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ORIGINAL RESEARCH

Choosing Wisely in Pediatric Hospital Medicine: Five Opportunities for Improved Healthcare Value

Ricardo A. Quinonez, MD[1]*, Matthew D. Garber, MD[2], Alan R. Schroeder, MD[3], Brian K. Alverson, MD[4], Wendy Nickel, MPH[5], Jenna Goldstein, MA[5], Jeffrey S. Bennett, MD[6], Bryan R. Fine, MD, MPH[7], Timothy H. Hartzog, MD[8], Heather S. McLean, MD[9], Vineeta Mittal, MD[10], Rita M. Pappas, MD[11], Jack M. Percelay, MD, MPH[12], Shannon C. Phillips, MD, MPH[11], Mark Shen, MD[13], Shawn L. Ralston, MD[14]

[1]Department of Pediatrics, Section of Pediatric Hospital Medicine, Baylor College of Medicine, Houston, Texas; [2]Division of General and Hospital Pediatrics, University of South Carolina School of Medicine, Columbia, South Carolina; [3]Department of Pediatrics, Santa Clara Valley Medical Center, San Jose, California; [4]Department of Pediatrics, Hasbro Children's Hospital, Brown University, Providence, Rhode Island; [5]Center for Hospital Innovation and Improvement, Society of Hospital Medicine, Philadelphia, Pennsylvania; [6]Department of Pediatrics, University of Kentucky College of Medicine, Lexington, Kentucky; [7]Department of Pediatrics, Eastern Virginia Medical School, Children's Hospital of The King's Daughters, Norfolk, Virginia; [8]Division of General Pediatrics, Medical University of South Carolina, Charleston, South Carolina; [9]Department of Pediatrics, Duke University School of Medicine, Durham, North Carolina; [10]Department of Pediatrics, University of Texas Southwestern Medical Center and Children's Medical Center Dallas, Texas; [11]Department of Pediatric Hospital Medicine, Cleveland Clinic Children's Hospital, Cleveland, Ohio; [12]E. L. M. O Pediatrics, New York, New York; [13]Dell Children's Medical Center, Austin, Texas; [14]Department of Pediatrics, Dartmouth-Hitchcock Medical Center, Lebanon, New Hampshire.

BACKGROUND: Despite estimates that waste constitutes up to 20% of healthcare expenditures in the United States, overuse of tests and therapies is significantly underrecognized in medicine, particularly in pediatrics. The American Board of Internal Medicine Foundation developed the Choosing Wisely campaign, which challenged medical societies to develop a list of 5 things physicians and patients should question. The Society of Hospital Medicine (SHM) joined this effort in the spring of 2012. This report provides the pediatric workgroup's results.

METHODS: A workgroup of experienced and geographically dispersed pediatric hospitalists was convened by the Quality and Safety Committee of the SHM. This group developed an initial list of 20 recommendations, which was pared down through a modified Delphi process to the final 5 listed below.

RESULTS: The top 5 recommendations proposed for pediatric hospital medicine are: (1) Do not order chest radiographs in children with asthma or bronchiolitis. (2) Do not use systemic corticosteroids in children under 2 years of age with a lower respiratory tract infection. (3) Do not use bronchodilators in children with bronchiolitis. (4) Do not treat gastroesophageal reflux in infants routinely with acid suppression therapy. (5) Do not use continuous pulse oximetry routinely in children with acute respiratory illness unless they are on supplemental oxygen.

CONCLUSION: We recommend that pediatric hospitalists use this list to prioritize quality improvement efforts and include issues of waste and overuse in their efforts to improve patient care. *Journal of Hospital Medicine* 2013;8:479–485. © 2013 Society of Hospital Medicine

Overuse in medicine is a significant and underrecognized problem. Don Berwick estimated that waste accounts for at least 20% of healthcare expenditures in the United States, with overtreatment as one of the largest categories.[1] A commentary by Schroeder et al. challenged pediatricians to incorporate this knowledge into our own patient safety and quality movement.[2] Recently published data suggest that we are far from achieving the patient safety goals set forth in the Institute of Medicine's landmark *To Err is Human*[3] report, despite more than a decade of national, local, and regional efforts.[4] One way to reduce waste and improve patient safety is to eliminate practices of unproven benefit. Therapies or tests that may initially seem promising are often proven to be not only unhelpful but actually harmful. The recommendation of the US Preventive Services Task Force against routine screening for prostate specific antigen is an example of how a common test initially thought of as lifesaving actually increases harm.[5]

The American Board of Internal Medicine Foundation (ABIM-F) recently announced the Choosing Wisely campaign. Through this campaign the Foundation encourages "physicians, patients and other healthcare stakeholders to think and talk about medical tests and procedures that may be unnecessary."[6] The primary output of this challenge is the development of a list of 5 tests and or therapies that physicians and patients should question. The ABIM-F approached different medical societies to develop these lists within their own specialties. The Society of Hospital Medicine (SHM) joined the Choosing Wisely campaign in April 2012, and agreed to develop a list

*Address for correspondence and reprint requests: Ricardo A. Quinonez, MD, Associate Professor of Pediatrics, Section of Pediatric Hospital Medicine, Baylor College of Medicine/Texas Children's Hospital, 6621 Fannin St., Suite A210, Houston, TX 77030; Telephone: 713-240-7908; Fax: 832–825–5424; E-mail: quinonez@bcm.edu

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of 5 therapies and tests for adult hospital medicine and pediatric hospital medicine. Here we present the contribution of the pediatric workgroup detailing the methodology and process for developing the list, as well as summarizing the evidence supporting each recommendation.

METHODS

In the spring of 2012, the pediatric committee of the SHM convened a workgroup of pediatric hospitalists to develop a top 5 list for the field. This workgroup was composed of experienced pediatric hospitalists representing diverse geographic locations of the United States and a mix of academic and nonacademic practice settings. The group, consisting of 4 women and 9 men, began by proposing candidate recommendations after discussion with colleagues at their different practice sites. The group was charged to maintain a focus on overuse practices that had a strong basis in evidence, were frequently encountered at their practice sites, and achieved significant consensus among their colleagues. Figure 1 shows the process map describing the method for the development of the pediatric recommendations. All workgroup participants were queried as to conflict of interest relevant to this work and none were identified.

Literature Review

After the generation of the initial top 20 list, 2 reviewers conducted independent literature searches in PubMed, MEDLINE, and the Cochrane Library on the proposed topics. The reviewers also conducted generic Internet searches. Key search terms included "pediatric asthma," "bronchiolitis," "chest radiograph," "systemic corticosteroids," "gastroesophageal reflux disease ("GERD")," "infant," "child," "acid suppression therapy," "continuous pulse oximetry," "pneumonia," "gastroenteritis," "viral testing," "blood culture," and "soft tissue infections." To ensure that the reviewers included all studies relevant to the searches, they utilized broad terms. The search included all literature published through 2012, and non–English language publications were included in the search. Studies selected and included in the review were based upon common criteria including whether the article discussed an evaluation of efficacy and/or utility of treatment, included a pediatric population in the guidelines or study, reviewed the harm associated with the administration of a particular test or treatment, and explored the cost associated with the test or treatment.

The Delphi Panel

Members of the workgroup formed a Delphi panel except for 1 member (R.Q.) who served as the nonvoting moderator. The members of the Delphi panel considered the results of the literature search for each recommendation along with the collated feedback from hospitalist listserves as described in Figure 1. Each panel member received a voting instrument with the candidate tests and treatments for the first round of Delphi voting. The panel utilized a modified Delphi method or the RAND Corporation (RAND)/University of California at Los Angeles (UCLA) appropriateness method as described in previous publications of quality indicator development in pediatrics.[7] Each panelist scored the candidate tests and treatments and forwarded the scores to the moderator. Subsequently, all the members of the Delphi panel met through a conference call to carry out the second round of voting. The deidentified collated results of the first round of Delphi voting were made available and discussed during the call. The moderator collated the final results, and the final 5 recommendations were those that had the highest score after the second round of Delphi voting.

Volume and Costs

During deliberations, the committee took into account the prevalence and cost rankings of our most common pediatric inpatient diagnoses. This was done using the Agency for Healthcare Research and Quality's (AHRQ) Healthcare Utilization Project (HCUP), specifically, the Kids' Inpatient Database (KID). HCUP includes the largest collection of longitudinal hospital care data in the United States, encompassing all-payer discharge-level information. We excluded normal newborn hospitalizations, and looked at the top 10 acute inpatient diagnoses in terms of both volume and aggregate costs.

RESULTS

The initial list of 20 candidate tests and treatments as well as the refined list of 11 recommendations can be found as electronic supplements to this publication (see Supporting Table 1 and Supporting Table 2 in the online version of this article). The format and language of the list of 11 recommendations were chosen to mesh with that typically used in the ABIM-F Choosing Wisely campaign. During the Delphi panel, there was strong group consensus about combining items 1 and 2 (chest radiographs in asthma and bronchiolitis) into a single recommendation.

The top 5 recommendations based on the result of the second round of Delphi scoring are shown in Table 1 and described below along with a detailed evidence summary.

Do not order chest radiographs in children with asthma or bronchiolitis.

The National Heart and Lung Institute's guidelines for the management of asthma, published in 1987, recommend against routinely obtaining chest radiographs in patients with asthma or asthma exacerbations.[8] Supporting this recommendation are several

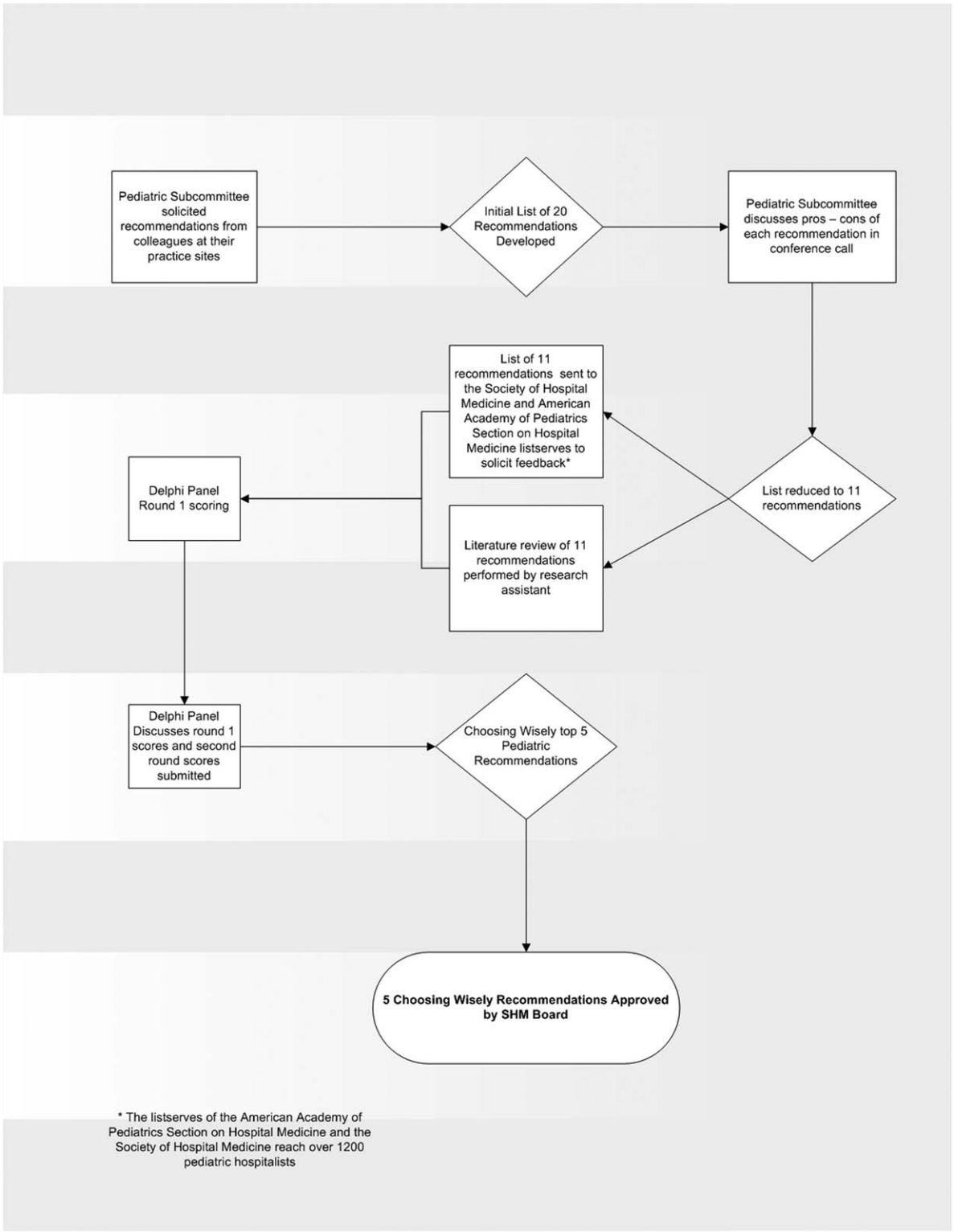

FIG. 1. Society of Hospital Medicine Pediatric Subcommittee Choosing Wisely list development process map.

studies that show a low overall yield when obtaining chest radiographs for wheezing patients.[9–11] Most relevant, studies that evaluated the clinical utility of radiographs in patients with asthma have demonstrated that they influence clinical management in less than 2% of cases.[12] A quality improvement project aimed at decreasing the rate of chest radiographs obtained in patients with asthma demonstrated that close to 60% of patients admitted to the hospital had chest radiographs performed, and that significant overall reductions can be achieved (45.3%–28.9%, $P = 0.0005$) without impacting clinical outcomes negatively.[13]

TABLE 1. Top Five Pediatric Hospital Medicine Recommendations

Do not order chest radiographs in children with asthma or bronchiolitis.
Do not use bronchodilators in children with bronchiolitis.
Do not use systemic corticosteroids in children under 2 years of age with a lower respiratory tract infection.
Do not treat gastroesophageal reflux in infants routinely with acid suppression therapy.
Do not use continuous pulse oximetry routinely in children with acute respiratory illness unless they are on supplemental oxygen.

Similarly, the Subcommittee on Diagnosis and Management of Bronchiolitis of the American Academy of Pediatrics recommends against routinely obtaining radiographs during the evaluation for bronchiolitis.[14] Studies assessing the utility of chest x-rays in these children demonstrate an even lower incidence of abnormalities (0.75%) and indicate that, despite this low incidence, physicians are more likely to treat with antibiotics when radiographs are obtained.[15] There is also evidence that chest radiographs in patients with bronchiolitis are not useful in predicting severity of illness.[16] Furthermore, cost-effective analyses have demonstrated that omitting chest radiographs in bronchiolitis is actually cost-effective, without compromising diagnostic accuracy.[17] In a recently published national benchmarking inpatient collaborative, Ralston et al. demonstrated that the majority of patients admitted to the hospital with bronchiolitis have chest radiographs performed at a rate of 64% (interquartile range [IQR], 54%–81%).[18]

In both bronchiolitis and asthma, the elimination of unnecessary radiographs has the potential to decrease costs, reduce radiation exposure, and minimize the overuse of antibiotics that often occurs secondary to false positive results.

Do not use bronchodilators in children with bronchiolitis.

Ralston showed that 70% (IQR, 59%–83%) of admitted bronchiolitis patients received bronchodilators with an average of 7.9 doses per patient (IQR, 4.6–9.8). National guidelines for bronchiolitis suggest a very limited role of bronchodilators in patients with bronchiolitis.[14] The first meta-analyses of studies related to the question of β-agonist efficacy in bronchiolitis were published in the late 1990s, revealing minimal or no treatment effects.[19,20] Since then, further research has solidified these findings, and fairly definitive statements can be made based on a recent comprehensive meta-analysis.[21] The pooled data do not show any effect on hospitalization rates, hospital length of stay, or other inpatient outcomes in bronchiolitis. They do show a small change in clinical scores documented in the outpatient setting, though these scores have not correlated with any detectable difference in outcomes. Routine use of β-agonists in the inpatient setting has no proven benefit, and given the large amount of consistent data, there is no compelling reason for further study of this therapy in the inpatient setting.

Epinephrine, a combined β- and α-agonist, has been extensively evaluated in bronchiolitis as well. Like albuterol, epinephrine has been reported to have no effect on hospital length of stay in bronchiolitis.[22] The issue of admission rates after epinephrine is complicated by 1 very large study that combined epinephrine with dexamethasone and reported a decreased admission rate, though only at 7 days after therapy; however, this effect was nullified after adjustment for multiple comparisons.[23] When the end point is improvement of respiratory scores, epinephrine may perform better than albuterol in studies where they are directly compared; however, there is no evidence that repeated usage of epinephrine has any impact on any clinical outcome for inpatients.[24,25]

Do not use systemic corticosteroids in children under 2 years of age with a lower respiratory tract infection

In their summary of evidence, the Subcommittee on Diagnosis and Management of Bronchiolitis of the American Academy of Pediatrics recommends against routinely using systemic corticosteroids for infants with bronchiolitis.[14] The previously reference bronchiolitis benchmarking study demonstrated that admitted patients received steroids at a rate of 21% (IQR, 14%–26%). The poor efficacy of corticosteroids in children with bronchiolitis under 2 years of age is well demonstrated in the literature. A large, blinded, randomized, controlled study compared systemic oral corticosteroids to placebo in hospitalized children 10 months to 6 years of age with viral wheezing.[26] This study showed no benefit of corticosteroids over placebo in length of stay or parental report of symptoms 1 week later. In the study, a subanalysis of children with eczema and family history of asthma also demonstrated no benefit of systemic corticosteroids. Large systematic reviews further argue that there is no effect of corticosteroids on the likelihood of admission or length of stay in infants with bronchiolitis.[27,28] One 4-armed prospective study of children 6 weeks to 12 months of age found no efficacy of dexamethasone over placebo.[23] There was modest benefit of dexamethasone in conjunction with racemic epinephrine; however, this benefit disappeared after adjustment for multiple comparisons. Three smaller studies showing benefit of systemic corticosteroids, however, were highly problematic. They have included older children, were retrospective, or demonstrated inconsistent results.[29,30] A smaller study showed benefit for children over 2 years of age, but none for children under 2 years of age.[31] Premature infants are at increased risk of asthma, which typically responds

well to corticosteroids as these children get older. However, a retrospective study of premature infants under 2 years of age with bronchiolitis demonstrated no association between corticosteroid use and length of stay, even in the subset of premature infants responding to albuterol.[32]

Systemic corticosteroid use in children is not harmless. Children under 2 years of age are especially vulnerable to the decreased growth velocity seen as a side effect of systemic corticosteroids.[33] Corticosteroids may also negatively impact the course of infectious illness. For instance, in children hospitalized with pneumonia but not receiving β-agonists (ie, patients who are unlikely to have asthma), length of stay is prolonged and readmission is higher in those who receive corticosteroids.[34]

Do not treat gastroesophageal reflux in infants routinely with acid suppression therapy.

From 2000 to 2005, the incidence of infants diagnosed with gastroeshopaheal reflux (GER) tripled (3.4%–12.3%), and the use of proton pump inhibitors (PPIs) doubled (31.5%–62.6%).[35] Patients diagnosed with GER and treated with antireflux medication incurred 1.8 times higher healthcare costs in 1 study compared to healthy controls.[36] Though common, the use of acid suppressive medications in infants lacks evidence for efficacy in the majority of the clinical scenarios in which they are prescribed.[37,38] PPIs have failed to outperform placebo for typical infant reflux, which is generally developmental and not pathologic.[39,40] Furthermore, prompted by findings in adults, multiple pediatric investigators have now catalogued the potential risks associated with acid blockade in children in multiple clinical settings. Specifically, increased risk of pneumonia has been documented in inpatients and outpatients, and increased risk of necrotizing enterocolitis and other serious infections have been documented in intensive care unit settings.[41] In the absence of data supporting efficacy and given the emerging data on risk, empiric acid suppression in infants with reflux is wasteful and potentially harmful.

Do not use continuous pulse oximetry routinely in children with acute respiratory illness unless they are on supplemental oxygen.

Pulse oximetry use has become widespread in the management of infants with bronchiolitis and likely accounts for the dramatic increase in bronchiolitis hospitalization rates in recent years.[14,42–47] Despite this increase in hospitalization rate, there was no change in mortality from bronchiolitis between 1979 and 1997.[48] The continuous monitoring of oxygen saturations in hospitalized infants with bronchiolitis may lead to overdiagnosis of hypoxemia and subsequent oxygen use that is of no apparent benefit to the child. Schroeder et al. demonstrated that 26% of a sample of infants hospitalized with bronchiolitis had a prolonged length of stay because of a perceived need for oxygen based on pulse oximetry readings.[43] Unger and Cunningham showed that the need for oxygen was the final determinant of length of stay in 58% of cases, and Cunningham and Murray suggested that using an oxygen saturation cutoff of 94% instead of 90% might increase the length of stay by ~22 hours.[44,49]

It has been previously shown that hypoxia is normative in infants. Healthy infants experience multiple episodes of SpO2 ≤90% while sleeping.[50] This finding strengthens the notion that detection of low saturations in infants convalescing from bronchiolitis may simply reflect overdiagnosis. Among children with chronic severe asthma, who presumably have experienced episodes of hypoxia throughout childhood, there is no difference in school performance compared to healthy controls.[51]

The practice parameter on bronchiolitis from the American Academy of Pediatrics states: "as the child's clinical course improves, continuous measurement of SpO2 is not routinely needed," which is a recommendation based on expert consensus.[14] There is at least one ongoing randomized trial comparing the use of continuous versus intermittent pulse oximetry in hospitalized infants with bronchiolitis who are weaned off oxygen (clinicaltrials.gov NCT01014910). An interim analysis of this trial revealed no safety concerns with intermittent pulse oximetry over continuous monitoring.[52] Given the substantial risks and resources associated with prolonged bronchiolitis hospitalizations, a reduction in pulse oximetry use has great potential to reduce costs and improve overall care.

DISCUSSION

Berwick and Hackbarth define overtreatment as: "waste that comes from subjecting patients to care that, according to sound science and the patients' own preferences, cannot possibly help them—care rooted in outmoded habits, supply-driven behaviors, and ignoring science."[1] With this project, we tried to capture common clinical sources of waste in the inpatient pediatric setting. This is an inherently difficult project because of the absence of solid evidence to inform every decision point in medicine. Although there is always room for improvement in our evidence base, our group intentionally gravitated to areas where the evidence was robust.

The primary strength of this work is the use of the RAND/UCLA appropriateness method or modified Delphi method. Several publications have validated this methodology as a sound strategy to assess quality indicators and issues related to overuse.[7,53] To our knowledge, we are the first group to report the use of

this methodology to develop a list such as the list reported here.

There were some challenges inherent to this project that can be considered limitations of the work. One perceived limitation of our list is the heavy concentration on respiratory diagnoses, especially bronchiolitis and asthma. We do not feel this is a genuine limitation, as the recommendations were partly driven by volume and costs as assessed by the KID database. Among the top 10 acute inpatient diagnoses in pediatrics, respiratory diagnoses are the most common, including bronchiolitis, pneumonia, and asthma. Pneumonia or bronchiolitis has been the most common medical diagnosis in inpatient pediatrics for the past decade, and both are always in the top 10 for costs as well.[54] Thus, the impact of decreasing overuse for these conditions will be highly significant from a simple volume standpoint.

The primary limitation of this work is the lack of implementation strategies. Although the Choosing Wisely campaign has plans for dissemination of the lists, compliance with the recommendations may be suboptimal. Although the development process followed an accepted methodology, shortcomings include the lack of wide, local, multidisciplinary (including parents or caretakers) consultation. Other barriers to compliance with these recommendations exist. Despite evidence that bronchiolitis is a benign self-limited disease that does not respond to bronchodilators and steroids, the drive to identify and correct all abnormalities, such as wheezing or low oxygen saturation in a nontoxic infant with bronchiolitis, seems to trump the obligation to do no harm in daily practice.[55] This behavior may result from pressure by patients, families, nurses, or peers and is deeply embedded in our medical culture, where action is preferred to inaction without full knowledge or consideration of risks. Doctors and nurses have become attached to the pulse oximeter, believing somehow that the number displayed is less subjective and holds more predictive value than careful evaluation of the patient's respiratory status. Other pressures, such as direct to consumer marketing have made acid reflux a household term that is easily treated with over-the-counter medications. Considerations of the care continuum will also serve as barriers. Chest x-rays, for example, are frequently obtained prior to admission to the hospital before the hospitalist is involved.

To overcome these limitations, the study of individual and organizational adoption of innovation might be relevant. Though it is complex and often more descriptive than proscriptive, a few salient features have emerged. Champions and opinion leaders make a difference, local culture is dominant, social networking is important, simple innovations that can be trialed on a small scale are adaptable by the user and have observable benefits, are more likely to be adopted.[56] Fortunately, the top 5 list meets many of these criteria, but also faces the daunting challenges of inertia, lack of financial incentive, inability to break with old habits, and fear of lawsuits and perceived patient/parent dissatisfaction. Ongoing evaluation, feedback, and audit will be necessary to detect and sustain change.

CONCLUSION

We have identified 5 tests or therapies overused in inpatient general pediatrics. One goal of the Choosing Wisely campaign is to begin to change social norms related to physician behavior. We hope by asking clinicians to consider doing less for common conditions in inpatient pediatrics, that they will increasingly consider the known and unanticipated risks of any medical interventions they choose to use. Finally, we would like to encourage all pediatricians to embrace the idea of good stewardship and join us in prioritizing and addressing waste and overuse as important patient safety issues as well as threats to the sustainability of our healthcare system.

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