

Improving the Quality of Care for Children in Health Systems

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Objective. To summarize the state of the art in quality improvement, review its application to care for children, and define the information that will be needed so that care for children can be further improved.

Principal Findings. Health services for children exhibit numerous deficiencies in quality of care. The deficiencies cross all major domains of pediatric care—preventive services, acute care, and chronic care—and provide the opportunity for creative application of improvement strategies with a potential to benefit the health and well-being of children.

Approaches to quality improvement have changed over the past two decades from those emphasizing the inspection of structural aspects of care and the imposition of sanctions to more dynamic strategies that emphasize measurement and comparison to motivate change; the use of evidence to specify aims for improvement; and the adoption of a variety of management strategies adapted from business and the social sciences to achieve these aims.

These modern approaches to quality improvement have rarely been subjected to rigorous testing of their effectiveness. Moreover, their application in pediatrics has been less widespread than in adult healthcare. For children, several aspects about health services, such as the relative rarity of chronic illness, the important effects of social factors on health, and the limited cost, make some of these approaches even more challenging and may require new approaches or meaningful modifications.

Recommendations. Research to understand better the general process of improvement will benefit improvement efforts for children. Research that builds the base of knowledge about best practices for children—effectiveness research—will also result in an enhanced capacity for improvement of those systems that care for children's health. Quality of care for children would be enhanced by targeted research examining ways both to foster improvement across segments of society, and to make recommendations for care more sensitive to children's development and environmental context. Research that supports incorporating the child's perspective into care is both uniquely challenging to perform and central to improving pediatric care.

Key Words. Children, quality improvement, formal and informal healthcare, health-care systems

Despite the substantial improvement in health status for children in the United States over the past half-century, health services for children exhibit numerous deficiencies in quality of care. The deficiencies cross all major domains of pediatric care—preventive services, acute care, and chronic care—and provide the opportunity for creative application of improvement strategies with a potential to benefit the health and well-being of children. This article seeks to review many current approaches to improving systems of care, to consider their specific application to healthcare for children, and to identify gaps in knowledge about how to improve child health as the foundation for an agenda for research.

THE CONTEXT FOR IMPROVEMENT

Child and Adult Systems of Care

The healthcare system for children shares many defining characteristics with systems of care for adults and the elderly. These characteristics include the dominance of the personal medical care system compared with public health; the central role of employment-based health insurance in defining access to and benefits provided by care; differential patterns of reimbursement for procedures vis-à-vis cognitive and behavioral therapies; and the emergence of managed care systems over the past decade. These commonalities in health systems suggest that lessons learned about strategies to improve systems of care for adults will apply in large measure to efforts to improve children's healthcare.

At the same time, meaningful differences between systems of care for children and for adults do exist. Public health remains a more prominent component of the healthcare system for children than it does for the care of adults; preventive care services constitute a larger proportion of individual healthcare services for children. Serious chronic illness is, in general, less prevalent among children than among older adults; healthcare expenditures

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among children are highly skewed to a small proportion of the total childhood population. Pediatric subspecialists are more concentrated in academic institutions. A greater proportion of children than adults are insured through Medicaid or are without any health insurance. The educational system, rather than the workplace, is the locale for children's function. Other systems, including welfare and justice, exert substantial effects on children's well-being. Children's developmental capabilities are changing more rapidly. These differences between children and adults, and between healthcare for children and adults, necessitate shifts of emphasis, and the need for specific knowledge, in order to maximize the likelihood of success of improvement efforts.

Scope and Stakeholders of Quality of Children's Health Services

The goal of healthcare, for children and everyone else, is to maximize health, not simply to treat disease. For the care of children, maximizing health entails fostering growth and development, to a great extent. As a result, health supervision and promotion are central to children's health services. In addition, child healthcare also focuses on the diagnosis, treatment, and management of acute and, less commonly, chronic conditions.

Quality of care is the extent to which health services are likely to achieve their stated goal, or, as stated by the Institute of Medicine, "the degree to which health services for individuals and populations increase the probability of desired health outcomes and are consistent with current professional knowledge" (Lohr 1990). Health services are processes of care that take place in the context of a structure, that is, inputs and system characteristics, and result in an outcome (or, more precisely, a change in likelihood of an outcome) (Donabedian 1980). In order for health services to achieve their intended goal, they should be necessary and appropriate, of high technical quality, and delivered with dignity and respect (Brook 1991). The mechanism for monitoring and improving the quality of a system is one key administrative characteristic of the system that is the focus of this review.

Different stakeholders in children's healthcare services have different levels of interest in improving quality of care, and different capabilities for influencing system change. The stakeholders include children and their families; clinicians; organizational providers, such as general acute care, specialty (e.g., children's hospitals), and rehabilitation hospitals; managed care and integrated delivery systems; employers and governmental purchasers of care; and government more generally in its role of articulating the public's interests through regulation and attention to special populations. Additional participants include regulatory and accrediting bodies; professional societies

and professional boards; and voluntary and advocacy organizations, as well as those in other related child life systems, such as teachers and schools, welfare workers, and welfare agencies.

Children themselves have limited power of their own to affect system behavior, although this power may increase with the age or developmental capabilities of the child (Guyatt et al. 1997). Parents clearly have an interest in improving the systems responsible for their children's formal care but, without empowerment, training, and support, they may be ineffectual, unaware, or distracted from focusing on improvement (Shelton et al. 1987). Thus, even though they are the stakeholders with the most at stake, children and their families may have the least immediate leverage over system performance. Children and families often assume that an appropriate level of technical quality is in place, and may focus most on access and the interpersonal quality of care (Rosenbaum et al. 1992).

In the current health system, clinicians may not be drivers of change (Annas 1995). The issue of who defines improvement and who controls change is a key subtext in current activities to change health system behavior—as shown in the controversy surrounding reduced newborn length of stay (Kessel et al. 1995). The priorities of the parties, their specific interest in quality, and their ability to influence the performance of systems of care are summarized in Table 1.

Quality of Care for Children: The Need for Improvement

Despite its dramatic improvement over time, the health status of children in the United States could still be improved. Although the causes for this

Table 1: Stakeholders in Pediatric Quality of Care

Stakeholder	Principal Priorities	Components of Quality of Great Interest			Capability to Influence System
		Access	Technical	Interpersonal	Change
Children/Parents	Quality	X		X	+
Clinicians	Quality and efficiency		X		++
Hospital Leaders	Cost		X	X	++
Traditional Insurers	Cost	X			+
Managed Care	Marginal cost		X	X	+++
Employers	Cost and productivity		X		++

problem are complex, health services, both narrowly conceived as medical care and more broadly viewed as encompassing public health, prevention, and advocacy, are effective in improving children's health status (Wise and Meyers 1988; Starfield et al. 1985; Wise 1990). But the existence of poor health outcomes for children of itself is sufficient evidence that the quality of health services must improve. The way that healthcare is practiced for children varies widely across geographic areas (Wennberg et al. 1987; Wennberg and Gittelsohn 1973). Indeed, pediatric care is among the most variable of all health services. The rates of tonsillectomies performed varied tenfold among children in different communities in Maine and New Hampshire. Hospitalization rates for practically all pediatric medical conditions varied more than threefold between Rochester (New York) and Boston (Perrin et al. 1989).

A substantial amount of the care that children receive cannot be easily justified. Studies reported that one-fifth to one-quarter of pediatric hospital days could be justified neither on severity of illness, intensity of service, nor social risk criteria (Kemper 1988; Kreger and Restuccia 1989). Similarly, surgeries for placement of ear tubes failed to meet expert-derived criteria for this procedure almost one-quarter of the time that the procedures were proposed (Kleinman et al. 1994).

Technical processes of care are not where evidence and expert opinion have recommended they should be. The average performance of health plans in the proportion of two-year-old children (continuously enrolled) that they have kept up to date on immunizations is less than 67 percent. Children who are undergoing hospitalizations for known asthma are frequently found not to be receiving the recommended anti-inflammatory medicines (Homer et al. 1996). Children with gastroenteritis continue to receive oral fluids known to be ineffective for, and possibly harmful to, the establishment and maintenance of adequate hydration (Snyder 1991).

Many parents perceive that they are not as involved in decision making as they would choose to be (Wood et al. 1992). Most parents of children with chronic conditions do not feel that they receive sufficient information about their child's condition, prognosis, or treatment, or about available services (Liptak and Revell 1989). Parents perceive that the delivery of care is often fragmented and not coordinated across different levels of providers and across different systems (such as health and education) in which children and families function (Blaine et al. 1995).

Taken together, these themes, (1) that health status for children could improve more and that health services are an effective means for doing so;

(2) that care for children is variable, at times inappropriate, and that at times it is not meeting quality of care criteria; and (3) that parents report opportunities for improvement in coordination and involvement, all indicate the need to improve the quality of the systems providing healthcare for children.

Methods for Improving Quality of Care in Health Systems

Quality improvement is the effort to move a system from its current level of performance to one more likely to result in desired outcomes for patients (Berwick 1989). As noted earlier, approaches to quality improvement have changed from those emphasizing inspection of structural aspects of care and imposition of sanctions to activities that (1) employ measurement and comparison to motivate change, (2) use either scientific evidence or patient-derived information to specify targets for improvement, and (3) adopt a variety of management strategies to achieve results. Although a review of all of these approaches is beyond the scope of this review, we highlight several of them. For each approach, we provide a description and an example (preferably from child health) and comment on any special issues of child health that might require our modifying of the general approach. Finally, we include recommendations for research to enhance the effectiveness of the strategy discussed as a mechanism to improve the quality of care for children.

MOTIVATING SYSTEM CHANGE: MEASUREMENT FOR ACCOUNTABILITY

The principal strategy used to motivate system change has been the development of measures of quality and their use as a means of comparing or accrediting health plans (Congress and Office of Technology Assessment [OTA] 1988). The most prominent of these measurement activities are HEDIS (Health Plan Employer Data and Information Set) measures from the National Commission for Quality Assurance and recommended measurement sets from Facct (Foundation for Accountability). Both measurement systems seek "to establish accountability in the managed care industry" (NCQA 1997). Because concerns about cost have heretofore been the largest driver of change in health systems, and because costs of children's care are low in most cases, using appropriate measures to motivate change can potentially benefit children's care substantially by focusing attention on pediatric quality concerns.

The idea of using quality measurement as the prime motivator for overall health system change raises several concerns for improving quality of care in general and pediatric quality of care in particular. External

measurement may promote defensiveness rather than a desire to change, as occurred with the publication of HCFA's hospital-specific mortality data (Nelson et al. 1995). Use of better measures, and the demand for their use by purchasers, has mitigated this concern. To improve care meaningfully, the measures must reflect important processes and outcomes. Existing measures do not always fully meet this criterion. For example, the HEDIS measures of immunization (up through HEDIS 3.0) lag behind current recommendations for immunization practices. Conversely, a sole reliance on measurement to motivate change assumes that all important aspects of quality are readily measurable; clearly, certain aspects of care are difficult to measure. Measures of quality for small but high-risk populations, such as children with specific chronic conditions, have been challenging to identify; care related to long-term outcomes (such as the general goals of health supervision noted earlier) is similarly difficult to assess. This difficulty in assessment should not diminish the importance of the care.

In order to enhance the contribution that measurement for accountability makes to improving quality of care for children, research should seek first to clarify the conceptual framework for measurement, making sure that measures reflect the issues important to children and families, as well as those important to child health. The combined Facct/NCQA framework is a strong beginning to this effort (Solloway 1997). Building on that conceptual framework, research activities should continue to develop valid measures of processes and outcomes of care for children. Particular attention should be paid to measures of care for children with chronic conditions, and to measures of care with potential long-term benefit. Research should also examine both the effectiveness of these measures in motivating change over time, and whether the responses to such measures are narrowly confined or broadly spread. Research should also identify and evaluate complementary means of capturing the attention of health system leadership.

CHOOSING AIMS FOR IMPROVEMENT: CLINICAL PRACTICE GUIDELINES

In response to concerns about both the variability and costs of care, healthcare organizations, government, and professional societies have worked to specify optimal care through clinical practice guidelines. As defined by the Institute of Medicine (IOM), "practice guidelines are systematically developed statements to assist practitioner and patient decisions about appropriate health

care for specific clinical circumstances” (Field and Lohr 1990). Such guidelines can cover simple clinical decisions, such as whether or not to order an x-ray for a particular type of injury, or can seek to guide the management of an entire clinical entity, such as asthma, over time (National Asthma Education Program [NAEP] 1991; Stiell et al. 1993).

The IOM did not specify that such guidelines need to be rigorously evidence based (Lohr 1995). Nonetheless, the characteristic that most distinguishes current efforts at guideline development from prior policy and consensus statements from professional societies and NIH is their reliance on a rigorous assessment of published evidence, and then combinations of this evidence, through techniques such as meta analysis, that permit more valid inferences from such data. The use of the evidence-based approach strongly characterized the development of guidelines at the Agency for Health Care Policy and Research (AHCPR) as well as the approach used by the American Academy of Pediatrics (AAP) for their practice parameters (Table 2) (Congress, Office of Technology Assessment [OTA] 1994).

The process of evidence-based guideline development—particularly as it has defined the structure of the clinical problem and has identified and reviewed the literature—has been slow and expensive. The cadre of child health professionals with the skill and interest necessary to pursue this activity is finite, particularly given the limited resources made available for this work to date. In addition, achieving a group consensus—even given the evidence—can be time consuming. The development of most practice parameters for the AAP has taken approximately two to three years.

These concerns have led to the creation of Evidence-Based Practice Centers (EPCs) by AHCPR and to the growth of the Cochrane collaborative group as potential mechanisms for a more efficient assembly of evidence. Whether these structures actually will result in more efficient assembly of the information is thus far unproven. The EPCs are already involved in assembling the data for clinical conditions with a prominent pediatric focus: attention deficit/hyperactivity disorder and sinusitis.

The complexity of the formal evidence-based process has led other organizations, such as RAND, to use the more rapid and less expensive “consensus approaches.” The consensus approach used by RAND is formal and results in reproducible recommendations, whereas the one used in many healthcare organizations is typically less reproducible. Whether or not the trade-off in time and development expense is worthwhile—in terms either of the validity of recommendations or of their ability to influence care—is unknown. At the same time, a rigid insistence on formal evidence may inhibit

Table 2: Recent and Forthcoming Guidelines for Pediatrics

<i>Guideline</i>	<i>Date</i>
<i>American Academy of Pediatrics</i>	
The office management of acute exacerbations of asthma in children	January 1994
Management of hyperbilirubinemia in the healthy term newborn	October 1994
Managing otitis media with effusion in young children	November 1994
Management of acute gastroenteritis in young children	March 1996
Neurodiagnostic imaging of a child with a first simple febrile seizure	May 1996
Minor head trauma	Under development
Urinary tract infection	Under development
Serious head trauma	Under development
Wheezing in young children	Under development
Diabetes mellitus	Under development
Treatment of febrile seizures	Under development
Developmental dysplasia of the hip	Under development
Attention deficit hyperactivity disorder	Under development
<i>Agency for Health Care Policy and Research</i>	
Acute pain management	1992
Sickle cell disease	1993
Evaluation and management of early HIV infection	1994
Managing otitis media with effusion in young children (same as AAP)	1994
<i>National Institutes of Health—National Heart, Lung, and Blood Institute</i>	
National Asthma Education and Prevention Program: Guidelines for the diagnosis and management of asthma	1991, 1997

the ability to develop recommendations that reduce unnecessary variation in pediatrics, given that the pediatric evidence base is more constrained.

Further research should identify the relative effects of different types of guidelines on actual practice. As noted later on, of even greater priority is research concerning mechanisms to implement guidelines and to capture data about processes and outcomes for improving the recommendations over time (Evans et al. 1998). Research should also examine more efficient means to assemble the evidence and to assess the validity of the less formal approaches.

Identifying Patient and Family Concerns. A central tenet of quality improvement is the necessity that systems focus on meeting the needs of their customers. Literature extending back at least 30 years demonstrates the

importance that patients in general, and parents in particular, place on the quality of communication with their clinician—particularly the clinician’s responsiveness to parental concerns and his or her ability to convey clear and complete information to the parent (Francis et al. 1969; Kanthor et al. 1974). Over the past ten years, numerous initiatives by parent/patient and provider groups have sought to focus organizational attention on meeting these particular needs. An early approach to emphasize this focus was a statement of the principles of family-centered care, and the effort to encourage organizations to adopt this statement (Health 1991). Subsequently, several investigators created measures to assess the degree to which this care was met (Rosenbaum et al. 1992) (Liptak and Revell 1989). Later, others developed more extensive measures to assess hospital performance and to use the results of those data in shaping hospital practice through monitoring, feedback, and ongoing quality improvement (Alpert, Alpert, and Homer 1997; Homer et al. 1996).

Measures have recently been developed to identify the experience of “consumers” in medical groups and healthcare plans. Such surveys assess both clinical care and broader system function. The most prominent of these activities is the Consumer Assessment of Health Plan Study (CAHPS), funded through AHCPR, as an initiative with a significant child health component. Approaches such as CAHPS will provide a standardized approach to assessing at least the parental perspective on care. Additional efforts are needed to find means of articulating the patient perspective directly, at least for adolescents and, ideally, for pre-adolescents as well. More fine-grained mechanisms are also needed to identify qualitative aspects of patient experience, including “latent need,” that is, aspects of care that would be desirable but are not recognized as such by patients and families. Mechanisms that provide more rapid and more local feedback—that do not require such large sample sizes—would be helpful for many care settings.

Even were these measurement issues addressed, such approaches are examples of improvement initiatives that specify aims and measures, but not mechanisms to *make change occur*. Children’s hospitals are increasingly engaging in such initiatives, such as the creation of parent faculty at Children’s Hospital of Philadelphia, to undertake training of clinical and administrative staff, or to provide in-hospital consultation to other parents during their children’s hospital stays. Others have undertaken to train clinicians in ambulatory settings to communicate better with parents, understand parental and child concerns, and engage families in partnerships around the management of children with chronic conditions (Clark et al. 1998). Such “on the ground” initiatives

are needed as follow-up to the broader-based and larger-scale identification of parent and family concerns provided by consumer assessment measures.

Strategies for Implementing Change

Implementation of Practice Guidelines. Clinical decision making and action reflect influences from a number of sources. Individual clinicians have their own knowledge, attitudes, and skills for a particular clinical practice. These derive in some measure from the quality of the evidence, but also from the perceived credibility of the evidence, the level of awareness about it, and the attitudes of the clinician toward change, among other influences. The clinician's likelihood of performing a particular practice may be influenced further by both macro-environmental characteristics, such as the turnover in patient populations due to employer shifts in benefit plans, and the micro-environment in which the clinician works (e.g., the pace of encounters), as well as by feedback from patients and families (Congress, OTA 1994; Eisenberg 1986; Soumerai and Avorn 1990; Salem-Schatz et al. 1990). Sustaining a change in behavior additionally requires opportunities for the behavior to be practiced and reinforced (Elson and Connelly 1995). Understanding the conceptual framework for influences in care allows the appropriate choice of interventions to effect change.

Strong evidence supports the effectiveness of change initiatives that identify barriers to change and address them in a systemic manner (Grimshaw and Russell 1993; Johnston et al. 1994). The evidence is clear that while simple guideline dissemination and passive educational initiatives do not result in meaningful changes in care, more systematic approaches can make a difference. These strategies have been applied in both primary and tertiary care and have focused both on improvement of preventive services and on better care for children with complex health needs (Solberg et al. 1996; Evans et al. 1997; Cooley 1994; Carlin et al. 1996). Strategies have included the use of written or computer-based reminders; enhancing the role of parents and patients as triggers for change; the use of focused, change-oriented education ("academic detailing"); the mobilization of "opinion leaders"; and the redesign of the office encounter. Some of these issues, such as the use of financial incentives and the mobilization of parents and patients, are discussed elsewhere in this report.

The structural and epidemiological aspects of pediatric care do place some challenges on the effective implementation of these change strategies. Because most primary care pediatrics is delivered in small practice settings, research needs to examine how best to influence and improve care in this

environment. One example of particular need in this area is in the application of computer-based decision support to improve office-based pediatric care. Several demonstration projects have demonstrated the capacity of elegant computer-based decision support services at specialized tertiary care centers to improve care; much more research needs to examine how to implement such approaches most effectively and efficiently on a larger scale in everyday "real-life" practice settings (Evans et al. 1998). The rarity of many pediatric conditions may make the implementation of practice change difficult, in that encounters for these rare events may be too infrequent to allow testing and improvement. Further research should also identify the most efficient means to identify processes in need of redesign and to select the most effective approach for a particular problem (applying to both adult and pediatric care).

Rapid Cycle Change: The Breakthrough Series. Quality improvement theory provides a broad-based framework to support change and improvement across a variety of content areas. Although numerous formulations of quality improvement have been articulated, the model put forward by Langley, Nolan, and Nolan is one that is widely employed in healthcare (Langley et al. 1996). In this model, the group or organization wishing to improve is first challenged to ask three focused questions: (1) What are we trying to accomplish (the aim)?; (2) How will we know that a change is an improvement (the measure)?; and (3) What change can we make that will result in an improvement (the change concept)? From those three questions, the model then specifies the need to undertake "tests of change." In these tests, those organizations seeking improvement should plan tests of change, carry out the tests, study the results of the test, and then act on the results (P-D-S-A). Multiple tests of change should then be linked in order to effect more substantial organizational change.

Among the best-known applications of this approach to improving clinical care is the Breakthrough Series. Organized by the Institute for Healthcare Improvement, this initiative recruits organizations (typically hospitals and managed care organizations) to participate in a collaborative "improvement" activity. This activity consists of endorsing specific improvement aims; training in process improvement and in "change concepts," or general suggestions for improvement, in the substantive area (e.g., asthma care, lower back pain, waiting time, adverse drug events); initiating, supporting, and reporting on cycles of testing and improvement; and sharing the results of the initiatives at the conclusion of the collaborative process. Organizations implementing change cycles earlier and more often are more likely to achieve the aims of

the initiative than are organizations that are slower and less prolific in trying out new approaches; approximately half appear to make meaningful changes in care (T. Nolan, personal communication).

Most of the Breakthrough Series activities apply equally well to care for children and care for adults. Children's hospitals participate in these programs, and several initiatives in general care organizations have focused on improving care for children. Further research is needed on the narrower issues within this broad model: questions such as how to generate and identify successful change concepts with a high likelihood of success; how to motivate rapid change; and how to move from small-scale to larger-scale change. In addition, broader assessment of the effectiveness, and the cost-effectiveness, of this approach is required. Ideally, research should identify whether participation in such initiatives leads to greater improvement than would have occurred otherwise. Indeed, several trials of "quality improvement" approaches are now under way (although not specifically focused on the rapid-cycle testing component), with preliminary results showing little meaningful change (Horowitz et al. 1996; Solberg et al. 1996). Such tests are challenging because the nature of a quality improvement intervention is that of a process of improvement rather than a set approach to a clinical issue; this poses challenges to the general requirement that randomized trials "fix" the intervention being assessed. Moreover, approaches to quality improvement are evolving over time. Despite these difficulties, more such rigorous trials should be performed.

EXTENDING OUTSIDE THE PERSONAL CARE PARADIGM: DISEASE MANAGEMENT AND POPULATION-BASED CARE

Population-based care uses an epidemiological assessment of population needs as the trigger for priority setting and selection of interventions. This approach has recently been applied, under the term disease management, to the care of persons with specific conditions (Harris 1996; Kleinman 1995; Nutting 1990; Payne et al. 1995; Todd and Nash 1997). In this model, all individuals in a defined population (either a practice or, more easily, a managed care organization) who have a condition are identified. After they are identified, a comprehensive array of services are applied to maximize desired

outcomes. The services included in the package of disease management tools may include not only traditional medical care, but also pharmaceuticals and devices, education (of clinician and patient), home services, case management, transportation, and the like. This model posits approaching a population with a condition, and viewing medical care as one manageable component of overall care.

Many of the initial approaches to disease management have focused on the care of children with asthma (Kozma et al. 1997; Homer 1997). In this model, children with asthma are identified through diagnosis codes or the prescription of specified medicines. Patients who achieve a certain threshold of severity are then offered a package of services, such as a home visit for environmental assessment. Physicians might be provided with lists of their asthma patients as well as with information about the patients' healthcare and medication use. The choice of pharmaceuticals might be restricted, and automatic triggers might be instituted within the system for patients who make excessive refills of beta-agonist medications. Especially high-risk patients might be referred to a case manager or to a specialist program. Overall outcomes—such as healthcare use, symptom burden, or functional effect—can be monitored on an ongoing basis to assess the impact of particular program components. Promising results have been reported for improving several preventive care and chronic illness management processes, although good data have been limited (Payne et al. 1995).

Further research should examine whether this strategy will indeed improve outcomes and reduce cost. Whether such an approach will be well received by clinicians, or viewed as a threat to autonomy and decision making, should be explored. Whether this approach can be successfully applied in practice environments in which only a small proportion of a clinician's patients are in the particular managed care plan also needs further exploration (Homer 1997).

CONCLUSIONS

Substantial opportunities exist for improving the quality of pediatric care. At the same time, widespread quality improvement initiatives are under way. Research that furthers the knowledge and capacity to improve care in general should be broadly applicable to improving systems of care for children. At the same time, specific issues need emphasis if this research is to maximally benefit systems care for children:

1. Widespread measurement initiatives seek to motivate healthcare leadership to initiate and sustain change through public accountability. Research should examine whether in fact this mechanism is effective, how organizations respond to these pressures, and whether alternative mechanisms exist for gaining attention. *Additional measures need to be developed for children's care, particularly focused on the care of children with special healthcare and mental health needs. Other strategies to maintain interest in children's health need to be explored.*
2. Measurement of patients' experience of care and of population health and risk status can maintain an organizational focus on patient and populations' needs. Patient- and family-centered care initiatives may make such organizations more responsive to these identified needs. Research should continue to enhance the development of efficient and valid measures, building on the CAHPS model. *Research should also focus on measuring adolescent and child preferences and experience, and should emphasize the identification and testing of approaches to change individual and organizational behavior making them more responsive to identified needs.*
3. Clinical practice guidelines have been the most widely used strategy to articulate general aims for improvement. Research should continue to develop more efficient means for developing guidelines. *Building the base of clinical research for children's health should be a priority.* Strategies for the use of consensus and acknowledgment of the difficulties in assessing the long-term impact of children's care should temper a rigid insistence on evidence-based care.
4. Research should address efficient ways of identifying critical barriers to good care and should match interventions to the need to facilitate the implementation of guidelines; how to use information systems more efficiently is a major component of this agenda. *Research that would be particularly valuable for children's healthcare would include how to redesign systems at the level of care at which most child health services are delivered (smaller practice settings) and how to make improvements in system design when systems cross sectors of society (such as health and education).*
5. Rapid and repeated testing of interventions is a core component of continuous quality improvement. Research should address ways to measure the impact of such interventions efficiently and in a valid manner; ways to choose interventions likely to succeed; and ways to spread interventions that are found to be effective on a small scale.

General testing of the improvement model would also be valuable, although it would be difficult to perform.

Quality improvement research, with a focus on systems for children, should be a high priority as one important way to improve the health and well-being of children.

REFERENCES

- Alpert, H. R., S. B. Alpert, and C. J. Homer. 1997. "Salient Factors in Parents' Experiences of Ambulatory Care." *Ambulatory Child Health*. In press.
- Annas, G. 1995. "Women and Children First." *The New England Journal of Medicine* 336 (23): 1647-51.
- Association for the Care of Children's Health. 1991. *A Pediatric Bill of Rights*. Bethesda, MD: ACCH.
- Berwick, D. 1989. "Continuous Improvement as an Ideal in Health Care." *The New England Journal of Medicine* 319 (1): 53-56.
- Blaine, S., P. Rosenbaum, and S. King. 1995. "Chronic Childhood Illnesses: What Aspects of Caregiving Do Parents Value?" *Child: Care, Health, and Development*: 291-304.
- Brook, R. H. 1991. "Quality of Care: Do We Care?" *Annals of Internal Medicine*: 486-90.
- Carlin, E., R. Carlson, and J. Nordin. 1996. "Using Continuous Improvement Tools to Improve Pediatric Immunization Rates." *Journal on Quality Improvement*: 277-88.
- Clark, N., M. Gong, A. Schork, D. Evans, D. Roloff, M. Hurwitz, L. Maiman, and R. Mellins. 1998. "Impact of Education for Physicians on Patient Outcomes." *Pediatrics*: 831-36.
- Congress, U.S., Office of Technology Assessment. 1988. *The Quality of Medical Care: Information for Consumers*. Washington, DC: Government Printing Office.
- . 1994. *Identifying Health Technologies That Work: Searching for Evidence*. Washington, DC: Government Printing Office.
- Cooley, W. C. 1994. "Changing Care in Private Practice: Management of Chronic Conditions in the Primary Care Setting." *Chronic Illness and the Pediatrician*.
- Donabedian, A. 1980. *The Definition of Quality and Approaches to Its Assessment*. Chicago: Health Administration Press.
- Eisenberg, J. M. 1986. *Doctors' Decisions and the Cost of Medical Care: The Reasons for Doctors' Practice Patterns and Ways to Change Them*. Chicago: Health Administration Press.
- Elson, R. B., and D. P. Connelly. 1995. "Computerized Patient Records in Primary Care: Their Role in Mediating Guideline-Driven Physician Behavior Change." *Archives of Family Medicine* 4 (8): 698-705.
- Evans, D., R. Mellins, K. Lobach, C. Ramos-Bonoan, M. Pinkett-Heller, S. Wisemann, I. Klein, C. Donahue, D. Burke, M. Levison, B. Leven, B. Zimmerman, and N. Clark. 1997. "Improving Care for Minority Children with Asthma: Professional Education in Public Health Clinics." *Pediatrics* 99 (2): 157-64.

- Evans, R., S. Pestotnik, D. Classen, T. Clemmer, L. Weaver, J. Orme, Jr., J. Lloyd, and J. Burke. 1998. "A Computer-Assisted Management Program for Antibiotics and Other Antiinfective Agents (Comments)." *The New England Journal of Medicine* 338 (4): 232-38.
- Field, M. J., and K. N. Lohr. 1990. *Clinical Practice Guidelines: Directions for a New Program*, 1st ed. Washington, DC: National Academy Press.
- Francis, V., B. Korsch, and M. Morris. 1969. "Gaps in Doctor-Patient Communication." *The New England Journal of Medicine* 280 (10): 535-40.
- Grimshaw, J. M., and I. T. Russell. 1993. "Effect of Clinical Guidelines on Medical Practice: A Systematic Review of Rigorous Evaluations (Comments)." *Lancet*: 1317-22.
- Guyatt, G., E. Juniper, L. Griffith, D. Feeney, and P. Ferrie. 1997. "Children and Adult Perceptions of Childhood Asthma." *Pediatrics* 8883 (342): 165-68.
- Harris, J., Jr. 1996. "Disease Management: New Wine in New Bottles?" *Annals of Internal Medicine* 124 (9): 838-42.
- Homer, C. 1997. "Asthma Disease Management." *The New England Journal of Medicine* 337 (20): 1461-63.
- Homer, C., B. Marino, P. Cleary, R. Brustowicz, B. Smith, C. Ganser, and D. Goldmann. 1996. "Predicting Satisfaction with Inpatient Care in a Children's Hospital." *Archives of Pediatric and Adolescent Medicine* 150.
- Homer, C., P. Szilagyi, L. Rodewald, S. Yazdgerdi, J. M. Leventhal, D. Finkelstein, and J. M. Perrin. 1996. "Does Quality of Care Affect Rates of Hospitalization for Childhood Asthma?" *Pediatrics* 98 (1): 18-23.
- Horowitz, C., H. Goldberg, D. Martin, E. Wagner, S. Fihn, D. Christensen, and A. Cheadle. 1996. "Conducting a Randomized, Controlled Trial of CQI and Academic Detailing to Implement Clinical Guidelines." *The Joint Commission Journal on Quality Improvement* 22 (11): 734-50.
- Johnston, M., K. Langton, R. Haynes, and A. Mathieu. 1994. "Effects of Computer-Based Clinical Decision Support Systems on Clinician Performance and Patient Outcome: A Critical Appraisal of Research." *Archives of Internal Medicine* 120 (2): 135-42.
- Kanthor, H., I. Pless, B. Satterwhite, and G. Myers. 1974. "Areas of Responsibility in the Health Care of Multiply Handicapped Children." *Pediatrics* 54 (6): 779-85.
- Kemper, K. 1988. "Medically Inappropriate Hospital Use in a Pediatric Population." *The New England Journal of Medicine* 318 (6): 1033-37.
- Kessel, W., M. Kiely, A. Nora, and S. Cu. 1995. "Early Discharge: In the End, It Is Judgment." *Pediatrics* 96 (4): 739-42.
- Kleinman, L. 1995. "A Vision for Disease Management." *Surgical Services Management* December: 9.
- Kleinman, L., J. Kosecoff, R. Dubois, and R. H. Brook. 1994. "The Medical Appropriateness of Tympanostomy Tubes in Children Under 16 Years in the United States." *Journal of the American Medical Association* 271 (16): 1250-55.
- Kozma, C., K. Kaa, and C. Reeder. 1997. "A Model for Comprehensive Disease State Management." *Journal of Outcomes Management* 4 (1): 4-8.

- Kreger, B., and J. Restuccia. 1989. "Assessing the Need to Hospitalize Children: Pediatric Appropriateness Evaluation Protocol." *Pediatrics* 84 (2): 242-47.
- Langley, G., K. Nolan, T. Nolan, C. Nomrlan, and L. Provost. 1996. *The Improvement Guide: A Practical Approach to Enhancing Organizational Performance*, p. 370. San Francisco: Jossey-Bass.
- Liptak, G. S., and G. M. Revell. 1989. "Community Physician's Role in Case Management of Children with Chronic Disease." *Pediatrics* 84 (3): 465-71.
- Lohr, K. 1990. *Medicare: A Strategy for Quality Assurance*. Washington, DC: National Academy Press.
- . 1995. "Guidelines for Clinical Practice: What They Are and Why They Count." *Journal of Law, Medicine, & Ethics* 23 (1): 49-56.
- National Asthma Education Program (NEAP). 1991. *Guidelines for the Diagnosis and Management of Asthma*. Office of Prevention and Control, National Heart, Lung, and Blood Institute, Pub. No. 91-3042. Bethesda, MD: National Institutes of Health.
- National Center for Quality Assurance. 1997. HEDIS 3.0. Washington, DC: NCQA.
- Nelson, E., P. Batalden, S. Plume, N. Mihevic, and W. Swartz. 1995. "Report Cards or Instrument Panels: Who Needs What?" *Journal on Quality Improvement* ?? (??): 155-65.
- Nutting, P. 1990. "Community-Oriented Primary Care: Researchable Questions for Family Practice." *Journal of Family Practice*: 633-35.
- Payne, T. H., M. Galvin, S. H. Taplin, B. Austin, J. Savarino, and E. H. Wagner. 1995. "Practicing Population-Based Care in an HMO: Evaluation After 18 Months." *HMO Practice* 9 (3): 101-106.
- Perrin, J., C. Homer, D. Berwick, A. Woolf, J. Freeman, and J. Wennberg. 1989. "Regional Variation in Rates of Hospitalization of Children." *The New England Journal of Medicine* 320 (18): 1183-87.
- Rosenbaum, P. L., S. M. King, and D. T. Cadman. 1992. "Measuring Processes of Caregiving to Physically Disabled Children and Their Families: Identifying Relevant Components of Care." *Developmental Medicine and Child Neurology* 34 (2): 103-14.
- Salem-Schatz, S., J. Avorn, and S. Soumerai. 1990. "Influence of Clinical Knowledge, Organizational Context, and Practice Style on Transfusion Decision Making." *Journal of the American Medical Association* 264 (4): 476-83.
- Shelton, T., E. Jeppson, and B. Johnson. 1987. *Family Centered Care for Children with Special Health Care Needs*, 1st ed. Washington, DC: Association for the Care of Children's Health.
- Snyder, J. 1991. "Use and Misuse of Oral Therapy for Diarrhea: Comparisons of U.S. Practices with American Academy of Pediatrics' Recommendations." *Pediatrics* 87 (1): 28-33.
- Solberg, L., T. Kottke, M. Brekke, C. Calomenio, S. Conn, and G. Davidson. 1996. "Using Continuous Quality Improvement to Increase Preventive Services in Clinical Practice: Going Beyond Guidelines." *Preventive Medicine* 25 (3): 259-67.
- Solloway, M. 1997. *Developing a Framework for Pediatric Measures of Accountability*. Portland, OR: Foundation for Accountability.

- Soumerai, S. B., and J. Avorn. 1990. "Principles of Educational Outreach ('Academic Detailing') to Improve Clinical Decision Making." *Journal of the American Medical Association* 263 (4): 549-56.
- Starfield, B., M. Farfel, N. Hutton, J. Alain, and L. Wissow. 1985. *The Effectiveness of Medical Care, Volume I*, The Johns Hopkins Series in Contemporary Medicine and Public Health, p. 168. Baltimore, MD: The Johns Hopkins University Press.
- Stiell, I., G. Greenberg, R. McKnight, and Others. 1993. "Decision Rules for the Use of Radiography in Acute Ankle Injuries: Refinement and Prospective Validation." *Journal of the American Medical Association* 269 (9): 1127-1132.
- Todd, W., and D. Nash. 1997. *Disease Management: A Systems Approach to Improving Patient Outcomes*. Chicago: American Hospital Association.
- Wennberg, J., J. Freeman, and W. Culp. 1987. "Are Hospital Services Rationed in New Haven or Over-Utilised in Boston?" *Lancet* 854 (1): 1185-88.
- Wennberg, J., and A. Gittelsohn. 1973. "Small Area Variations in Health Care Delivery." *Science* 182 (117): 1102-108.
- Wise, P. H. 1990. "Poverty, Technology, and Recent Trends in the United States Infant Mortality Rate." *Paediatric and Perinatal Epidemiology* 4 (4): 390-401.
- Wise, P. H., and A. Meyers. 1988. "Poverty and Child Health." *Pediatric Clinics of North America* 35 (6): 1169-86.
- Wood, D. L., C. Corey, H. E. Freeman, and M. F. Shapiro. 1992. (Comment) "Are Poor Families Satisfied with the Medical Care Their Children Receive?" *Pediatrics* 90: 66-70.