

# Measuring Pediatric Hospital Readmission Rates to Drive Quality Improvement



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## ABSTRACT

The Pediatric Quality Measures Program is developing readmission measures for pediatric use. We sought to describe the importance of readmissions in children and the challenges of developing readmission quality measures. We consider findings and perspectives from research studies and commentaries in the pediatric and adult literature, characterizing arguments for and against using readmission rates as measures of pediatric quality and discussing available evidence and current knowledge gaps. The major topic of debate regarding readmission rates as pediatric quality measures is the relative influence of hospital quality versus other factors within and outside of health systems on readmission risk. The complex causation of readmissions leads to disagreement, particularly when rates are publicly reported or

tied to payment, about whether readmissions can be prevented and how to achieve fair comparisons of readmission performance. Despite these controversies, the policy focus on readmissions has motivated widespread efforts by hospitals and outpatient providers to evaluate and reengineer care processes. Many adult studies demonstrate a link between successful initiatives to improve quality and reductions in readmissions. More research is needed on methods to enhance adjustment of readmission rates and on how to prevent pediatric readmissions.

**KEYWORDS:** pediatrics; quality measurement; readmissions

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REDUCING READMISSIONS HAS become a focus of efforts to improve health care quality. The Centers for Medicare & Medicaid Services (CMS) has publicly reported readmission rates for Medicare beneficiaries since 2009.<sup>1</sup> In 2012, CMS began decreasing Medicare payments to hospitals with excess readmissions.<sup>2</sup> Many hospitals, payers, and states are benchmarking readmission rates and working to lower them, including for pediatric patients.<sup>3,4</sup>

The use of readmission rates as quality measures has generated controversy, particularly with respect to including readmission rates in public reporting and pay-for-performance programs.<sup>5</sup> A major topic of dispute is the extent to which readmissions are affected by hospital quality as opposed to other factors. Multiple elements within and outside of health systems potentially contribute to patients' health status after discharge and thus their likelihood of readmission (Figure).<sup>6,7</sup>

The Pediatric Quality Measures Program, under CMS and the Agency for Healthcare Research and Quality, is developing hospital readmission measures for pediatric use. To inform this work, we examined research articles and commentaries in the pediatric and adult literature on measuring readmission rates to evaluate quality and drive quality improvement. Our intent was to characterize the major issues surrounding pediatric readmission rates.

Here we note arguments for and against using readmission rates to measure quality. We discuss the multifactorial causation of readmissions and the resulting implications for assigning responsibility for and decreasing readmissions. We describe the evidence available to inform the debate, focusing on studies in children where available, and conclude by identifying areas for further investigation.

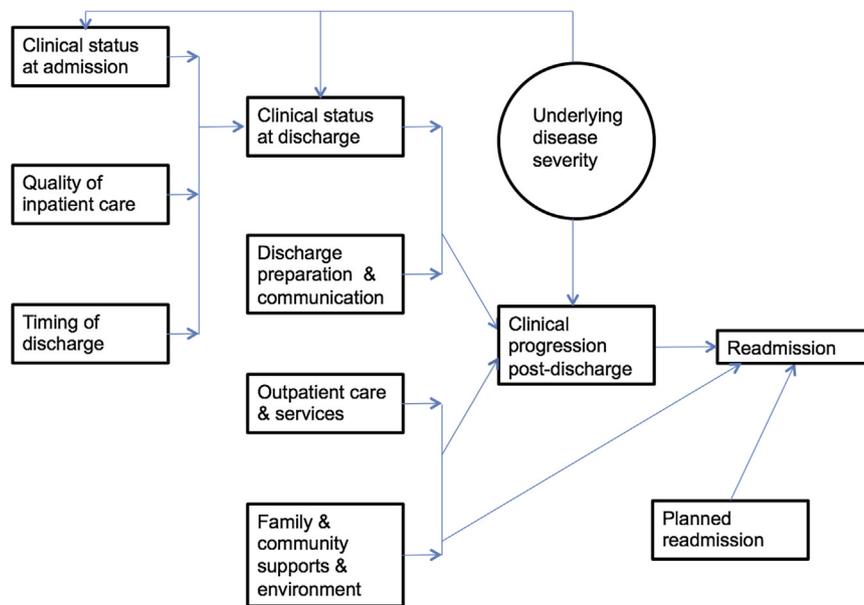


Figure. Proposed conceptual framework.

## IMPORTANCE OF READMISSIONS

### SOCIAL AND CLINICAL BURDENS

For patients who require the intensity of care and resources available in the inpatient setting, hospitalization is beneficial and appropriate. Avoiding hospitalization when possible, however, is generally desirable because it can be disruptive and harmful to patients and their families.<sup>5</sup> It upsets family functioning, interferes with work and school, and is emotionally and physically distressing.<sup>8,9</sup> Recurrent hospitalization may have negative developmental effects, particularly for children who are chronically ill.<sup>10</sup> Furthermore, by exposing patients to additional hospital days, readmissions increase the potential for health care–associated infections and medical errors.<sup>11,12</sup>

### PREVALENCE

Readmissions within 30 days occur for 2% to 6% of hospitalizations in children.<sup>13,14</sup> Just over 20% of children admitted to children's hospitals are readmitted within 1 year.<sup>15</sup> These figures represent substantial numbers given that >2 million children are hospitalized annually.<sup>16</sup> Thirty-day readmission rates for children are lower than the often-cited rate of 20% for Medicare beneficiaries but overlap with those for adults <65 years old, which are 5% and 8% for adults covered by private insurance and Medicaid, respectively.<sup>14,17</sup> Rates of 30-day pediatric readmissions are equal to or greater than rates for other outcomes that are the focus of quality improvement efforts. For example, pediatric readmissions occur at rates equivalent to those for pediatric inpatient adverse drug events, which also affect 2% to 6% of hospitalizations.<sup>18</sup>

Some groups of children disproportionately experience readmissions and might especially benefit from efforts to prevent rehospitalization. Throughout the first year of life, readmission risk generally increases with decreasing gestational age, with the most premature infants having 3

to 4 times increased odds compared with term infants.<sup>19</sup> Certain conditions are associated with a relatively high readmission risk. For instance, a 30-day readmission rate of 17% has been reported for children with sickle cell disease.<sup>20</sup> Children with complex chronic conditions and those assisted by medical technology tend to have frequent readmissions and account for a disproportionately large share of readmissions and bed days.<sup>15,21</sup>

### COSTS

Readmissions lead to significant costs for health systems and for patients and families. In a study that examined readmissions after preventable hospitalizations in 4 states (hospitalizations were classified as preventable if they were for conditions affected by the quality of ambulatory care, such as asthma and gastroenteritis), investigators found that pediatric readmissions within 6 months resulted in a total hospital cost of \$136 million.<sup>22</sup> Readmissions for children with frequent rehospitalizations make up a high proportion of inpatient costs: among patients admitted to 37 children's hospitals in 2003, the 2.9% of subjects who had  $\geq 4$  readmissions accounted for about 19% of the \$14.7 billion in hospital charges for the entire cohort.<sup>15</sup> During a child's hospitalization, families incur time and monetary costs as a result of time spent in the hospital and lost wages, as well as expenses such as travel, meals, and prescription copays.<sup>23,24</sup>

### DISPARITIES

Some but not all studies in children and adults have found evidence suggesting racial and ethnic disparities in readmission risk.<sup>15,25,26</sup> Compared with non-Hispanic white children, non-Hispanic black children receiving care at children's hospitals have a higher risk of readmission after asthma hospitalizations (odds ratio for 365-day readmissions 1.8, 95% confidence interval 1.6–1.9) and of recurrent readmissions after hospitalization for all conditions (odds

ratio 1.65, 95% confidence interval 1.59–1.70).<sup>15,27</sup> Among premature infants, however, readmission risk is not associated with race and ethnicity.<sup>26</sup> Multiple studies in children and adults have revealed an association between readmission risk and insurance status.<sup>14,15,21</sup> An analysis of data for 10 states found a significantly higher 30-day readmission rate for pediatric Medicaid beneficiaries than privately insured children (3.1% vs 2.0%,  $P < .05$ ).<sup>14</sup>

## READMISSIONS AND QUALITY

### PREVENTABILITY

Although some readmissions are unavoidable, studies in adults and children have shown that others are potentially preventable, meaning that they were associated with suboptimal care and might have been avoided with better care during or after the index hospitalization.<sup>6,21,28,29</sup> In adults, the percentage of readmissions that are preventable ranged from 9% to 50% in 1 review, while another review reported a median of 27% with a range of 5% to 79%.<sup>29,30</sup> Far less information is available on the percentage of readmissions that are preventable in children. A review of pediatric 15-day readmissions found that 20% of readmissions overall could likely have been prevented by the discharging hospital.<sup>31</sup>

Multiple factors explain the variability in estimates of preventable readmissions. The proportion of preventable pediatric and adult readmissions differs on the basis of readmission interval, with an association observed between shorter intervals from discharge and higher proportions of preventable readmissions.<sup>6,32</sup> Although there is no follow-up period that has been determined to be best for pediatric readmissions (pediatric studies have examined intervals up to 365 days<sup>15,27</sup>), 30 days is used by CMS for its adult readmission measures,<sup>1</sup> and some other measures have used this interval, as well.<sup>33</sup> It may be that different intervals offer information about different aspects of care, with shorter intervals more often reflecting the quality of acute and transitional care and longer intervals reflecting the quality of chronic care management.<sup>27</sup>

The proportion of preventable readmissions also varies with the index admission diagnosis.<sup>6,28,29,31</sup> In the evaluation of pediatric 15-day readmissions described above, readmissions were more often preventable after surgical than medical hospitalizations (38.9% vs 15.9%) and less often preventable for patients with malignancies versus other chronic illnesses (5.8% vs 25.8%).<sup>31</sup> In addition, variation and subjectivity in definitions of “preventable” make comparisons across studies difficult.<sup>30,31</sup>

### ASSOCIATION WITH QUALITY

Pediatric and adult studies have shown positive correlations between readmission performance and quality.<sup>28,34–36</sup> A meta-analysis of adult studies determined that the risk of readmission within 31 days was 55% greater for patients who experienced inpatient care of lower versus higher quality.<sup>34</sup> Provision of care consistent with clinical practice guidelines has been associated with lower readmission rates in children and adults with various conditions.<sup>35–37</sup>

Readmission rates have also been found to reflect the quality of discharge and transition processes.<sup>28,38,39</sup> Parental perception that a child is not healthy enough for discharge is associated with a greater risk of subsequent, unplanned 30-day readmission.<sup>40</sup>

Some studies have found that readmission is weakly correlated, not correlated, or negatively correlated with other quality indicators. These indicators have included mortality rates; quality of evaluation, treatment, or discharge processes; and hospital characteristics associated with quality, such as teaching status and volume.<sup>41–44</sup> Various explanations have been proposed for these findings, including the hypothesis that readmissions depend more on factors other than quality, such as severity of illness or socioeconomic factors.<sup>43,45</sup>

Alternatively, some of the negative or inconsistent findings may relate to how aspects of quality were measured or other issues with the studies themselves.<sup>44</sup> One systematic review of adult studies found that in most cases, a lack of association between inpatient care processes and readmissions seemed attributable to study design or failure to account for confounding and intervening variables.<sup>6</sup> An important potential source of confounding in evaluating quality and outcome relationships is unmeasured severity.<sup>45</sup> This is particularly an issue in pediatrics given the marked concentration at children’s hospitals of children with severe conditions.<sup>46</sup> The ability to adjust for severity is limited using administrative data, which are currently used for outcome measures because they are widely accessible but which do not offer adequate clinical information to adjust fully for severity.<sup>47</sup>

Another possibility is that quality measures, including readmission rates, may provide insights about distinct aspects of quality rather than acting as global performance indicators.<sup>48</sup> After finding little association between readmission and mortality rates, Krumholz et al<sup>42</sup> suggested that factors affecting mortality risk, such as rapid triage and early intervention in the hospital, may be less important for readmission risk.

### HOSPITAL VERSUS HEALTH SYSTEM ACCOUNTABILITY

Because readmission rates are calculated at the hospital level, public reporting and pay-for-performance programs generally attribute responsibility for readmissions to the discharging hospital.<sup>49</sup> However, readmission rates reflect the quality of entire health systems.<sup>4,49,50</sup> Not only hospitals but also primary and specialty care providers, post-acute care facilities, home health agencies, pharmacies, and public health and social service agencies influence the likelihood of readmission.<sup>6,7,26,49</sup> The multifactorial nature of readmissions calls into question the approach of holding hospitals solely accountable, particularly if rates are reported publicly and tied to payment.

At the same time, there are good reasons to focus on hospitals. The hospital has the ability to shape inpatient care and transitions to posthospital settings. It may also have greater power than other players to affect practices within the wider system.<sup>50</sup> Interventions that involve both the hospital and other organizations are among the most successful in

decreasing readmissions.<sup>38,51–54</sup> By extension, policies that encourage such interventions rather than focusing exclusively on hospitals, including global payments for inpatient and outpatient care, will likely be most effective.<sup>49</sup>

## POTENTIAL FOR IMPROVEMENT

### VARIATION

Studies have revealed variation in pediatric readmission rates. A study of children's and nonchildren's hospitals found significant variation in readmission rates across hospitals for 6 of the 7 common conditions examined.<sup>55</sup> In a study of children's hospitals, hospital readmission rates varied significantly overall and for 8 of the 10 diagnoses with the highest number of readmissions.<sup>13</sup> Likewise, analyses focusing on readmission rates after hospitalization for specific conditions, including appendicitis, asthma, bronchiolitis, and diabetic ketoacidosis, have found significant variation.<sup>27,56–58</sup> Some investigators interpret the variation in pediatric readmission rates as indicating that health systems have the potential to reduce readmissions.<sup>40,56,57</sup>

### INTERVENTIONS

Readmissions have been associated with the quality of disease evaluation and treatment: better clinical care leads to improved health status, which, in turn, can reduce the need for rehospitalization. Pediatric and adult studies have demonstrated that increased use of evidence-based practices results in improved health outcomes and fewer readmissions.<sup>28,35,36,59</sup> Improvements in bronchiolitis and pneumonia treatment, for instance, have been associated with decreased pediatric readmission rates.<sup>36,59</sup>

Many adult studies have demonstrated that interventions to improve the quality of discharge processes, transitions from hospital to posthospital care, and timeliness of follow-up care are also associated with reduced readmissions.<sup>38,51,52,60</sup> Far fewer studies have investigated how discharge and transition processes affect pediatric readmissions. A review of pediatric discharge interventions found that among 4 asthma-focused studies reporting a change in readmission rates, 3 showed a decrease in readmissions, while the fourth showed an increase.<sup>61</sup>

Furthermore, readmissions are part of a spectrum of post-discharge health care utilization that also includes outcomes such as emergency department visits<sup>62</sup> and unplanned outpatient visits. Improvements in care aimed at decreasing readmissions could reduce utilization more broadly.

## FACTORS OTHER THAN QUALITY THAT INFLUENCE READMISSIONS

### CLINICAL PROGRESSION AND PLANNED CARE

Even with exemplary care, some children experience worsening of their health conditions and require rehospitalization. Readmissions in such cases are unavoidable and appropriate.<sup>6,50</sup> In other cases, hospitalizations are planned in advance as part of a patient's intended course of care. In contrast with outcomes such as health care–associated infections, decreasing readmission rates to zero is both

impossible and undesirable. The inability to reduce rates to zero is a feature of other measures, as well, such as mortality rates. The challenge is that we do not yet know what is attainable for these outcomes, and goals will be moving targets as medicine advances and care delivery improves. As endeavors to decrease readmissions intensify, results will help clarify what are optimal readmission rates.

### SOCIOECONOMIC FACTORS

Readmission risk is influenced not just by health systems, but also by patients' and families' social and economic conditions, including community resources such as access to transportation and paid family leave.<sup>7,49,63–66</sup> These factors affect health directly, as well as indirectly through self-management, adherence to recommendations, and access to care, all of which could affect the likelihood of readmission.<sup>67–69</sup> The effects of socioeconomic status (SES) on health are particularly relevant in pediatrics given that nearly 21% of children live in poverty, a rate almost double that for adults.<sup>70</sup> The impact of SES raises at least 2 concerns about using readmissions, as well as many outcomes in general, to evaluate quality. The first is how much health systems can prevent adverse outcomes given that external forces also drive them. The second is whether fair comparisons for purposes such as public reporting and pay for performance require that outcome measures be adjusted for SES.

Regarding the first concern, health systems may not be able to ameliorate fully the effects of low SES, but they can help to mitigate them. Readmission penalties might encourage hospitals to invest in hospital and community psychosocial programs and connect patients with community-based resources.<sup>7</sup> Organizations serving children may be especially equipped to embrace such strategies. As a result of children's vulnerability to harmful effects of their social environment and an emphasis on patient- and family-centeredness, pediatrics has a history of addressing social determinants of health.<sup>71</sup> Furthermore, although socioeconomic factors are important, health systems can decrease readmissions substantially for all patients, regardless of patients' SES, by focusing on their own processes and structures. A transitional care intervention for pediatric and adult Medicaid beneficiaries, for instance, reduced readmission risk by 20%.<sup>53</sup> Interventions to improve transitions from the hospital have reduced adult readmissions in general by 30% to 50%.<sup>50,52</sup>

The answer to the second question, whether fair comparisons require adjustment for SES, relates to the purpose behind case-mix adjustment. Case-mix adjustment accounts for confounding effects of patient characteristics on an outcome of interest, such as readmission, when those patient characteristics affect the outcome, are distributed unevenly across health systems, and are not caused or controlled by health systems.<sup>72</sup> To the extent that SES influences health or health care directly or affects families' ability to care for children in ways beyond the control of health systems, adjustment for SES for the purpose of comparing performance across health systems is desirable. Otherwise, some of the apparent variation in

readmission performance across hospitals would be due to differences in the proportion of patients with low SES served by hospitals, not differences in the quality of care for patients with low SES provided by one hospital versus another.<sup>72</sup>

The concern has been raised that if patients with low SES receive worse care than those with higher SES, then adjusting readmission rates for SES could obscure disparities in quality associated with SES.<sup>5,73</sup> However, in practice, disparities are not revealed by unadjusted hospital readmission rates alone; evaluation for disparities requires further analysis of patient-level or stratified data. Moreover, even if rates are adjusted for SES, differences in quality associated with SES are still evident. If Hospitals A and B had the same proportion of poor patients, Hospital A provided worse care (causing more readmissions) for poor patients than Hospital B, and both hospitals otherwise provided care of equal quality, then the income adjustment would be the same for both hospitals, and Hospital A would have a higher adjusted readmission rate than Hospital B. If the scenario were the same but Hospital A had a higher proportion of poor patients than Hospital B, the overall income adjustment would be larger for Hospital A to account for its having a larger share of poor patients, but the adjustment would not cancel the effect of the worse care provided by Hospital A for any given poor patient. As a result, because poor patients at Hospital A would have a residual higher likelihood of readmission compared with those at Hospital B even after adjusting for income, Hospital A still would have a higher adjusted readmission rate than Hospital B.

Thus, adjustment facilitates performance comparisons by removing from quality scores the effects of patient characteristics that are associated with worse outcomes at all hospitals while leaving the effects of quality that is differentially inferior for a subgroup at a particular hospital. At the same time, it is also crucial to perform stratified analyses to evaluate whether certain patient groups indeed experience higher readmission risk as a whole. As noted above, although health systems do not have complete power to address such global disparities, they nevertheless can contribute to reducing them.

## EFFECTS OF READMISSION POLICIES

### UNINTENDED CONSEQUENCES

Concerns about publicly reporting readmission rates or basing payment on readmission performance include possible unanticipated negative effects. If hospitals prolong stays to avoid readmissions, they could prevent premature discharges in some cases but also unnecessarily delay discharges in others, increasing costs and exposure to harms of hospitalization and perhaps eclipsing the benefits of averted readmissions.<sup>74</sup> Efforts to avoid readmissions could raise thresholds for admitting patients and thus reduce access to necessary inpatient care.<sup>5</sup> Reducing overall admissions could decrease the denominator for readmission rate calculations, leading to erroneous conclusions that readmissions have increased. To monitor for and avoid

such effects, balancing measures such as length of stay, mortality rates, and admission rates can be tracked in concert with readmission rates.<sup>5</sup>

Commentators also note potential financial consequences for hospitals. Under traditional payment methods, fewer readmissions would benefit patients and payers but translate to decreased revenue for hospitals. This financial disincentive may outweigh the incentive of avoiding readmission penalties.<sup>49</sup> Integrated payment approaches that enable hospitals to share savings (or penalties) with other organizations, particularly primary care providers, could offset such negative financial effects for hospitals.<sup>49</sup> Furthermore, given that the cost associated with reducing readmissions will vary depending on the setting, hospitals may differ with respect to how much they prioritize reducing readmissions and how they go about doing so.

Another concern, true for other quality measures, as well, is that hospitals that perform worst on readmissions may include those that have the fewest resources and thus are least equipped to improve quality or cope with penalties.<sup>75</sup> Challenges may be particularly great for safety net hospitals. Socioeconomic conditions for patients at these hospitals may contribute substantially to high readmission rates,<sup>76</sup> yet financial stresses due to Medicaid reimbursement rates that are well below private insurance rates and scarce funding for other public programs limit these hospitals' ability to assist patients.<sup>77</sup> Imposing readmission penalties may be counterproductive, only further decreasing resources to improve care. The approach proposed by the Medicare Payment Advisory Commission (MedPAC) of determining payment on the basis of a hospital's performance relative to peers with similar proportions of low-income patients might help to avoid disproportionately penalizing safety net hospitals.<sup>5,78</sup> Another alternative to promote reductions in readmissions for these hospitals might be policies that support implementation of evidence-based programs to strengthen care. An example of such a policy is CMS's Community-based Care Transitions Program, which was created under the Affordable Care Act to test models for improving care transitions and reducing readmissions in 102 communities across the United States.<sup>79</sup>

### ACTIVATION TOWARD IMPROVEMENT

Readmission policies have inspired a groundswell of effort to better understand modifiable causes of readmission and health system innovations that might address them.<sup>5</sup> The focus on readmissions has motivated hospitals, payers, and state governments to examine care processes and effect changes to decrease readmission risk.<sup>3,4</sup> Although debate is intense about how to best measure and use readmission rates, commentators generally agree that the increased focus on improving hospital and postdischarge care is much needed and beneficial.<sup>5,80</sup> Hospitals and outpatient providers are collaborating in statewide or cross-state initiatives to reduce readmissions for children and adults by improving quality in areas such as patient and family education, discharge communication, and timely follow-up care.<sup>4,53</sup>

## TOPICS FOR FURTHER INVESTIGATION

Although the pediatric readmission literature is growing, much less is known for children than adults about causes of and interventions to prevent readmissions. In addition, many general knowledge gaps remain relating to the issues outlined above.

### PREVENTABILITY AND PREVENTION OF PEDIATRIC READMISSION

To identify targets to prevent pediatric readmissions, further studies are needed on the issues contributing to readmissions in children. As suggested in the proposed framework (Figure), these likely consist of multiple, interacting factors at the level of the patient, family, hospital, and health system, as well as the broader community. In gauging which of these factors might be modifiable, conceptualizing preventability as a spectrum in which readmission risk may be increased or decreased is a more useful and realistic approach than a fixed, binary definition of preventability. This is particularly true given that what is perceived to be preventable evolves over time with innovations in therapeutics and care delivery.

More research is also required on interventions to decrease pediatric readmissions. Questions include whether successful strategies in adults also work in children and whether effective interventions in trials are scalable and sustainable.<sup>49</sup> The success of interventions focused on improvements in care transitions and postdischarge support, including cost-effective measures to reduce barriers to care for uninsured patients and Medicaid beneficiaries, is especially promising.<sup>53,54</sup> It seems likely that such approaches could offer broad benefit to children with a wide range of conditions.

### SOCIOECONOMIC FACTORS

A better understanding of SES-based disparities in quality would guide decisions about whether to include SES when adjusting readmission rates and about which aspects of SES to include. Multiple variables at the patient, family, and community level may influence readmission risk and thus require investigation. Furthermore, work is needed to determine how to measure the most relevant variables accurately and reliably using available data sources. In addition, alternatives for accounting for SES require study, including MedPAC's proposal to report readmission rates without adjustment for SES but calculate penalties by comparing hospitals with similar proportions of low-income patients.<sup>78</sup> Examining how this approach would play out, including for pediatric hospitals, would be useful.

### USE OF ELECTRONIC HEALTH RECORD DATA

As previously noted, current readmission measures rely on administrative data because they are easily accessible, but these data have limitations in completeness and quality.<sup>47</sup> As electronic health records (EHRs) become widespread, EHR data could potentially be used to improve adjustment of outcome measures, including for clinical factors such as severity of index hospitalization diagnoses

and comorbid conditions. A hybrid of claims and EHR data could benefit from the convenience of the first and the richness of the second. Given that some pediatric hospitals already possess relatively sophisticated EHR systems, the feasibility and value of such an approach could be examined for pediatric readmission rates.

### INTEGRATED CARE DELIVERY AND PAYMENT

As detailed above, improved care coordination across hospitals and other organizations has been among the most consistently effective interventions for reducing readmissions. The movement toward integrated systems for care delivery, such as accountable care organizations, could facilitate posthospital transitions and care coordination. Global payment mechanisms could align financial incentives in a way that leads to a decrease in readmissions and enables use of readmission rates as system measures, with shared accountability and shared penalties.<sup>49</sup> The effects of these health system changes on readmission are an important area for investigation.

## CONCLUSIONS

The controversies around pediatric readmission rates stem in part from incomplete or inconsistent information and become particularly salient when rates are publicly reported or linked to payment. Reports of successful programs to reduce adult readmissions provide evidence that at least some readmissions are related to quality; similar studies in pediatrics would be helpful. Further research is also required in children and adults on better methods to account for factors other than quality that influence readmissions. Innovations in US health systems and widespread interest in readmissions provide opportunities to gather valuable data on readmission causation and prevention. Such knowledge, together with the energy generated by current policies, could create tremendous potential to improve care for children.

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## SUPPLEMENTARY DATA

Supplementary data related to this article can be found online at <http://dx.doi.org/10.1016/j.acap.2014.06.012>.

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