SPECIAL ARTICLE

Development and Evaluation of High-Value Pediatrics: A High-Value Care Pediatric Resident Curriculum

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ABSTRACT

Low-value health care is pervasive in the United States, and clinicians need to be trained to be stewards of health care resources. Despite a mandate by the Accreditation Council for Graduate Medical Education to educate trainee physicians on cost awareness, only 10% of pediatric residency programs have a high-value care (HVC) curriculum. To meet this need, we set out to develop and evaluate the impact of High-Value Pediatrics, an open-access HVC curriculum. High-Value Pediatrics is a 3-part curriculum that includes 4 standardized didactics, monthly interactive morning reports, and an embedded HVC improvement project. Curriculum evaluation through an anonymous, voluntary survey revealed an improvement in the self-reported knowledge of health care costs, charges, reimbursement, and value ($P < .05$). Qualitative results revealed self-reported behavior changes, and HVC improvement projects resulted in higher-value patient care. The implementation of High-Value Pediatrics is feasible and reveals improved knowledge and attitudes about HVC. HVC improvement projects augmented curricular knowledge gains and revealed behavior changes. It is imperative that formal high-value education be taught to every pediatric trainee to lead the culture change that is necessary to turn the tide against low-value health care. In addition, simultaneous work on faculty education and attention to the hidden curriculum of low-value care is needed for sustained and long-term improvements.

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PROBLEM IDENTIFICATION

There is general consensus that the future of health care delivery needs to be different; it must be more value oriented, with accountability for quality and costs on the part of clinicians and institutions. Pediatric health care costs are rapidly increasing (with worse outcomes than those of our peer nations), driving an increase in awareness of the need for high-value care (HVC), with “value” defined as quality over cost. In addition, concerns regarding overdiagnosis and overtreatment leading to higher costs and increased harms to pediatric patients have further increased the focus on the need for HVC.

Low-value health care is pervasive in the United States, and there is growing attention to the need for clinicians to take on the role of stewards of health care resources. Clinicians drive the majority of health care spending, but physician knowledge of the value of the care they provide is poor. They often lack knowledge of the absolute and relative costs of the care they provide, and they often have an inaccurate perception of the relative benefits and harms of care decisions. For clinicians to effectively improve the value of care, they must understand the relative balance of benefits and harms to make value-oriented decisions. One method to achieve this is through focused HVC education. Clinicians need to know not only the clinical factors and quality drivers that affect care outcomes but also the financial aspects of delivering HVC. Without appropriate knowledge on this topic, clinicians will find themselves unable to effectively act on behalf of patients when considering quality, costs, and value.

The Accreditation Council for Graduate Medical Education mandates that trainee physicians “incorporate considerations of cost awareness” into their clinical practice; however, many programs do not currently have the curriculum to facilitate this education. A few successful projects have revealed that a focused HVC curriculum can be implemented, although the development of such a curriculum can be extremely expensive and time consuming. Necessary educational resources are available through journal sections on value, Choosing Wisely resources, and various other HVC curricula. Despite these resources, data reveal that only 10% of pediatric program directors and 15% of internal medicine residency programs report having a formal curriculum on HVC. In a survey of pediatric residency programs, respondents identified the largest barrier to HVC as a lack of cost transparency. The majority of respondents agreed that their program needed an HVC curriculum, and 90% of respondents reported that they would use a curriculum if one was available. Program directors and chief residents primarily desire case presentations at educational conferences.

Although existing HVC educational resources are focused primarily on knowledge about value and HVC concepts, much less is known about trainee practice of HVC in clinical settings and HVC bedside teaching. McDaniel, et al developed the HVC Rounding Tool, which is used to define observable HVC behavior to measure the content and frequency of HVC discussions in the context of family-centered rounds. In implementing this tool, they found that only 29% of patient encounters included at least 1 HVC discussion. Of these, only 31% of HVC discussions were initiated by a trainee (resident or medical student) and fewer than half (41%) of HVC discussions were initiated by attending physicians or fellows. Successful HVC curricula need to provide a foundation for knowledge transmission; however, additional supports, including faculty development in which informal HVC education is addressed and broader educational efforts to address the institutional culture of value and hidden curriculum, are necessary.

In response to this need for HVC education, we developed High-Value Pediatrics, a pediatric HVC curriculum, and subsequently evaluated its impact on pediatric resident knowledge, attitudes, and behaviors. The development and evaluation of High-Value Pediatrics followed the Kern et al framework for curriculum development.

DEVELOPING HIGH-VALUE PEDIATRICS

Targeted Needs Assessment

A needs assessment was performed at Children’s Hospital of Philadelphia (CHOP) in July 2015 before any HVC teaching via an optional survey of first- and second-year pediatric residents (response rate: 48%; n = 48 of 101). Overall, the needs assessment revealed that residents had a low self-reported understanding of health care cost, charges, and reimbursement. No residents described themselves as very or moderately knowledgeable when asked about their understanding of cost or charges, and >60% of residents rated themselves as minimally knowledgeable or completely unaware on all 3 topics. On the basis of this needs assessment, a pilot resident HVC curriculum was launched at CHOP for the 2015–2016 academic year. This curriculum was adapted and expanded to Cincinnati Children’s Hospital Medical Center (CCHMC) for the 2016–2017 academic year. CHOP is a 546-bed quaternary-care pediatric hospital in the Northeast. CCHMC is a 673-bed quaternary-care pediatric hospital in the Midwest. The pediatrics residency programs are 3 years in duration and include ~40 categorical residents per year at both institutions.

Goals and Objectives

Our overall goal was to develop an open-access pediatric HVC curriculum that contained the interactive component desired by learners and medical educators. Specifically, with the curriculum, we aim to prepare pediatric residents to (1) be stewards of high-quality, high-value, and family-centered care and (2) develop a culture of HVC that will shape residents as future clinicians.

Curriculum objectives were identified to address pediatric resident knowledge, comprehension, and application of HVC. Objectives include the following: (1) to define high-value health care; (2) to identify strategies and challenges for bringing HVC into daily practice; (3) to discuss the role that clinicians can play in the promotion or reduction of costs; (4) to identify sources of uncertainty in medical decision-making; (5)
Educational Strategies

High-Value Pediatrics is a 3-part educational program (see Fig 1). First, 4 standardized didactic lectures are given throughout the first 6 months of the academic year. Lectures were adapted from a previously described faculty development curriculum.30 Topics include an introduction to value in health care, health care costs, balancing cost with other important factors in health care, and high-value diagnosis. Key objectives are used to address comprehension, knowledge, and application. (see Table 1 for overview of curriculum objectives and content.)

Second, residents participate in monthly interactive morning reports that are focused on high-value diagnoses in patients. During these sessions, participants use a tool that mimics computerized physician order entry and allows for residents to select laboratory tests and diagnostic procedures from a large database stored on a Web server. Chosen tests are added to a “shopping cart,” and the cumulative total charges are displayed on a $1000 scale. In contrast to the classic approach of the “million-dollar” workup of a traditional morning report, the $1000 workup is focused on changing culture by celebrating mindful clinical care that includes appropriate levels of cost considerations. Key objectives include to define HVC and to practice using a value-based framework in weighing benefits, harms, and costs. The value-based framework is used to encourage learners to consider all testing and/or interventions in terms of both their quality and their cost.

Lastly, an embedded HVC improvement project serves as an adjunct to the more formal didactics offered through the curriculum. Curriculum authors worked with residency leadership to incorporate value-based projects into the residency programs’ existing QI curricula (already a mandated part of residency training per requirements by the Accreditation Council for Graduate Medical Education). Residents rotating through a hospital medicine team participate in a longitudinal QI project that spans 6 to 8 months. As different residents rotate through, they participate in different aspects of the QI process. Using QI methodology, residents develop a value-focused project with clear specific aims, tracked outcomes, and cost information to help them use the principles of HVC in real-life clinical settings. Key objectives include to implement the knowledge gained through the first 2 components of the curriculum to improve value, to apply the QI process, and to improve the value of the care that pediatric patients receive. This is a strength of High-Value Pediatrics because the combination of both case-based and didactic presentations with a clinically based improvement project can be used to address learning in multiple modalities, which may improve effectiveness.31 Although not all residents are exposed to this component of the curriculum in a given year, they will all have the opportunity to work on a value-based QI project at some point in residency.

Implementation

We developed open-access materials that can be downloaded and adapted and/or customized for the local learning environment. The complete High-Value Pediatrics curriculum is currently available for open access at www.pedsvalue.com. An overall curriculum guide, the 4 didactic lectures with facilitator guides and interactive activities, and access to the $1000 workup tool with a user guide are all available online. Access to the materials requires registration by participants on initial use of the curriculum. This feature allows the creators to track usage and also notifies users when changes are made. In addition, useful references, including granular cost data Web sites, national organizations on cost and value, databases on cost and value, journal sections on value, books on HVC and other HVC curricula are all linked on the Web site.

Evaluation of the Curriculum

We used a mixed-methods approach to evaluate the curriculum during the 2016–2017 academic year at 2 institutions. This mixed-methods approach was chosen to both evaluate the curriculum as well as to generate hypotheses regarding the impact of HVC curricula for future HVC education efforts. We used a previously published quantitative pre- and post-survey tool10 to evaluate resident knowledge and attitude change. A qualitative analysis of pediatric resident focus groups was used...
Table 1: Overview of the High-Value Pediatrics Curriculum

<table>
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<tr>
<th>Part 1: didactics</th>
<th>Objectives</th>
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<tr>
<td>Lecture 1: health care value; activity: think-pair-share</td>
<td>Recognize the urgent need for focus on value in health care delivery in the United States (comprehension) Define high-value health care (knowledge) Articulate strategies for bringing HVC into daily practice (comprehension) Identify challenges to providing HVC (comprehension)</td>
</tr>
<tr>
<td>Lecture 2: health care costs; activity: estimated care costs</td>
<td>Recognize the key terms and challenges related to health care costs in pediatrics (comprehension) Define the various types of costs that exist in health care delivery (knowledge) Discuss the role that clinicians play in the promotion or reduction of costs (comprehension) Practice strategies to consider costs and value in daily practice (application)</td>
</tr>
<tr>
<td>Lecture 3: balancing benefits, harms and cost; activity: opening case discussion</td>
<td>Explain the factors that contribute to test ordering by trainees (comprehension) Identify sources of uncertainty in medical decision-making (comprehension) Recognize potential biases that may hinder your clinical decision-making (comprehension) Practice using a value-based framework in weighing benefits, harms, and costs (application)</td>
</tr>
<tr>
<td>Lecture 4: high-value diagnosis; activity: threshold worksheet</td>
<td>Describe the threshold approach to clinical decision-making (comprehension) Identify that a working knowledge of basic statistical concepts is important to practicing HVC (comprehension) Explain the concept of likelihood ratios (comprehension) Discuss how likelihood ratios can influence the practice of HVC (comprehension) Practice weighing costs, benefits, and risks using the threshold approach and basic statistical concepts in clinical scenarios (application)</td>
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Part 2: monthly morning reports in which $1000 workup tool is used
- At least monthly interactive case conference recommended
- Part 3: intensive high-value, project-based curriculum
- Short and focused QI project on value driven by residents
- PDSA, plan-do-study-act.

Note: PDSA refers to the Plan-Do-Study-Act cycle, a continuous improvement method used to achieve changes in the health care system. QI refers to Quality Improvement.

After curriculum participation, residents were asked to reflect on the impact of the curriculum on their resident attitudes and practice. This study was approved by the Institutional Review Boards of CHOP and CCHMC with a waiver of consent. Quantitative data collection occurred via an anonymous, voluntary REDCap (Research Electronic Data Capture) survey adapted from a previously published tool (see Supplemental Fig 3 for the complete tool). The survey was distributed to all residents before initiation of the curriculum in July 2016 and after exposure to the curriculum in May 2017 (6 months after completion of lecture series).

Qualitative data collection was conducted with small-group interviews in the spring of 2017 to better understand the resident experience with the High-Value Pediatrics curriculum. All pediatric residents who had attended at least 1 lecture and at least 1 morning report were invited to participate. Eleven pediatric residents from both CCHMC and CHOP participated (7 women and 4 men) in 60-minute small-group sessions in a private location within the hospital. The group interview guide (see Supplemental Fig 4) included open-ended questions in which the impact of the curriculum on resident attitudes, behaviors, and practice was explored. The interviews were audio-recorded and transcribed verbatim. A thematic analysis of the transcribed focus group interviews (n = 4) was conducted. ATLAS.ti (version 1.6.0) qualitative data analysis software was used to manage, organize, and analyze coding.

Outcomes of the Curriculum

During the 2016–2017 academic year, 279 pediatric residents were exposed to the High-Value Pediatrics curriculum. All 4 lectures were completed at both institutions in conjunction with the completion of monthly high-value morning reports from August 2016 to May 2017. Fifty residents (18%) were exposed to both the curriculum and the embedded HVC improvement project (16 at CHOP and 34 at CCHMC). A total of 80 residents (29%) responded to the pre-and post-survey tool. Self-reported attendance at lectures ranged from 0 to 4 with a median of 2, and self-reported attendance at morning reports ranged from 0 to 8 with a median of 2 (see Supplemental Table 3). Self-reported knowledge of health care costs, charges, reimbursement, and value revealed statistically significant improvement at both institutions (Fig 2). Attitudes toward value revealed mixed results (see Supplemental Table 4).

A thematic analysis of focus group transcripts revealed resident perceptions of the impact of the curriculum on their behavior and overall practice. Two main themes emerged: curriculum contribution to understanding HVC and how HVC affects practice. Overall, residents reported that the curriculum improved their knowledge of...
FIGURE 2  Self-reported knowledge of health care costs, charges, reimbursement, and value revealed statistically significant improvement at both institutions ($P < .003$ via paired $t$ test for all categories). A, Results from the pre- and postcurriculum survey at CCHMC. B, Results from the pre- and postcurriculum survey at CHOP.
HVC by pushing them to understand how an intervention changes management and to think about cost as a harm and by encouraging prompted discussions. Participants believed that the curriculum and that learning about HVC affected their practice through a better understanding of medicine and of the health care system, through changing ordering practices, and through honing clinical skills. In Table 2, we present the themes and corresponding subthemes with exemplary quotes.

### TABLE 2  Exemplary Quotes of Themes and Subthemes Identified in Resident Focus Groups

<table>
<thead>
<tr>
<th>Theme</th>
<th>Quotes</th>
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<tr>
<td>Curriculum contribution to understanding of HVC</td>
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<tr>
<td>How an intervention changes management</td>
<td></td>
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<tr>
<td>Overall</td>
<td>“[P]rompting us to think about why we’re ordering tests and if they’re really providing value is the main thing that this has done.” CCHMC2.2</td>
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<tr>
<td>Benefit to the patient</td>
<td>“I think it has made me more mindful of why am I ordering this test? What benefit is it really going to be to the patient?” CHOP1.1</td>
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<td>“One thing that I appreciate about value in general is it forces you to say why am I doing this, and at least forecast a little bit how might this help, how might this hurt, how might this do nothing, and what do I think those are?” CHOP1.2</td>
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<td>Safely doing less</td>
<td>“We’d go through all the orders and see how frequently are they getting the labs, and then we would sort of decide do we need them that frequently? And normally…we would decrease the frequency of them, so I feel there was a conscious [effort] to decrease unnecessary labs and/or only get the parts that you needed.” CCHMC1.1</td>
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<td>Right test for the right patient</td>
<td>“It’s like did I order 8 things, and did they only need me to order 2 or 3? And then I think in particular, imaging tends to be more expensive. So, what image did they need, and did I need to get it tonight, or could it wait for a little bit more of a discussion on rounds as to what the right image is?” CHOP1.2</td>
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<td>Prompted discussion</td>
<td>“[T]he value of the curriculum is just starting the conversation or making it something to think about or be aware of, because I think there’s so many nuances…cost, medications, and things like that. So, just helping us know some of these things and setting that conversation.” CCHMC3.2</td>
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<td>Thinking about the cost as a harm</td>
<td>“The thing that’s probably hit me the hardest is not only the cost but then the charge to the patients.” CCHMC1.2</td>
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<td>“It’s more money than I could afford, so I can’t imagine what it’s like for most of our patients…we’re supposed to be advocates for our patients, and I don’t even know what the actual impact of my actions are all the time, so I think that’s a huge value of talking about the cost of things. It empowers me to be better at my job.” CCHMC2.2</td>
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<td>How HVC affects practice</td>
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<td>Better understanding of medicine</td>
<td>“So, I think not only in just the abstract…we need to reduce our costs in general and provide better quality care, etc, but I actually think it forces you to think about disease processes and learn medicine a little bit too, because that informs how valuable you think the test is. So, I think it does force you to think about things and learn both medicine and also like, health economics or whatever you want to call it, a little bit better.” CHOP1.2</td>
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<td>Better understanding of health care system</td>
<td>“I also think that healthcare costs are ridiculous and…ridiculously expensive, but I don’t know enough details about it to advocate…. And so I think that the benefit comes also in helping us be better advocates for making our health system better.” CCHMC2.1</td>
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<td>Changed how I ordered…</td>
<td>“And I found myself ordering less and different kinds of lab tests on a lot of patients that before the curriculum I would have practiced differently. But knowing certain aspects of the curriculum and…how I could become more aware and become a better high-value practitioner changed how I ordered a lot of labs and imagining.” CCHMC1.2</td>
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<td>“And so I would say most of the patients on our team, even if they were on IV fluids, we didn’t get renals unless we were concerned that maybe they had some lactoid abnormality or unless they were on fluids like a week…I think we were a lot more thoughtful about that. And I think that’s a big part to this curriculum, people sort of forcing us to think about what benefit does…the lab have?” CCHMC1.3</td>
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<td>“I think the biggest, where I’ve done it myself, is transitioning people to PO medications fastest and like avoiding IV TYLENOL…. And then the benefit also trying to transition them too, if they tolerate their 1 dose of oral antibiotics and then getting them out the door a little bit faster.” CCHMC3.1</td>
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<td>Hone your clinical skills</td>
<td>“I think it makes you hone in on your clinical skills in terms of really trying to hone in on one or a few diagnoses and then relying more on your physical exam skills, your history taking, and then sort of your clinical reasoning.” CCHMC1.2</td>
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<td>“But also I think it forces us to be better clinicians, because it forces us to think about what we’re doing and why we’re doing it, what information it’s going to give us, and whether or not it’s actually going to give us any information that we would act on.” CCHMC2.1</td>
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IV, intravenous; PO, by mouth. In this table, individual participants are denoted by first location where the focus group took place (CHOP or CCHMC), then by the number of the focus group held there, and lastly by the number assigned to each participant.
Results from the HVC improvement projects revealed an increase in high-value patient care at both sites. The resident team at CHOP demonstrated a safe reduction in continuous pulse oximetry monitoring orders for patients between 29 days and 1 year of age with mild to moderate bronchiolitis. The team at CCHMC increased the percentage of timely transitioned intravenous to oral antibiotics for hospital medicine patients admitted for uncomplicated pneumonia or skin and soft tissue infections, leading to a 75% cost reduction per patient encounter without an increase in readmissions.

Implications and Next Steps

At a time when most pediatric residencies do not have formal curricula on value, High-Value Pediatrics provides an open-access resource that includes interactive case presentation components that are highly desired by both pediatric program directors and chief residents in addition to didactic lectures and a framework for value-focused improvement projects. We know that clinicians have a poor knowledge of the cost of the care they provide, so the results of our curriculum implementation reveal promise. Exposure to High-Value Pediatrics led to improvements in resident perceived knowledge of value. The qualitative focus groups outlined self-reported changes in practice (influenced by a better understanding of the health care system), including focusing clinical skills and improving HVC ordering habits. The embedded QI project revealed trainee-led practice change at the 2 institutions.

The spread of this curriculum to other hospitals could serve as a key cog in improving value. Shared knowledge between and throughout institutions will lead to a better HVC foundation and shared understanding. Crowded residency curricula can serve as a barrier to the implementation of new curricular elements regarding HVC. By integrating HVC with existing QI efforts, programs can provide an opportunity for trainees to think about the application of HVC in their own practice while seeing its impact on patient care. The use of an open-access platform allows for easy use and adaptation to local institutional culture and educational environment.

For HVC education to lead to a successful culture change, it will require a broader adoption because the majority of education for trainees and physicians occurs through informal teaching and role modeling. By targeting only trainees, we risk creating conflict between trainees and attending physicians. Because trainees most commonly simulate their attending physician’s clinical practice, it is imperative that faculty be incorporated into the curriculum along with concurrent faculty development. This serves to address both the formal as well as the hidden curriculum that exists in HVC. It is imperative that through formal curriculum, like High-Value Pediatrics, we strengthen the foundational knowledge regarding value to drive improvements in the culture of value at pediatric institutions.

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