

# Categorization of National Pediatric Quality Measures

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abstract

**BACKGROUND AND OBJECTIVE:** The number of quality measures has grown dramatically in recent years. This growth has outpaced research characterizing content and impact of these metrics. Our study aimed to identify and classify nationally promoted quality metrics applicable to children, both by type and by content, and to analyze the representation of common pediatric issues among available measures.

**METHODS:** We identified nationally applicable quality measure collections from organizational databases or clearinghouses, federal Web sites, and key informant interviews and then screened each measure for pediatric applicability. We classified measures as structure, process, or outcome using a Donabedian framework. Additionally, we classified process measures as targeting underuse, overuse, or misuse of health services. We then classified measures by content area and compared disease-specific metrics to frequency of diagnoses observed among children.

**RESULTS:** A total of 386 identified measures were relevant to pediatric patients; exclusion of duplicates left 257 unique measures. The majority of pediatric measures were process measures (59%), most of which target underuse of health services (77%). Among disease-specific measures, those related to depression and asthma were the most common, reflecting the prevalence and importance of these conditions in pediatrics. Conditions such as respiratory infection and otitis media had fewer associated measures despite their prevalence. Other notable pediatric issues lacking associated measures included care of medically complex children and injuries.

**CONCLUSIONS:** Pediatric quality measures are predominated by process measures targeting underuse of health care services. The content represented among these measures is broad, although there remain important gaps.



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**WHAT'S KNOWN ON THIS SUBJECT:** The number of quality measures and their centrality in health care is increasing. There has been no synthesis of the type and content of measures applying to pediatric populations.

**WHAT THIS STUDY ADDS:** Our study found an abundance of process measures targeting underuse of services among national measures. We also suggest that there may be discordance between the frequency and potential impact of some pediatric conditions and the number of applicable measures.

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Over recent decades, quality improvement has become a major focus in health care.<sup>1</sup> Measurement is a key component of advancing health care quality, intended to provide an objective picture of services rendered and allow for meaningful comparisons across institutions and providers to drive improvement. Many organizations have devoted resources to the development of measures with the aim of facilitating transparency, higher value care, and improved outcomes.<sup>2-4</sup>

Nevertheless, some experts have expressed concern about the centrality that quality measures have taken in revamping health care delivery systems, raising the possibility of unintended negative consequences.<sup>5,6</sup> Questions remain regarding the value of quality measurement, specifically around the balance of benefit accrued weighed against the financial and opportunity costs of implementation.<sup>3</sup> The rapidity with which measures have been developed has outpaced research examining the associated outcomes, and the sheer number of measures is felt by some to be excessive.<sup>7</sup> A focus on measurement without a clear understanding of consequences has been suggested to be detrimental to physicians, patients, and broader health systems.<sup>4,6</sup>

A small number of researchers have aimed to describe available quality measures in detail. Some have focused on those pertaining to particular areas or fields to determine whether these adequately represent the quality of care delivered in these domains,<sup>8-10</sup> whereas others have attempted broader classifications.<sup>5</sup> Although setting-specific research evaluating pediatric quality measurement has been performed,<sup>10</sup> a characterization of the measures applying to broad pediatric populations, either by type or by content, has not been performed. The aim of this study is

to quantify nationally promulgated quality measures applicable to pediatric populations and to characterize the prevalence of measures by domain and content area.

## METHODS

### Identification of Measures

We identified candidate national clinical quality measure collections available in databases or clearinghouses (eg, the National Quality Forum and the Joint Commission), federal government Web sites (eg, the Center for Medicare and Medicaid Services and the Agency for Healthcare Research and Quality) and by using key informant interviews with experts in health services research and health care operations. Key informants included a chief quality officer, hospital chief executives, and several health services researchers. We then made a master list of all measures extracted from the identified resources applicable to pediatric populations as of December 31, 2015. Screening for pediatric applicability included first assessing any age restrictions contained within the measure definition (ie, use of the word “adult” or a statement of applicability to age >18 years or Medicare-only populations) and then applying a qualitative assessment of whether the measure pertained to a disease or condition of children. Diseases designated as not relevant for children’s health care quality through our qualitative assessment included: myocardial infarction, coronary artery disease, ischemic vascular disease, abdominal aortic aneurysm, atrial fibrillation, chronic obstructive pulmonary disease, dementia, cataracts, colon cancer, breast cancer, melanoma, prostate cancer, cervical cancer, hypertension, stroke, Parkinson’s disease, amyotrophic lateral sclerosis,

osteoarthritis, low back pain, and osteoporosis.

### Classification of Measures

We classified measures as relating to structure (those focused on static aspects of an organization’s setting, systems, or providers), process (the activities carried out by providers in the delivery of health care), or outcome (changes in patient health) using a Donabedian framework and additionally delineated by the Agency for Healthcare Research and Quality.<sup>11,12</sup> We additionally classified process measures as intended to address underuse (too little care provided), overuse (too much care provided), or misuse (provision of incorrect care) of health services based on definitions specified by Newton et al.<sup>5</sup>

All measures were independently classified by at least 2 of the 4 authors, with priority given to existing classifications in published studies or by the measure developer. In areas where disagreement existed, resolution was achieved through an iterative process involving group consensus. Analyses were initially conducted on all measures; subsequently, duplicates were removed and additional analyses were performed using unique measures.

Measures were then characterized based on content. Six main content groups were identified through consensus of the authors: condition-specific metrics, other diagnostics and therapeutics, preventive care, hospital-based outcomes, systems of care, and surgical. Measures were placed into the group determined to best fit the intent of the specific metric.

### Comparison of Measures to Frequency of Pediatric Presentations

Specific health conditions represented within the identified measures were ranked based on the number of associated metrics (ranking system included both the total number of

**TABLE 1** National Quality Measure Collections Pertaining to Pediatric Providers

Source	Collection	No. of Measures Reviewed	Relevant to Pediatric Providers
Center for Medicare and Medicaid Services	Child Core Set	24	19
	Hospital Inpatient Quality Reporting	42	16
	Hospital Outpatient Quality Reporting	26	13
	Hospital Compare	118	25
	Physician Quality Reporting System	254	55
Agency for Healthcare Research and Quality	Pediatric Quality Indicators	24	17
National Quality Forum Joint Commission	Endorsed	626	105
	Core Measures	46	17
	Outpatient Core Measures	33	12
National Committee for Quality Assurance	Healthcare Effectiveness Data and Information Set Physician Measures	51	25
Health Resources and Services Administration	Uniform Data System	13	7
American Medical Association	Physician Consortium for Performance Improvement	325	49
Children's Hospital Association	Solutions for Patient Safety	10	9
	Whole System Measures	11	11
Centers for Disease Control and Prevention	National Healthcare Safety Network	10	6

measures and the unique number of measures associated with that condition). We then compared the content of quality measures to conditions estimated as most common to the pediatric population in outpatient, inpatient, and emergency settings.<sup>13-15</sup> The rankings of outpatient diagnoses were obtained from a 2007 report of 20 practice-based research networks; we also evaluated National Ambulatory Care Survey data, however, we chose the former because 53% of participating physicians were pediatricians, whereas only 20% of National Ambulatory Care Survey providers were pediatricians.<sup>13</sup> Emergency department diagnoses were ascertained from a 2012 study categorizing nearly 6 million emergency visits among Medicaid-insured children.<sup>14</sup> Inpatient visit diagnosis frequency was taken from a recently published 2012 analysis of admissions to both children's hospitals and community hospitals by using the Kids' Inpatient Database.<sup>15</sup> For inpatient presentations, major depression, episodic mood disorders, and bipolar disorder are grouped together. Appendicitis with and without peritonitis and acute

**TABLE 2** Measure Classification by Domain

Measure Category	All Measures, N (%)	Unique Measures (Duplicates Removed), N (%)
Total	386	257
Outcome	118 (31)	83 (32)
Structure	28 (7)	22 (9)
Process	240 (62)	152 (59)
Process measures by type		
Underuse	179 (74)	117 (77)
Overuse	35 (15)	20 (13)
Misuse	26 (11)	15 (10)

appendicitis with abscess are all represented under "appendicitis."

## RESULTS

Across 15 measure collections, 386 measures (24%) were broadly applicable to pediatric populations. Table 1 presents the included measure collections. Exclusion of duplicates left 257 unique measures. Supplemental Tables 5 through 7 list all structure, process, and outcome measures, respectively. The majority of unique pediatric quality measures are process measures (59%), most of which target underuse of health services (77%) (Table 2). Table 3 demonstrates measures categorized by content, providing an overview of the aspects of pediatric care

represented among national quality measures. Among underuse metrics, those focused on vaccinations, depression, asthma, and well-child care were the most frequently observed. Of the 20 unique overuse metrics, a majority were related to minimization of medication and radiation exposure. Of the 15 unique misuse metrics, nearly half concerned emergency department flow.

Table 4 compares the relative amount of condition-specific content identified among available quality metrics to published accounts of their prevalence in the outpatient, inpatient, and emergency settings.<sup>13-15</sup> This table includes only conditions identified as the most common in these settings by using available references.<sup>13-15</sup>

**TABLE 3** Quality Measures Characterized by Content Area

Content Area	Total	Unique	Content Area	Total	Unique
Condition-specific measures			Preventive care		
Depression	20	11	Immunizations	24	8
Asthma	17	10	Nutrition/physical activity	9	4
Dental health	14	11	Developmental screening	3	2
HIV/AIDS	12	10	Well-child visits	8	3
Renal disease	11	8	Hearing/vision screening	4	4
Otitis media with effusion	8	5	Other screening	2	2
Lower respiratory infection (includes community-acquired pneumonia)	7	6	Hospital-based outcomes		
Acute otitis externa	7	3	Readmission	4	2
Acute gastroenteritis	6	5	Length of stay	1	1
Substance abuse (tobacco/alcohol)	5	3	Mortality	10	7
Atopic dermatitis	4	4	General quality/safety	4	4
Diabetes mellitus	4	3	Hospital-acquired infections	20	11
Attention-deficit/hyperactivity disorder	4	1	Adverse conditions/events	20	13
Chlamydia	4	1	Systems of care		
DVT management	3	3	Nursing care	4	4
Oncologic diagnoses	3	3	Care coordination	8	7
Upper respiratory infection	3	1	Transitions/discharges	6	6
Pharyngitis	3	1	Access to care	8	7
Appendicitis	1	1	Emergency visits and processes	24	10
Urinary tract infection	1	1	Environmental	4	4
Ventriculoperitoneal shunts	1	1	Patient satisfaction/surveys	9	7
Retinopathy of prematurity	1	1	Other diagnostics and therapeutics		
Other condition specific	6	6	Radiation studies	20	14
			Surgical		
			Cardiac	7	7
			General	30	19
			Total measures	386	257

**DISCUSSION**

Within the nationally promoted or required quality measure sets, we found approximately one-quarter were applicable to the pediatric population. The majority of these

pediatric measures are process measures, similar to the pattern previously described in adult populations.<sup>5</sup> Process measures consistently dominate the modern landscape of quality measurement,

reflective of the fact that they generally provide actionable targets and/or are conducive to data gathering over relatively short time cycles.<sup>16</sup> However, some skepticism remains surrounding the linkage of compliance with process measures and improved outcomes. Certainly, the use of vaccines to prevent life-threatening illness has been well-established<sup>17</sup>; in contrast, documentation of BMI has not clearly been linked to weight reduction, or even to the provision of more nutritional counseling.<sup>18,19</sup> Similarly, annual physical exams have not been distinctly linked to improved health outcomes in adult populations.<sup>20</sup> Within the category of process measures, we found that over three-quarters were intended to address underuse of services. This is despite the fact that estimates of waste in health care place medical overuse as one of the largest problems in both private and public sector care,<sup>21-23</sup> emphasizing an opportunity for more careful evaluation of the linkage between measurement and health services utilization. Given that resources to address gaps in care are directed toward those areas we are measuring and reporting, the paucity of overuse metrics may be 1 driver for why deimplementation of contradicted and unproven practices has lagged behind other efforts.<sup>24</sup> For instance, recent studies in adult

**TABLE 4** Comparison of Quality Measure Content to Prevalence of Pediatric Conditions Across Care Settings

Condition	Rank Among Condition-Specific Measures	No. of Total Measures/% Total	Rank Among Outpatient Visits	Rank Among Inpatient Visits	Rank Among Emergency Visits
Routine health maintenance	—	50/13.0	1	NR	NR
Depression/anxiety	1	20/5.2	6	10	NR
Asthma	2	17/4.4	7	2	5
Otitis media	6	8/2.1	4	NR	3
Lower respiratory infection (includes community-acquired pneumonia)	7	7/1.8	11	Pneumonia: 1 Bronchiolitis: 3	10
Gastroenteritis	9	6/1.6	NR	Dehydration: 6	Nausea/vomiting: 6
Oncologic diagnoses	13	3/0.8	NR	Chemotherapy: 8	NR
Diabetes mellitus	11	4/1.0	5	NR	NR
Upper respiratory infection	15	3/0.8	2	NR	1
Appendicitis	16	1/0.3	NR	4	NR
Urinary tract infection	16	1/0.3	NR	7	NR

NR, not ranked; —, not categorized as condition-specific (represents all general preventive care).

populations have identified greater gains in physician performance on underuse metrics than those related to overuse.<sup>22</sup> Encouragingly, we did find a greater percentage of process metrics devoted to overuse of services in pediatrics (13%) than was identified in the categorization of adult measures (7%).<sup>5</sup>

Although outcome measures are often viewed as superior to process measures given that they more directly reflect patient health status, such measures also pose some challenges. There are many factors that influence patient outcomes, requiring risk adjustment to meaningfully interpret performance.<sup>16</sup> Data must be collected over longer periods of time, and the outcomes measured are sometimes quite rare, especially in children. Twenty-nine of the 83 unique (45/118 total) outcome measures we identified were related to hospital-acquired conditions or surgical complications; 7 additional unique measures (9 total) focused specifically on mortality. Such outcomes are undeniably important, but reflect a small component of pediatric health care, and low event rates make detection of true differences in quality a challenge.<sup>25</sup> A vast majority of children are in excellent or very good health<sup>26</sup>; mortality in pediatrics is fortunately quite rare,<sup>27</sup> and hospitalization for illness is rare when compared with adults.<sup>28</sup> Outcome measures are also not specific; identifying an adverse outcome does not necessarily clearly identify a target area for improvement given the complexity of the processes leading to such events. With many existing outcome measures focusing on infrequent childhood events, we are left with lingering questions as to whether these measures truly are superior indicators of children's health care quality.

Our evaluation of measure content is intended to provide a broad overview of conditions represented among

available metrics. We do not suggest that a direct correlation should exist between pediatric disease frequency and representative measures, nor would we propose that greater numbers of measures are always advantageous. However, given the focus currently placed on quality measurement, it is important to understand what areas of pediatric health care are being captured across measure sets. We found strong representation of several prevalent and impactful pediatric conditions. Twenty total measures (11 unique) were devoted to depression; mental health diagnoses rank sixth among outpatient visits and tenth among inpatient visits and are increasing in prevalence among children and adolescents.<sup>13,15,29</sup> Seventeen total measures (10 unique) were devoted to asthma, which ranks among the top 10 diagnoses seen in inpatient, outpatient, and emergency department settings among children.<sup>13-15</sup> There are measures designed to discourage excessive antibiotic use in common pediatric conditions, such as acute otitis media, otitis externa, upper respiratory infection, and pharyngitis, representing a focus on antimicrobial stewardship in light of increasing concerns for antibiotic resistance and other concerns associated with antibiotic overuse.<sup>30,31</sup> The preponderance of measures addressing health care maintenance is understandable given the frequency of pediatric well-child care, although the relationship between well-child care (apart from vaccinations) and health outcomes remains unclear.<sup>20</sup> The 24 total (8 unique) measures related to immunizations represent a critically important component of pediatric well-child care.

Despite the above, we feel there are likely important gaps in the identified measure sets. For instance, there are comparatively few metrics devoted to otitis media, one of the

most common pediatric diagnoses, ranking third among pediatric emergency visits and fourth in outpatient visits. Improvement in rigor around diagnostic criteria for otitis media has been suggested as an area of focus for additional gains in combatting antibiotic overuse,<sup>32,33</sup> and such efforts could be spurred by measure development. In addition, community-acquired pneumonia and bronchiolitis may be underrepresented given their prevalence and well-documented variation in care, as well as the proven effectiveness of quality improvement initiatives for these conditions.<sup>15,34-36</sup> Attention-deficit/hyperactivity disorder also has comparatively few associated measures; this is an increasingly common and costly pediatric disorder associated with significant morbidity.<sup>37,38</sup> Of the 10 American Academy of Pediatrics' *Choosing Wisely* recommendations, which are intended to discourage low-value care practices, only 1 (avoidance of antibiotics for apparent viral respiratory illnesses) is addressed within the identified measure sets.<sup>39</sup> Important pediatric issues, such as avoidance of inappropriate pharmacologic management of gastroesophageal reflux and avoidance of cough and cold medications in young children, are absent. None of the 5 perinatal *Choosing Wisely* topics are addressed.<sup>40</sup> Measures relating specifically to medically complex children are scarce; this area was prioritized for measure development >10 years ago, and yet remains underrepresented.<sup>3</sup> Medically complex children account for a high proportion of hospital admissions and health care costs, and their care has been shown to be quite variable.<sup>15,41</sup> Focus on this population has the potential to improve quality and substantially reduce costs. There are no measures that specifically address injury, an important pediatric topic that accounts for

significant emergency department visits and is the leading cause of death in children in the United States.<sup>14,42</sup>

Despite the inherent complexity of the task, objective measurement of quality should remain a priority in pediatrics, and we intend for this analysis to contribute to additional improvement and innovation. In a recent commentary, Berwick<sup>7</sup> called for an overall reduction of quality measures in use by 75% over a 6-year time span. The pediatric-relevant measures we have described in this article represent only a fraction of the total measures, but among these, we feel there may still be room for substantial reduction. The systems required to gather and analyze data on such a large number of measures are complex and costly, and the volume of measures in use may diminish any ability to address local concerns. We would suggest first eliminating redundancy by targeting metrics designed to measure similar aspects of care, but using subtly differing methodology. Careful analysis of measures developed for adult populations yet extrapolated to pediatrics without additional study should also be performed. For instance, we identified 3 measures related to hospital readmissions; this is a topic that has not been carefully examined in pediatric populations, and there is conflicting data surrounding the appropriateness of these measures in children's health care.<sup>43-45</sup> Process measures should be assessed for linkage to outcomes, and those that do not clearly contribute to improved outcomes could be eliminated. Finally, measures should

also be evaluated for association with unintended consequences. Many have expressed concerns about measurement "gaming," or manipulating documentation intentionally to improve performance on measures without altering the actual care delivery. For example, might physicians intentionally classify an illness incorrectly to justify antibiotic use? Careful study of practice patterns may be able to elucidate such trends, and measures associated with detrimental changes should be revised or eliminated.

With regard to the development of new measures, we would advocate for a careful avoidance of simple extrapolation of adult metrics. Development of measures related to prevalent and costly areas of pediatric care should be prioritized, as should those with the ability to impact long-term health outcomes. We identified some measures addressing social determinants of health, such as those assessing children who live in communities or attend schools that are perceived as safe. Although these components of pediatric care are inherently difficult to measure, they address key issues that may be overlooked by focusing only on physical health, and their potential role to effect positive changes that may impact future health outcomes should be carefully considered. Measures should be adopted as national quality metrics only when they are well-grounded in pediatric-specific literature, and ideally after they have been tested and validated in multiple settings.

Our study has some limitations. First, we excluded fully condition-specific

measure sets from our analysis, such as those developed by specialty groups for cystic fibrosis or inflammatory bowel disease. Additionally, we included measures for diseases that are rare in pediatric patients if there were no explicit age exclusions within the measure; for example, HIV/AIDS. In this case, what may seem to be an overrepresentation of measures for a pediatric population is reflective of the importance of this condition in adult populations. Categorization of measures will always be at least partially subjective, and there were many metrics that may have fit well into >1 category; to add rigor to this process, the measures were reviewed independently by at least 2 authors and discrepancies were resolved through full author group consensus.

## CONCLUSIONS

Quality measures applicable to children in the United States are mostly process measures and are mostly intended to measure underuse of health care services. Although some areas of pediatric health care are well represented, many common and costly pediatric conditions have few or no available measures, and not all measures are linked to improved health outcomes. A careful analysis of the impact of quality measures, specifically on pediatric health care, is warranted.

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