RESEARCH ARTICLE

# Toward Better Pain Management: The Development of a "Pain Stewardship Program" in a Tertiary Children's Hospital

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ABSTRACT

**OBJECTIVE:** Despite increased focus on pediatric pain, uncontrolled pain is still a problem for hospitalized pediatric inpatients. A program was designed to find patients with uncontrolled pain and develop a framework to oversee their pain management. This report details the development of a pain stewardship program with data from the first year of its activity.

**METHODS:** Hospitalized inpatients in a tertiary care pediatric center in the mid-Atlantic region were included in the study. Pain scores are recorded every 4 hours in the hospital electronic health record. A report was constructed to find all patients with an average pain score ≥7 in the preceding 12 hours. The charts of these patients were reviewed by our anesthesia pain service, and all patients were grouped into 1 of the following action categories: (1) no action required; (2) telephone call to the patient's attending physician; (3) one-time consultation; (4) consultation with ongoing management; or (5) patient was already on the anesthesia pain service. Demographic data, pain regimens, and outcomes were recorded in a prospectively collected database.

**RESULTS:** There were 843 records on 441 unique patients. Only 22% required action to be taken by the anesthesia pain service. The pain stewardship database revealed that patients with sickle cell disease or abdominal pain required more frequent attention.

**CONCLUSIONS:** An electronic health record–based pain stewardship program is an important step in identifying all children in the hospital with undermanaged pain, and it provides a warning system that may improve patient care, outcomes, and satisfaction.

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It is well recognized that effective pain management is an essential part of pediatric care and has the potential to reduce morbidity and mortality, facilitate recovery, allay the anxiety and stress of both the child and the parents, and reduce the cost of health care.[1–4] It has been argued recently that mismanaged or undertreated acute pain from procedures or surgery should be considered an adverse event because it is largely avoidable and because it has detrimental consequences for children from a behavioral and physiologic standpoint.[5] Despite more than a decade of focus on pediatric pain, ample recent evidence suggests that uncontrolled pain is still a problem in pediatric inpatient services.[6–9]

During the spring of 2013, our hospital received what was perceived to be poor pain management satisfaction scores for hospitalized pediatric patients as reported by the hospital benchmarking service, Press Ganey (Press Ganey Holdings INC, Wakefield, MA). Several meetings were convened to address the issue. The anesthesia pain service (APS) was given the opportunity to help plan a strategy to identify and analyze the problem and implement measures to improve our hospital's overall pain management. Several problems were identified from the outset. We were unable to identify which specific patients or patient populations were experiencing poor pain control or to determine whether the patients were surgical, medical, critical care, or chronic pain subjects. It was also unclear whether the problem was inadequate pain management while in the hospital or inadequate pain regimens after discharge from the hospital.

The model of "stewardship programs" was adopted. The word stewardship refers to the "responsible overseeing and protection of something worth caring for and preserving."[10] Antibiotic stewardship programs, managed by microbiology or infectious disease services, ensure that hospitalized patients with infections receive appropriate antibiotic therapy and assure patients that they are receiving therapy tailored for their infection. More recently, pain medication stewardship programs, managed by hospital pharmacy staff, have been initiated to oversee the orders for narcotic pain regimens. These programs serve as a method of error-proofing by providing oversight of medication management between the microbiology laboratory or pharmacy and the clinical floors.[11–13]

Similarly, a pain stewardship program was developed by using our hospital-wide electronic health record (EHR) that allows our APS to oversee pain management. From the perspective of functionality, the first step was to develop a method that would help identify the magnitude of the problem; to then determine how many and which patients were having ongoing severe pain; and finally to develop a response system to reliably provide appropriate management. We present here the development of our novel pain stewardship program and the results from the first year of its activity.

## METHODS

### Resources

This report is from a 200-bed tertiary pediatric medical center in the mid-Atlantic region. The APS is staffed by 2 advanced practice nurses with >10 years' experience dedicated to pain management and by 9 rotating anesthesia attending physicians who are generally on service for 1 week at a time.

### Initial Report Development

Our hospital uses Epic (Epic Systems, Verona, WI) as the institutional EHR for inpatients and outpatients. As recommended by The Joint Commission, pain is treated as a fifth vital sign, and all patients admitted to our hospital have pain assessed by nursing staff (on admission and at least every 4 hours) in addition to other routine vital signs.[14] Two pain scores with demonstrated clinical validity are used.[9,15] An observational scale (ie, the Faces, Legs, Activity, Cry, Consolability scale) is used for quantifying pain behaviors in children who are unable to verbalize the presence or severity of pain[9]; and a self-report scale (ie, the numeric rating scale) is used for cognitively intact patients, typically aged >7 years.[16]

A report was constructed within Epic (using Reporting Workbench, Epic Systems) to screen all hospitalized inpatients to detect those with severe pain, considered to be a pain score ≥7 in the preceding 12 hours. For 1 month, the pain stewardship daily report (PSDR) was tested by using different pain score thresholds (range, 5–8), different time frames (previous 8–24 hours), and differing time of day (morning or evening). We found that using an average pain score ≥8 often returned zero patients, whereas lowering the threshold to 5 often returned patients who were already followed by the APS. During the 1-month test period, few differences between time frames (duration) or time of day (morning or afternoon) were detected. In general, the report returned between 0 and 5 patients on each day during the 1-month test period.

### Report Response Process

The report was run daily (before morning rounds) by one of the advanced practice nurses, who reviewed the charts of all identified patients including, but not limited to, the patients' history, diagnosis, cause of pain, and the pain regimen ordered by the primary team. These findings were reviewed with the pain attending physician for the day. Based on our pain services' consultation protocols, 5 action categories were created. Depending on the perceived pain needs of each patient, all patients were grouped into 1 of the following action categories:

1. No intervention required (indicating that the pain regimen or plan initiated by the primary service was deemed adequate by the APS with no changes necessary)
2. Telephone call to the patient's attending physician with a review of the patient's pain plan (if the pain management was deemed inappropriate, suboptimal, or confusing)
3. One-time consultation and formal recommendations made (if approved by the primary service, depending on the results of category 2)
4. Consultation and subsequent management (in agreement with the primary service depending on the results of category 2)
5. Patient already on APS

Each patient listed in the PSDR was entered into a separate form constructed in our existing pain service database (Access; Microsoft Corporation, Bellevue, WA), maintained by the advanced practice nurses on the APS. This information served as the source data for the pain stewardship database. The fields in the data table were date of report, patient identifier, age, sex, weight, admitting diagnosis, service and attending, diagnosis category, pain description, pain distribution category, action taken, resolution description, and category of resolution.

One year of data from September 1, 2013, to August 31, 2014, was extracted to a spreadsheet (Excel; Microsoft Corporation). Descriptive statistics were used to illustrate the distribution of patients, incidence of pain, and actions taken. Specifically, the distribution of services the patients belonged to, the number of days patients were listed in the report, their categories of pain, the actions taken, and additional data elements (diagnosis and ultimate disposition) were examined. Approval was obtained from the Nemours Institutional Review Board to review charts and record information in our database for future analysis and reporting and presentation of findings.

## RESULTS

During the study period, there were 8423 admissions to our hospital. The PSDR generated 843 records belonging to 441 unique patients (revealing that some patients had >1 record), with ages ranging from 2 weeks to 20 years. The female-to-male ratio was 3:2. During the study period, the PSDR yielded an average of 2.3 patients per day, with a minimum of 1 patient and a maximum of 10 patients per day. The pain distribution category showing the number and percentage of records is given in Table 1. Abdominal pain was the most common pain distribution and comprised almost one-third of the records (32.5%).

All patients whose information appeared on the PSDR had their pain management strategy reviewed. A flow diagram of the actions taken by the APS is shown in Fig 1. No intervention was deemed necessary for the majority of patients (78%), and 15% of cases were already being managed by the APS. Telephone contact with the primary team's attending physician was initiated on 58 occasions (6.9% of total records), resulting in 50 (6%) new consultations (21 [2.5%] "one-time consultations" and 29 [3.4%] "consult and management" contacts).

**TABLE 1** Number and Percentage of Records According to Pain Distribution Category

| Pain Distribution Category | No. | Percentage |
|---|---|---|
| Abdominal pain | 274 | 32.5 |
| Extremity pain | 157 | 18.6 |
| Headache | 88 | 10.4 |
| Back pain | 66 | 7.8 |
| Generalized pain | 51 | 6.1 |
| Chest pain | 30 | 3.6 |
| Throat pain | 27 | 3.2 |
| Back and chest pain | 23 | 2.7 |
| Unspecified | 20 | 2.4 |
| Abdominal and headache | 15 | 1.8 |
| Abdominal and back pain | 14 | 1.7 |
| Back and extremity pain | 10 | 1.2 |
| Flank pain | 10 | 1.2 |
| Head and neck pain | 8 | 1 |
| Neck pain | 8 | 1 |
| Back and head pain | 7 | 0.8 |
| Mouth pain | 6 | 0.7 |
| Epigastric pain | 5 | 0.6 |
| Chest and head pain | 4 | 0.5 |
| Penoscrotal pain | 4 | 0.5 |
| Agitation | 3 | 0.4 |
| Neck and extremity | 3 | 0.4 |
| Abdominal and chest pain | 2 | 0.2 |
| Anogenital pain | 2 | 0.2 |
| Facial pain | 2 | 0.2 |
| Abdominal and extremity | 1 | 0.1 |
| Chest and extremity | 1 | 0.1 |
| Ear pain | 1 | 0.1 |
| Jaw pain | 1 | 0.1 |

The data were analyzed for the cases in which the APS did not intervene and are presented in Fig 2. These patients had no action taken because the APS deemed that they were receiving appropriate management by the primary ward team. Appropriate management was defined as the appropriate use and dosages of analgesic medications, either narcotic or nonnarcotic, depending on the patients' diagnosis. The remaining patients were grouped into 2 categories: (1) patients whose pain was being managed with a preexisting protocol by another service, such as neurology, palliative care, or intensive care; and (2) patients who had recently arrived in the hospital. For the former group, these services have existing pain regimen protocols developed with the help of the APS, and for the latter, either the appropriateness of their therapy was still being evaluated or they were scheduled for surgical treatment of the cause of pain (ie, planned appendectomy).

Analyzing the pain stewardship database provided us with additional information about the study patients. The number of daily PSDR according to unique patient is shown in Fig 3. Most patients (75% [$n = 329$]) were listed on the PSDR only once. The remaining 25% (112 unique patients) were listed in the report 2 to 25 times. We arbitrarily defined patients who appeared on the report ≥5 times as "persistent repeat" patients. This group of 32 patients accounted for 37% of total records ($n = 306$).

The flow diagram for the actions taken by the APS on the records generated from the persistent repeat patients is shown in Fig 4. Compared with the total population, in the persistent repeat group, the APS contacted the primary team almost twice as many times (11% vs 6.9%) and consulted on the patients more often (10% vs 5.9%) as well.

Figure 5 displays the distribution of the persistent repeat records according to service, indicating that hematology/oncology had the most records ($n = 139$). Figure 6 illustrates the distribution of the hematology/oncology service patients, categorized according to disease processes. Fifty-three percent of the hematology/oncology patients were in the hemoglobinopathy category and had sickle cell anemia.

Table 2 contains details for the persistent repeat patients, including service and pain category. Although hematology/oncology featured prominently among the services, as previously noted, abdominal pain was the

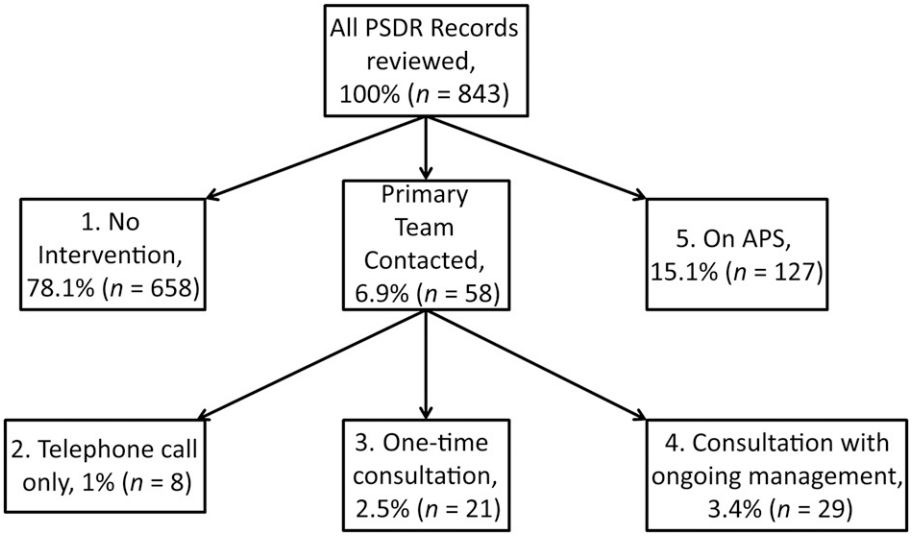


**FIGURE 1** Flow diagram of the distribution of patients in the 5 action categories. Data shown are the percentage and number of records.

most common pain distribution category among the persistent repeat patients, seen by several services.

## DISCUSSION

Despite rapid development of pediatric pain management services in pediatric health care institutions during the last 2 decades, there is an abundance of more recent literature revealing that pediatric patients might not always receive optimal pain management.[5–8,17–19] Single-hospital pain management surveys[7,18,20] and larger multi-institutional reviews[4] have shown that significant numbers of surgical and nonsurgical patients experiencing pain from both procedural and nonprocedural causes experience inconsistency in assessment and administration of pain medications.[7,18–20]

Groenewald et al[7] used a novel "daily pediatric pain report" to identify admitted patients with moderate to severe pain in 1 month in 2009. Our pain stewardship program extends the use of such an EHR-based, hospital-wide severe pain report to build an ongoing pain stewardship program. Similar to antibiotic or pain medication stewardship programs, this house-wide pain surveillance system identifies potential problem patients and allows early intervention that can improve pain management, overall patient care, and, potentially, outcomes. Our PSDR identified patients with severe pain who may be in need of additional pain therapy and serves as a backup system for the other busy services in a teaching institution.

The daily effort to identify and review patients who were revealed by the PSDR required no additional resources of the APS. Our APS utilizes an Epic "accordion report" (ie, a composite of vital signs, pain scores,

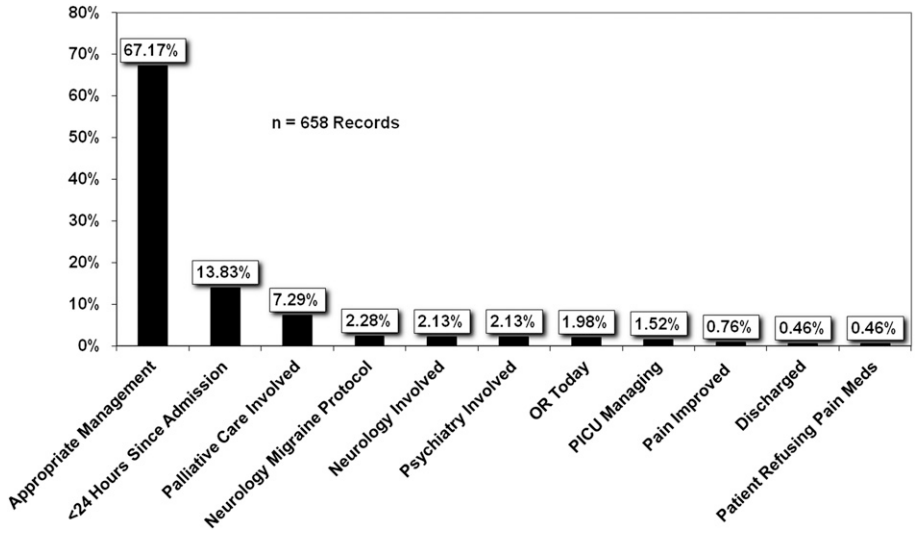


**FIGURE 2** The distribution of the reasons given for the "no intervention" action taken. Meds, medications; OR, operating room.

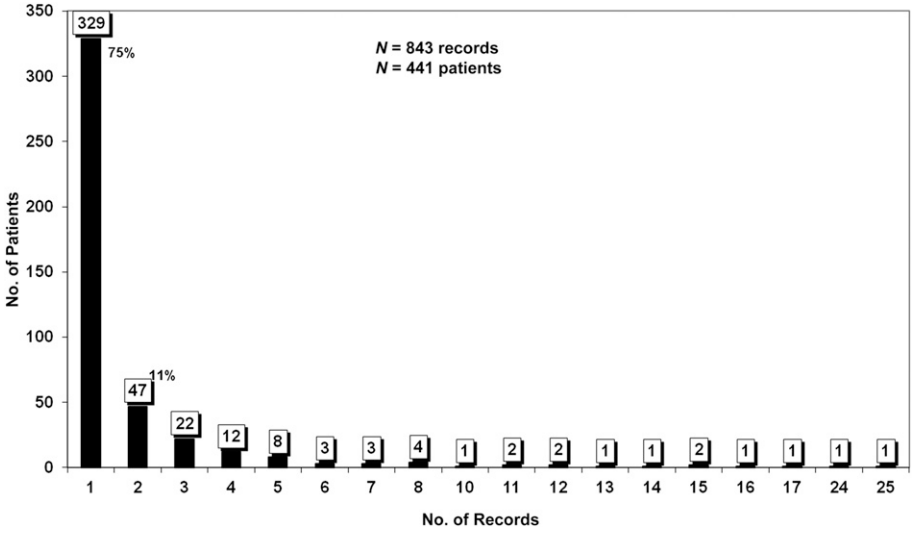


**FIGURE 3** The distribution of the number of daily PSDRs according to unique patient.

and pain medication administered) to obtain a snapshot of patients' pain management. Additional information is available in the patients' online records. The total time involved in reviewing the patients on the daily report is ~30 to 60 minutes, depending on the number of patients uncovered by the PSDR. The review of this information has become a routine part of daily pain rounds.

Further analysis of our pain stewardship database revealed individual patients with chronic pain as well as particular groups of patients (eg, those with sickle cell disease) who could benefit from improved pain control efforts. Indeed, as a result of our pain stewardship data, we identified that the patients with sickle cell anemia who had pain crises required a more focused pain management strategy with additional resources. The APS and our hematology/oncology service collaborated on a revised inpatient pathway and have added an advanced practice nurse to help manage patients with sickle cell disease as both inpatients and outpatients. Preliminary data show a 30% decrease in the number of persistent repeat patients from this group.

Our hospital uses Press Ganey surveys to monitor overall patient satisfaction with the hospital services. Unfortunately, the survey included only 1 general question regarding pain management. In addition, the surveys are sent to a small sample of the discharged patients, with an even smaller sample actually returned. In addition, the surveys are returned to the hospital in a processed fashion, and thus there is no way to glean where the problem areas are to

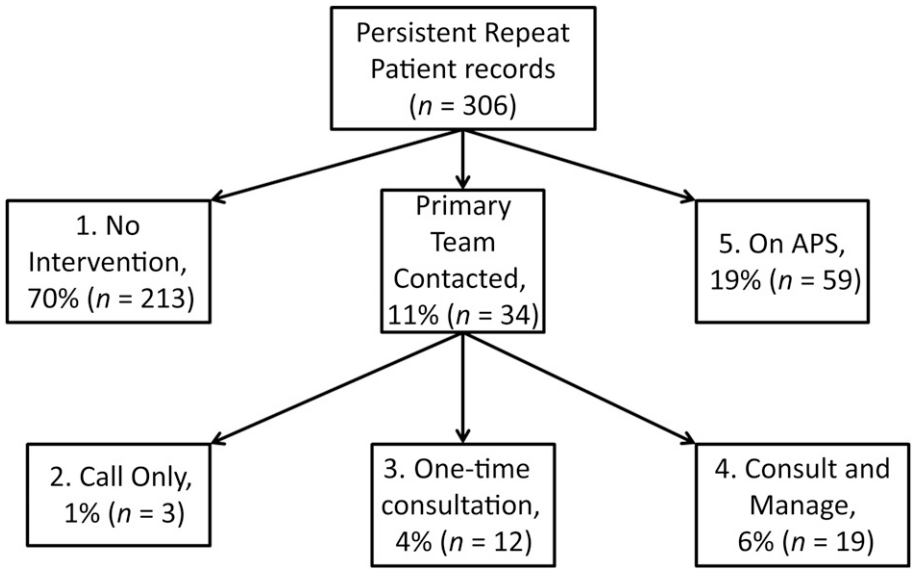


**FIGURE 4** Flow diagram of the interventions taken by APS on persistent repeat patients. Data shown as percentage and number of records.

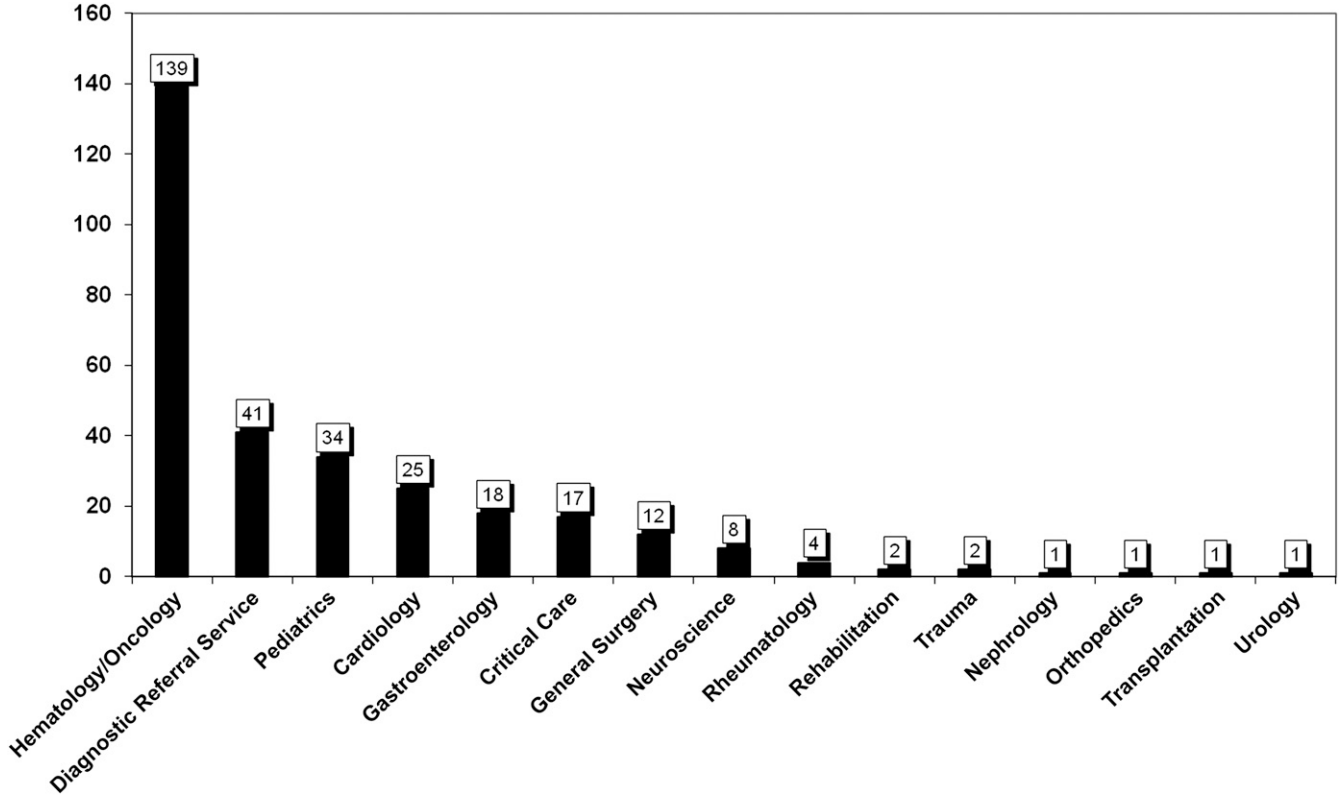


**FIGURE 5** Persistent repeat patients according to service.

target pain management efforts. Our EHR-based report has the ability to reveal where problems may still exist, and, more specifically, it offers the opportunity for early intervention and standardization of pain management if needed.

Several reports describe efforts to improve pain management in hospitals.[21–23] Dowden et al[21] reported the results of a hospital-wide, pain improvement effort consisting of interviews with 454 staff from a variety of backgrounds. Underfunding and underresourced issues, institutional attitudes, variability in therapeutic practice, opiophobia, and inadequate education about pain techniques spurred the development of a multidisciplinary acute pain service. Twycross et al[22] developed a list of

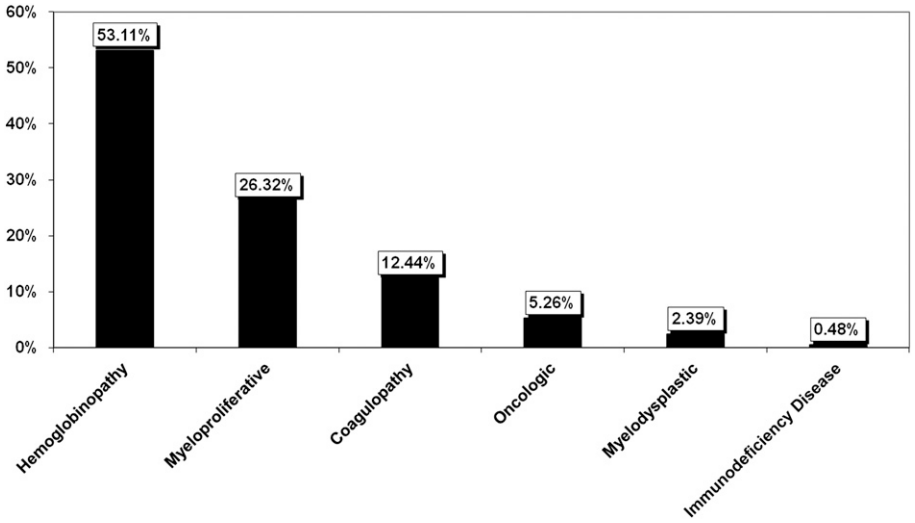


**FIGURE 6** Distribution of the hematology/oncology service patients, broken down according to disease processes.

**TABLE 2** Patients With ≥5 Records in the Pain Stewardship Database (Persistent Repeat Patients)

| Individual Record Count | Service | Pain Distribution Category |
|---|---|---|
| 25 | Cardiac | Generalized pain |
| 24 | Hematology/oncology | Back and chest pain |
| 17 | Neurosurgery | Headache |
| 16 | DRS | Abdominal pain |
| 15 | Hematology/oncology | Chest pain |
| 15 | Hematology/oncology | Generalized pain |
| 14 | Hematology/oncology | Extremity pain |
| 13 | Hematology/oncology | Back pain |
| 12 | Hematology/oncology | Back and extremity pain |
| 12 | Hematology/oncology | Back and chest pain |
| 11 | Pediatrics | Flank pain |
| 11 | DRS | Extremity pain |
| 10 | Hematology/oncology | Extremity pain |
| 8 | Hematology/oncology | Extremity pain |
| 8 | Pediatrics | Abdominal pain |
| 8 | DRS | Abdominal pain |
| 8 | Hematology/oncology | Extremity pain |
| 7 | Gastroenterology | Abdominal pain |
| 7 | Hematology/oncology | Abdominal pain |
| 7 | Gastroenterology | Abdominal pain |
| 6 | Rheumatology | Generalized pain |
| 6 | Gastroenterology | Abdominal pain |
| 6 | Pediatrics | Headache |
| 5 | Hematology/oncology | Extremity pain |
| 5 | Gastroenterology | Abdominal pain |
| 5 | Hematology/oncology | Abdominal pain |
| 5 | DRS | Abdominal pain |
| 5 | DRS | Abdominal pain |
| 5 | Pediatrics | Abdominal pain |
| 5 | General surgery | Abdominal pain |
| 5 | DRS | Abdominal pain |
| 5 | Rehabilitation | Back pain |

DRS, Diagnostic Referral Service.

indicators for undermanaged pain by using a Delphi technique involving a survey of pain experts at several institutions. This list of indicators can be used to review episodes of patient care to determine if there is quality pain management. Stevens et al[23] reported the effect of a "multidimensional knowledge translation intervention" to improve procedural pain. As a result of this educational intervention, more patients received validated pain assessments, more analgesics, and more complementary pain strategies, and they had improved pain intensity scores. Our stewardship program builds on these studies by revealing which patients and patient groups require additional intervention, and it has the potential to be an additional important step in ensuring effective pain management.

In most centers, the management of pain is decentralized. Because various services and numerous practitioners with variable pain training and experience handle pain management, it can be inconsistent. Our pain stewardship program supports the APS by establishing an oversight role and offers an opportunity to educate attending physicians, staff, and house officers, and to reduce the variability of pain regimens. Anesthesia-based pain services lead to better outcomes by lowering pain scores, reducing adverse effects, shortening intensive care and overall hospital length of stays, and reducing the incidence of chronic pain; these services also potentially reduce costs.[24–26] However, we did not think that our APS could handle the management of all patients with pain in our institution. Instead, the APS serves as a second pain reviewer and provides expert guidance in the management of patients with severe or difficult-to-treat pain.

Our study has some limitations. First, the study method was new and, thus far, explored in only 1 hospital. Second, we relied only on average pain scores as a screening tool to identify patients who may be having severe pain. Although the interpretation of the clinical relevance of pain scores varies,[27] pain scores have been validated as semi-objective measures of pain, and average pain scores have been used to judge responses to therapy. Children with a pain score of 6 on a numeric rating scale of 0 to 10 perceived the need for analgesia; those with a score of 3 believed that there was no need for intervention.[15] However, our use of a hospital-wide "trigger" report is unique in that it uses average pain scores to determine which patients likely have severe or uncontrolled pain.

Another study limitation is that we likely missed many patients with mild or moderate pain, as well as patients with short-lived or episodic pain associated with minor inpatient procedures. Studies have shown that the pain associated with minor procedures is a significant source of dissatisfaction in pediatric patients.[17] Finally, this central monitoring process of pain management could create the impression among various departments of intrusion and interference with their management. Therefore, the goal of the stewardship program as stated earlier must be emphasized: to serve as a second pain reviewer and provide guidance, if

needed, in the management of patients with severe or difficult-to-treat pain.

It is possible that the results of our method are unique to our institution. These parameters may yield different results at other institutions, given differing volumes and types of surgical, nonsurgical, and chronic pain patients. We speculate that, in addition to the numeric values of pain score, the number of times an individual patient registers a high pain score might also signify suboptimal pain management, warranting reevaluation of therapy. It is also possible that other institutions will conceive of other parameters or combinations of parameters that might prove to be more useful as a screening tool.

## CONCLUSIONS

Identification of children in pain and the assessment and documentation of that pain are the cornerstones of effective pain management. Until assessment and management become routine, treatment of pain will remain suboptimal. Our method uses information from a report constructed within our hospital-wide EHR to find all inpatients experiencing severe pain and potentially receiving suboptimal pain management. It enables us to monitor management provided by the primary services and to intervene if necessary. Although the majority of patients captured by the PSDR did not require intervention by our APS, certain patient groups and pain categories (eg, sickle cell disease, abdominal pain) were repeatedly identified as needing additional attention and resources of the pain service. As a result, our institution has altered the inpatient pain management protocols for sickle cell vaso-occlusive crisis, with preliminary data showing a reduction in the number of persistent repeat patients identified by the PSDR. An EHR-based pain stewardship program is an important step in identifying all children in the hospital with undermanaged pain and provides a warning system that may improve patient care, outcomes, and satisfaction.

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