001</td>
</tr>
<tr>
<td>Health insurance coverage, %</td>
<td></td>
<td></td>
<td>.86</td>
</tr>
<tr>
<td>None</td>
<td>17</td>
<td>16</td>
<td></td>
</tr>
<tr>
<td>Public</td>
<td>74</td>
<td>73</td>
<td></td>
</tr>
<tr>
<td>Private</td>
<td>9</td>
<td>11</td>
<td></td>
</tr>
<tr>
<td>Race/ethnicity, %</td>
<td></td>
<td></td>
<td>.64</td>
</tr>
<tr>
<td>African-American</td>
<td>57</td>
<td>63</td>
<td></td>
</tr>
<tr>
<td>Latino</td>
<td>29</td>
<td>23</td>
<td></td>
</tr>
<tr>
<td>White</td>
<td>9</td>
<td>10</td>
<td></td>
</tr>
<tr>
<td>Asian/Pacific islander</td>
<td>5</td>
<td>4</td>
<td></td>
</tr>
<tr>
<td>Parent not a high school graduate, %</td>
<td>37</td>
<td>43</td>
<td>.33</td>
</tr>
<tr>
<td>Median annual family income, $</td>
<td>12000</td>
<td>12072</td>
<td>.27</td>
</tr>
<tr>
<td>Child has regular physician, %</td>
<td>94</td>
<td>94</td>
<td>.88</td>
</tr>
<tr>
<td>Parent contacted PCP (by telephone or office visit) before admission, %</td>
<td>56</td>
<td>54</td>
<td>.70</td>
</tr>
<tr>
<td>Parent satisfied/very satisfied with regular physician’s care, %</td>
<td>9</td>
<td>89</td>
<td>.47</td>
</tr>
<tr>
<td>Child has easy access to medical care, %</td>
<td>87</td>
<td>90</td>
<td>.40</td>
</tr>
<tr>
<td>Child not brought in for medical care because of cost or insurance problems, %</td>
<td>8</td>
<td>8</td>
<td>.94</td>
</tr>
<tr>
<td>Ever had difficulty obtaining child’s medication, %</td>
<td>13</td>
<td>15</td>
<td>.60</td>
</tr>
</tbody>
</table>

* Wilcoxon 2-sample test used for continuous factors and χ² test for categorical factors.

the most common parent-related factors leading to preventable dehydration-related hospitalizations, as assessed by parents (Table 4). The 2 physician groups identified inadequate prevention and delay in or not seeking follow-up care as the most frequent parent-related factors, but did not identify lack of parental self-education as a reason.

Some parent/patient-related reasons were identified by only 1 source. For example, about one-third of parents cited failure to adequately educate themselves as a reason for avoidable hospitalization (Table 4). PCPs uniquely identified parents not going to the clinic before the hospitalization (25%), needing to call the PCP earlier (16%), and medication-related concerns (8%) as reasons for avoidable hospitalizations. IAPs uniquely reported a child lacking a PCP (20%) as a reason for a preventable hospitalization. There were no statistically significant intergroup differences according to assessing source for these reasons.

**Physician-Related**

Both physician groups were significantly more likely than parents to report that the admission was inappropriate (Table 5). More than one-third of parents cited poor quality of care as a physician-related factor, compared with none for both physician groups. IAPs uniquely identified that overly short observation times in the emergency department and the need for observation units as reasons for preventable hospitalization. All 3 sources reported that inadequate education of the parent (by the physician) was a reason for preventable hospitalization. Other reasons identified by parents were their child was discharged too early, or inadequate or no intervention was administered during hospitalization.

**Other Reasons**

The remaining reasons occurred infrequently and included no reason given, and "don’t know" responses from parents or physicians.

**Multivariable Analyses**

Two factors were significantly associated with dehydration-related hospitalizations, as assessed by the IAP (Table 6). A history of the parents not bringing their child to the physician because of costs or insurance problems was associated with 12 times the adjusted odds of a preventable hospitalization, and parental dissatisfaction with their child’s medical care with 7 times the adjusted odds of a preventable hospitalization.
FIGURE 1 Illustrative cases of agreement (A–D) and disagreement (E–G) among parents, PCPs, and IAPs about the preventability of dehydration-related hospitalizations for children. ER, emergency room.

<table>
<thead>
<tr>
<th></th>
<th>Parent</th>
<th>PCP</th>
<th>IAP</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>“No, my child was sick and here he gets better medical care.”</td>
<td>“Not preventable. The child was vomiting frequently, couldn’t keep anything down; the parents were so patient.”</td>
<td>“Not preventable. The patient was given oral fluid for quite some time in the ER before she had to be admitted.”</td>
</tr>
<tr>
<td>B</td>
<td>“No, I have been in the ER 3 times since yesterday.”</td>
<td>“It was probably not preventable.”</td>
<td>“Not preventable; the patient didn’t take enough oral fluid in the ER and needed admission.”</td>
</tr>
<tr>
<td>C</td>
<td>“Yes; the doctors sent me home with my child in the morning, then I had to come back again in the afternoon.”</td>
<td>“Yes; inappropriate admission for observation.”</td>
<td>Not applicable (PCP = IAP)</td>
</tr>
<tr>
<td>D</td>
<td>“I don’t know; maybe if they (clinic doctors) had given me more information before I had gone to Honduras with my child. If they had prescribed her some vitamins, this could have avoided that she may get something there.”</td>
<td>“Yes; maybe preventable with more outpatient information to the parent about safety when traveling with child to another country.”</td>
<td>“Yes.”</td>
</tr>
<tr>
<td>E</td>
<td>“No; it was so sudden.”</td>
<td>“Not preventable; the child was very dehydrated. This hospitalization was necessary.”</td>
<td>“Yes; the child might have not needed to be admitted if we had a short-stay unit in the ER. This unit can help us to have more time, around 4-6 hours, just for oral rehydration and observation of kids like this.”</td>
</tr>
<tr>
<td>F</td>
<td>“No; if she is sick, she needs to be taken care of.”</td>
<td>“Yes; this patient did not come to the clinic for a sick visit prior to admission.”</td>
<td>“No; she is a very small baby who was vomiting a lot. The hospitalization was the correct choice.”</td>
</tr>
<tr>
<td>G</td>
<td>“Yes; if the health center had given better medical care to my child, this hospitalization could have been avoided.”</td>
<td>“No; I didn’t see this patient before the admission, but looking at the chart, it looks like she was really sick and needed to be hospitalized.”</td>
<td>“Yes; they waited too much time before sending the child in.”</td>
</tr>
</tbody>
</table>

DISCUSSION

The study findings indicate that 12% to 45% of dehydration-related hospitalizations are preventable, depending on the assessing source. These findings, when extrapolated to national data, suggest that as many as 8000 to 33,000 fewer hospital discharges annually and $67 to $253 million savings in hospital costs could result from prevention of these hospitalizations.2

The results underscore the variability in assessing “avoidability” of dehydration-related hospitalizations by providers. Similar variability in assessments by parents and providers of preventable hospitalizations for asthma, pneumonia, urinary tract infections, and other ACSCs has been shown.4 When dehydration-related hospitalizations are analyzed in administrative databases, caution should be exercised, as more than one-half (55%-88%) of these admissions may be unavoidable.

Inadequate Prevention and Parental Education

One-half of parents and one-third of physicians reported that inadequate prevention (eg, not providing enough fluids at home) was the reason for preventable hospitalizations. In addition, one-fourth to one-third of patients and physicians cited inadequate parental education by physicians as a reason why these hospitalizations could have been prevented. Oral rehydration solution (ORS) has proven efficacy and safety as a first-line therapy for the management of mild to moderate pediatric dehydration.8,9 Nevertheless, ORS is underused: studies document <10% of patients hospitalized for dehydration received ORS before admission.10-12 High-quality ORS education interventions have been shown...
to reduce dehydration-related hospitalizations by 40%.13 These interventions consist of educating parents on the signs and symptoms of dehydration, ORS home treatment, and when the PCP should be contacted. Our study findings suggest that physician education of parents that focuses on home ORS therapy and indications for outpatient visits may prove useful in preventing dehydration-related hospitalizations.

Primary Care Access and Utilization

Although 94% of patients in our study had a PCP, 17% of parents, 25% of PCPs, and 40% of IAPs cited a delay in getting care or not making follow-up visits as the reason why the hospitalization was preventable. Not receiving timely care, defined as a delay in initial care or subsequent follow-up, has been shown to lead to poor health-care outcomes and increased costs.14,15 Barriers to obtaining timely care and follow-up, other than not having a PCP, should be identified. In addition, our study found that parents who previously had not brought their child to the physician because of costs or insurance problems had 12 times the odds of a preventable dehydration-related hospitalization for their child. These findings suggest that improvements in primary care access and utilization might help to prevent dehydration-related hospitalizations.

Early Management of Dehydration

Three-fourths of PCPs and two-thirds of the IAPs cited inappropriate admissions as physician-related reasons for preventable dehydration-related hospitalizations. Substantial variability exists in the preadmission management and the disposition of children with dehydration, including rehydration trials, laboratory evaluations, and utilization of observation units.9,11,16–19 Previous studies suggest that most children with acute dehydration are suboptimally managed before admission.19 With effective guideline implementation, admissions for dehydration-related gastroenteritis can be reduced by one-third.20 Studies have also shown that the vast majority of dehydration-related hospitalizations can be managed efficiently in observation units,21 allowing for shorter lengths of stay and decreased inpatient bed utilization.16–18 Thus, development and use of evidence-based preadmission management guidelines that include objective criteria for admission, ORS administration, and use of observation units may help reduce inappropriate dehydration-related hospitalizations.

Quality of Care

More than one-third of parents reported that poor quality of care was the reason for preventable dehydration-related hospitalizations, whereas physicians did not report poor quality of care as a reason. Studies have shown that large variations exist in the care of children with dehydration-related gastroenteritis in the outpatient, emergency department, and hospitalized settings.22–25 The lack of validated measures for health-care quality in children with dehydration makes assessment of quality of care difficult. Quality domains, however, have been identified, and efficient and patient-centered care is an important component of high-quality care. Parental participation in care, and decision-making and family-friendly environments that attempt to normalize family functioning, can contribute to improved care delivery.26 In addition, the use of clinical practice guidelines in the outpatient setting for children with gastroenteritis has been shown to decrease duration of illness and
TABLE 5 Proportion of Physician-Related Reasons for Preventability of Dehydration-Related Hospitalizations by Source

<table>
<thead>
<tr>
<th>Reason</th>
<th>% Reasons Preventable by Source</th>
<th>P</th>
</tr>
</thead>
<tbody>
<tr>
<td>Parent (n = 13)</td>
<td>PCP (n = 4)</td>
<td>IAPa (n = 6)</td>
</tr>
<tr>
<td>Inappropriate admission</td>
<td>0</td>
<td>75</td>
</tr>
<tr>
<td>Poor quality of care</td>
<td>38</td>
<td>0</td>
</tr>
<tr>
<td>Short observation time in emergency department</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Develop observation unit</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Physician did not adequately educate parent</td>
<td>23</td>
<td>25</td>
</tr>
<tr>
<td>Child discharged too early</td>
<td>14</td>
<td>0</td>
</tr>
<tr>
<td>Inadequate or no intervention administered</td>
<td>23</td>
<td>0</td>
</tr>
</tbody>
</table>

* Column total exceeds 100% because each source could choose >1 reason.

marginally improve weight gain. Efforts to improve quality of care through parental participation and use of clinical guidelines, therefore, might prevent dehydration-related hospitalizations.

### Parental and Patient Satisfaction

Children with parents who were dissatisfied with their child’s regular physician had greater odds of a dehydration-related hospitalization. Studies have assessed parental preferences and satisfaction with PCP care; however, before this study, a relationship between parental dissatisfaction with the PCP and an increased risk of hospitalization had not been noted. Efforts to understand the specific reasons for parental dissatisfaction with their child’s PCP might prove useful in reducing dehydration-related hospitalizations.

### Study Limitations

Certain study limitations should be noted. This study was conducted in a single urban academic center with a predominantly African-American and Latino population, who were primarily publicly insured and from low-income families. The findings, therefore, may not necessarily generalize to rural, suburban, or nonacademic hospitals. Sample sizes were not sufficiently large to perform multivariable analyses for subcategories of dehydration-related hospitalizations. In addition, the survey data are more than a decade old; however, the survey remains unique in its direct assessment of physicians and parents of children with potentially avoidable hospitalizations, and there have been no significant management changes that would make the results and conclusions invalid. Comparisons with national data are not possible because analogous national data on the actual avoidability of pediatric ACSC hospitalizations do not exist.

### CONCLUSIONS

Up to 45% of dehydration-related hospitalizations may be avoidable. Inadequate parental education by physicians, inadequate home rehydration, delays in getting care, not coming in for follow-up visits, inadequate access to care due to insurance or cost issues, inappropriate admissions, poor quality of care, and parental dissatisfaction with their child’s PCP were the reasons that these hospitalizations might have been prevented. Outpatient educational interventions, improved access to care, and the implementation of and adherence to early dehydration management guidelines might help reduce dehydration-related hospitalizations.

### REFERENCES


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