Research Article

Deciding without data: clinical decision-making in pediatric orthopedic surgery

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Abstract

Objective: Identifying when and how often decisions are made based on high-quality evidence can inform the development of evidence-based treatment plans and care pathways, which have been shown to improve quality of care and patient safety. Evidence to guide decision-making, national guidelines and clinical pathways for many conditions in pediatric orthopedic surgery are limited. This study investigated decision-making rationale and quantified the evidence supporting decisions made by pediatric orthopedic surgeons in an outpatient clinic.

Design/Setting/Participants/Intervention(s)/Main Outcome Measure(s): We recorded decisions made by eight pediatric orthopedic surgeons in an outpatient clinic and the surgeon's reported rationale behind the decisions. Surgeons categorized the rationale for each decision as one or a combination of 12 possibilities (e.g. 'Experience/anecdote,' 'First principles,' 'Trained to do it,' 'Arbitrary/instinct,' 'General study,' 'Specific study').

Results: Out of 1150 total decisions, the most frequent decisions were follow-up scheduling, followed by bracing prescription/removal. The most common decision rationales were 'First principles' ($n = 310$, 27.0%) and 'Experience/anecdote' ($n = 253$, 22.0%). Only 17.8% of decisions were attributed to scientific studies, with 7.3% based on studies specific to the decision. As high as 34.6% of surgical intervention decisions were based on scientific studies, while only 10.4% of follow-up scheduling decisions were made with studies in mind. Decision category was significantly associated with a basis in scientific studies: surgical intervention and medication prescription decisions were more likely to be based on scientific studies than all other decisions.

Conclusions: With increasing emphasis on high value, evidence-based care, understanding the rationale behind physician decision-making can educate physicians, identify common decisions without supporting evidence and help create clinical care pathways in pediatric orthopedic surgery. Decisions based on evidence or consensus between surgeons can inform pathways and national guidelines that minimize unwarranted variation in care and waste. Decision support tools and aids could also be implemented to guide these decisions.

Key words: decision analysis, care pathways/disease management, (orthopedic) surgery, practice variations

Introduction

The rising cost of health care has made physicians and patients more aware of the financial weight of every physician decision. Ideally, these medical decisions are patient-centered, based on medical knowledge from scientific studies and reflect up-to-date evidence. Clinical decision-making is often challenging because of conflicting evidence, lack of high-level evidence or inability of the clinician to have all of the evidence readily available at the time of decision-making. Physicians report that more than 20% of overall medical care was not needed [1]. This translates into \$210 billion of health care spending in the United States, making unsupported decisions the single largest contributor to wasted health care expenditure [1]. Physician surveys report that common reasoning behind unnecessary care decisions includes defensive medicine and lack of exposure to updated evidence-based practices. This demonstrates poor support of real-time physician decision-making and serves as a barrier to identifying areas that may benefit most from decision support or clinical pathways with the highest impact [1, 2].

Standardizing care through evidence-based practice and the development and implementation of clinical care pathways can be an effective method of reducing variation in medical decision-making [3], but many common conditions and clinical decisions faced daily in pediatric orthopedic clinics have not been studied. Clinical care pathways are widely used quality improvement strategies for organizing and reorganizing care processes toward evidence-based, patient-centered care [4]. These pathways have been shown, for example, to lower morbidity and mortality, decrease costs, improve teamwork, reduce utilization of post-acute care services and even decrease risk of burnout for health care teams [5–10]. Despite numerous adult orthopedic clinical practice guidelines published, few pediatric orthopedic evidence-based guidelines or care pathways are currently available. For example, the American Academy of Orthopaedic Surgeons has developed guidelines for only four pediatric conditions: pediatric femur fractures, osteochondritis dissecans, pediatric supracondylar humerus fractures and hip dysplasia in infants [11–15].

A recent study of pediatric cardiologists demonstrated nearly 80% of the outpatient decisions had no foundation in peer-reviewed data, while just 20% of decisions were based on a scientific study. Of those study-based decisions, only 14% (3% overall) were founded in a study specific to the decision being made [16]. Literature of this nature is scarce, despite its importance in the design and implementation of better decision-making models and tools. The current study aimed to quantify the rationales given by surgeons for decisions made in a pediatric orthopedic outpatient setting by applying the same methodology as the cardiology study. We aimed to determine if a similar lack of scientific literature support exists for pediatric orthopedic clinic decision-making.

Methods

Data collection

Eight pediatric orthopedic surgeons at an academic medical center were observed during outpatient clinic by trained observers from February to August 2018. An observer was physically present and recorded every clinical decision made during each patient encounter. Observers were trained by a single study investigator with a set protocol to record decision types and rationales in a homogenous manner. Decision types and rationales were initially based off of a prior pediatric cardiology study, modified to fit a pediatric orthopedic clinic setting and discussed with all pediatric orthopedic faculty ahead of

time to ensure that the categories and rationale were appropriate and sufficient [15, 16]. 36 half-day clinic sessions were observed. Visits during which decisions were recorded encompassed a wide range of pediatric orthopedic diagnoses such as abnormal gait, scoliosis, club foot, hip dysplasia, fractures, sports injuries and lower extremity deformities. Decisions were recorded if a treatment was recommended (surgery, medication, brace or cast, physical therapy, activity restrictions/rest) or if the decision would incur a cost to the patient (imaging or laboratory studies ordered, return visit to clinic). After each visit, the attending categorized the evidence or rationale for each decision made into one (or a combination) of 12 categories based on prior work in pediatric cardiology (Table 1) [16]. If, for a given decision, multiple categories were selected, the weight would be equally distributed among all selected answers in the resulting analysis such that, for example, if three categories were selected, each would have a weight of 0.333. Each physician was given descriptive information on each of the categories at the beginning of data collection and reminders on days of data collection.

Data analysis

Descriptive statistics were used to measure and report decisions types and categories. The associations between decision category and rationale were assessed using chi-square tests, with a two-sided $\alpha = 0.05$. A desired sample size of 1100 total decisions to record was estimated in order to most accurately compare this study's result to the prior pediatric cardiology study [16]. Due to the low number of surgeons observed, the data were pooled and a collective decision was made not to investigate individualized surgeon-by-surgeon

Table 1 Definitions of decision rationale categories

Decision rationale	Definition
Arbitrary/instinct	No clear rationale in mind, does not fit in one of the categories below
Avoid a lawsuit	For documentation or to avoid future litigation only
Experience/anecdote	Grounded on a recollection of one or more previous patients
First principles	Things widely accepted in orthopedics to be true (e.g. physiology-based)
For research	Decision made mainly to learn from the patient or about the disease
General study	Physician recalls a study but is unable to identify it by title, authors or journal
Limited study	Lower impact studies such as case reports
National guidelines	Can attribute decision to guidelines published by a national board/body
Parental preference	Influenced by parental input
Patient preference	Influenced by patient input
Specific study	Physician is able to cite a specific study (two of: title, author, journal)
Trained to do it	Was instructed to make a certain decision (e.g. during residency or fellowship training) by a more senior or experienced physician

data, in an effort to minimize the effect of study participation on decision-making and to protect anonymity.

Results

There were a total of 1150 decisions observed over 36 half-day clinic sessions, with an average of 31.9 decisions recorded per half-day clinic session by a surgeon (typically 15 patients). The most common decision rationales were 'First principles' ($n = 311$, 27.0%), 'Experience/anecdote' ($n = 253$, 22.0%) and 'Trained to do it' ($n = 195$, 17.0%) (Table 2). The least common decision rationales were 'Avoid a lawsuit' ($n = 0$, 0.0%), 'For research' ($n = 3.5$, 0.3%) and 'National guidelines' ($n = 7$, 0.6%). Few decisions were made for 'Parental or patient preference' as well ($n = 26.4$, 2.3% and $n = 30.1$, 2.6%, respectively). The most frequent decision category was follow-up scheduling ($n = 289$, 25.1%), followed by bracing prescription/removal ($n = 156$, 13.6%) and activity limitations ($n = 145$, 12.6%). The least frequent decision category was medication prescription ($n = 41$, 3.6%), followed by ordering or removal of casting ($n = 56$, 4.9%) and 'other' (conservative management, referrals, equipment adjustments, etc.) ($n = 61$, 5.3%). 205 of 1150 decisions (17.8%) were attributed to scientific studies. Of these decisions based on published literature, 41.1% (7.3% of overall decisions) were based on a study that the surgeon was able to specifically cite (title, author, journal), 6.7% of decisions (1.2% of overall decisions) were based on a limited study (lower impact study such as a case report) and 52.2% of decisions (9.3% of overall decisions) were based on a study that the physician was unable to name (Table 3).

Table 2 Proportions of reported decision rationales

Decision rationale	Decision rationales reported (weighted, $n = 1150$)
Arbitrary/instinct	120 (10.4%)
Avoid a lawsuit	0 (0.0%)
Experience/anecdote	253 (22.0%)
First principles	311 (27.0%)
For research	3.5 (0.3%)
General study	107 (9.3%)
Limited study	14 (1.2%)
National guidelines	7.33 (0.6%)
Parental preference	26.4 (2.3%)
Patient preference	30.1 (2.6%)
Specific study	83.5 (7.3%)
Trained to do it	195 (17.0%)

Table 3 Relationship between decision category and rationale

Decision category	% of Total decisions recorded ($n = 1150$)	% of Decisions based on scientific study
Activity limitations	12.6% (145)	12.9% (18.67/145)
Bracing prescribed or removed	13.6% (156)	18.8% (29.25/156)
Casting ordered or removed	4.9% (56)	21.1% (11.83/56)
Follow-up scheduled	25.1% (289)	10.4% (30/289)
Imaging ordered	13.3% (154)	18.6% (28.58/154)
Medication prescription	3.6% (39)	26.9%* (10.5/39)
Other (conservative management, referrals, equipment adjustments, etc.)	5.3% (61)	11.2% (6.83/61)
Physical therapy/exercises ordered	10.6% (123)	19.9% (24.5/123)
Surgical intervention	11.0% (127)	34.6%* (43.92/127)

*Indicates decision category significantly associated with a basis in scientific studies ($P < 0.01$ via chi-square test).

As high as 34.6% of surgical intervention decisions and 26.9% of medication prescription studies were based on scientific studies. Conversely, only 10.4% of follow-up scheduling decisions, 11.2% of 'other' decisions and 12.9% of activity limitation decisions were made with studies in mind (Table 3). Decision category was significantly associated with a basis in scientific studies—surgical intervention and medication prescription decisions were more likely to be based on scientific studies than all other decisions ($P < 0.01$).

Discussion

Despite recent emphasis on evidence-based medicine and clinical pathways, scant literature exists that measures the evidence behind physicians' typical, daily clinical decision-making [5–8, 17]. This study's objective was to quantify the surgeon's rationale for decisions in a pediatric orthopedic outpatient setting. Only 17.8% of decisions made in this setting had a basis in evidence (surgeon states decision supported by general study, limited study, specific study or national guideline), with less than half of those decisions (7.3% overall) based on a study or studies the surgeon could cite specifically. As rigorously developed national guidelines for decision-making in pediatric orthopedics exist for only four conditions, it is not surprising that <1% of decisions recorded in this study referred to national guidelines. The finding that most decisions studied were about scheduling a follow-up appointment is consistent with pediatric orthopedic teaching and practice, as long-term follow-up and assessing the trend (improving, stable or worsening) of various pediatric orthopedic conditions is fundamental. Decisions about surgical intervention and medication prescription were most likely to be evidence-based, while follow-up scheduling and activity limitation decisions were least likely to be made from evidence. This likely reflects the clinical research questions addressed in major research studies, as many concentrate on surgical and medical interventions, while few investigate the effects of appropriate or necessary follow-up or activity limitation on clinical outcomes. Nonevidence-based rationales 'First principles' and 'Experience or anecdote' accounted for nearly half of the decisions made, and 'Training' and 'Arbitrary or instinct' account for over another quarter. Despite recent support for shared decision-making models and concerns about the practice of defensive medicine in surgical specialties, few decisions were made based on parental/patient preference, and none on the basis of avoiding a lawsuit.

For context, these results can be compared to an analogous study done in pediatric cardiology [16], which found that 20.3% of decisions were based on any scientific study, with only 2.9% based in a specific study. In that study, 'Experience or anecdote' was the

most commonly cited decision rationale, followed by ‘Arbitrary or instinct’ and ‘Training’. This is in contrast to the current study, where ‘First principles’ was the most common, followed by ‘Experience or anecdote’ and ‘Training’. Additionally, general studies accounted for 12.3% of the pediatric cardiology decisions compared to 9.3% in this pediatric orthopedic study.

Limitations of this study include the inexact nature of distinguishing between certain qualitative decision rationale definitions, e.g. ‘Arbitrary or instinct,’ ‘First principles’ and ‘Trained to do it.’ Additionally, decisions attributed especially to training and national guidelines may be indirectly based in scientific studies without direct knowledge by the physicians of the exact studies themselves, therefore underestimating the percentage of decisions truly supported by scientific evidence. Moreover, the observers did not attempt to find studies for physicians when they could not recall the name or author of specific studies, and conversely did not verify whether or not a specifically cited study was in fact relevant to and in support of the clinical decision being made. Finally, these data are only representative of evidence-based decision-making in a single subspecialty, pediatric orthopedics, in a single setting of an outpatient clinic at a large academic medical center. There are differences (if minor) in this data between specialties (when compared to the aforementioned pediatric cardiology study); therefore, this data may not necessarily be generalizable.

A previous survey study evaluated the relative importance of different decision-support modalities for practicing orthopedic surgeons treating pediatric patients and found that residency training ranked first, followed by textbooks and then consultation with a colleague [18]. We found the top three reasons given by academic pediatric orthopedic surgeons to support an outpatient pediatric orthopedic decision were ‘First principles,’ ‘Experience/anecdote’ and ‘Trained to do it.’ As residency education focuses on teaching first principles (i.e. malalignment leads to early arthritis, ligamentous injury/joint instability decrease function, instability in open fractures increases the risk of infection, etc.) and providing a broad experience treating patients, the importance of residency education to guide future decision-making is again emphasized. In addition to providing knowledge of principles and experience-based guides to decision-making, residency education now also focuses on providing residents with tools to evaluate current literature, assess the levels of evidence and apply the best available evidence to decision-making for patients. This study demonstrates that for many common decisions, specific evidence is either not available or is not readily retrievable in clinic at the time decisions are being made. Decisions with greater potential risk to the patient (prescribing medications, recommending surgery) were more likely to be based on a scientific study, but still were only based on a specific study 27% and 35% of the time, respectively. These proportions likely relate to the type of information needed to answer the clinical question, with ‘background’ information—typically provided by residency training and textbooks—sufficient for some clinical questions, but ‘foreground’ information—typically provided by original research studies—needed for more patient and treatment specific questions [19, 20].

A lack of available clinical evidence cannot be solely blamed for the low utilization of evidence demonstrated in this study. Thousands of new randomized trials are published in online databases every year and it has been calculated that physicians would need to read 20 articles every day to maintain present knowledge [21, 22]. Therefore, despite the large volume of literature, physicians are in

need of decision aid tools to help synthesize scientific evidence. It can be argued that the particular clinical question being decided may not have been studied scientifically, a problem frequently referenced in the orthopedic literature on clinical practice guideline development [23–25]. Quality improvement strategies such as clinical pathways are steadily becoming more widely implemented and utilized, and have shown to have significant benefit for patients and providers alike [5–9, 24, 26–28]. Examples in pediatric orthopedics show guidelines usage improving clinical outcomes in musculoskeletal infections [26, 27, 29]. Promotion of an evidence-based medicine approach to orthopedic decision-making has been promoted in major journals for the past two decades, with classification of the levels of evidence of published articles, and development of clinical practice guidelines emphasizing the need for better research evidence quality in orthopedics [23, 29]. As the quality of evidence available in the literature improves, it will be important to provide other clinical decision-making tools to assist frontline decision-making in real time. As noted in a primer on use of EBM in pediatric orthopedics, there is often not enough time in typical clinical settings to search for the best and highest levels of evidence to support decision-making [19].

Understanding the rationale behind physician decision-making is a crucial first step toward designing and implementing clinical pathways and guidelines that can improve outcomes while reducing costs and ensuring appropriate utilization. Similar to previous pediatric cardiology research, this study found over 82% of pediatric orthopedic outpatient clinical decisions are not supported by evidence (scientific study) that the surgeon can cite. While there have been recent efforts to create evidence-based guidelines and pathways to inform clinical decisions, this finding underlines the need for continued efforts to achieve this goal.

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Data availability

All data are incorporated into the article and its online supplementary material.

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