Optimizing Linear Growth Measurement in Children

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ABSTRACT

A child's pattern of linear growth is one of the most sensitive indicators of health and well-being. However, many health care personnel use casual techniques and faulty instruments to measure children's growth and keep imprecise growth charts, making interpretation of growth patterns problematic. This situation can delay diagnosis and treatment of children with growth disorders and other conditions that affect growth. It can also lead to undue anxiety and unnecessary evaluation of children who are actually growing well. A clinical practice guideline was developed to optimize the accuracy and reliability of linear growth measurement. This article presents strategies to implement the guideline and thereby increase awareness of the importance of standardized growth measurement techniques and instruments, facilitate staff training and competency, and encourage standardized record keeping. These strategies will give providers more confidence in their interpretation of children's growth patterns and allow them to recognize potential problems, possibly before other symptoms appear. J Pediatr Health Care. (2014) *28*, 413-419.

KEY WORDS

Children, linear growth, measurement, implementation, clinical practice guideline

Monitoring growth patterns is an essential component of children's health care because abnormal growth warns of possible underlying pathologic conditions, including genetic, endocrine, and metabolic disorders, chronic diseases (e.g., gastrointestinal, renal, cardiac, and pulmonary diseases), and malnutrition, as well as psychosocial deprivation. Growth is so sensitive an indicator of a child's health that accurate growth monitoring can often detect childhood diseases before any other signs and symptoms appear (Craig, Fayter, Stirk, & Crott, 2011; Grote et al., 2008). Moreover, it is a rapid, cost-effective, and noninvasive way to assess a child's general health and nutritional status (Cernerud & Edding, 1994; Fayter et al., 2008; Zemel, Riley, & Stallings, 1997).

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PRACTICE RECOMMENDATIONS

The American Academy of Pediatrics recommends that any program of preventive pediatric health care include periodic age-appropriate measurement of length, height, weight, head circumference, weight for length, and body mass index during infancy, childhood, and adolescence (Hagan, Shaw, & Duncan, 2008). Unfortunately, the measurement and recording of growth in children is often inaccurate and unreliable, primarily because health care personnel are unaware of the inaccuracy of their measurements. Several problems might plague a measurement program: faulty instruments, casual measurement techniques, the posture and movement of children, diurnal variation in height, and measuring only once without confirming the measurement (Foote et al., 2011).

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BOX. Access to guideline and resources

Blank Children's Hospital Web site:
http://www.blankchildrens.org/linear-growth-measurement.aspx
- Full-text clinical practice guideline
- Posters with graphics and step-by-step instructions
- Sources for measurement instruments
- Instrument calibration log
- Linear growth measurement audit tool
- List of common measurement errors
- Glossary of terms

If growth assessment is inaccurate, then opportunities to identify children's growth disorders and underlying diseases might be missed. A perhaps less serious but nonetheless unnecessary problem is that measurement errors can suggest growth deviation in children who are growing normally. To optimize how providers track a child's linear growth, a children's hospital interprofessional team developed a guideline entitled *Evidence-Based Clinical Practice Guideline on Linear Growth Measurement of Children,* which has been endorsed by the Pediatric Endocrinology Nursing Society (Foote et al., 2009). The guideline was developed to assist clinicians in applying evidence-based knowledge to measure children's growth with use of standardized instruments and techniques. The guideline was limited to linear growth measurement because more errors are associated with the measurement of length and height than with the measurement of weight (Ulijaszek & Kerr, 1999) and head circumference (German, Mason, & Rossman, 1976). A description of the development and pilot testing of this guideline has been previously published (Foote et al., 2011), and the full-text clinical practice guideline is available through the Blank Children's Hospital (Box), the National Guideline Clearinghouse, and the Pediatric Endocrinology Nursing Society Web sites.

To be of value in clinical practice and research, linear growth measurements need to be both accurate and reliable (with accuracy defined as the closeness of the measured value to the true or actual value, and reliability defined as the reproducibility of repeated measurements). Although accurately and reliably measuring linear growth might at first seem a trivial and straightforward procedure, research indicates otherwise. In a landmark study of 55 pediatric and family practice clinics within eight geographical areas of the United States, Lipman and colleagues (2004) found that more than 40% of children standing and more than 80% of children in the recumbent position were measured with faulty instruments. Moreover, an astounding 70% of the children were measured with use of incorrect techniques. These shortcomings were addressed by an educational intervention, which improved the percentage of accurate measurements (within a 0.5 cm limit of agreement) from 30% to 70%. Still, a 70% success rate would leave an unacceptable number of children at risk.

A pilot study of the clinical practice guideline yielded even better results (Foote et al., 2011). Seventy-three children were measured (according to the guideline) three times each to determine the reliability of measurements. Intraexaminer and interexaminer reliability were 0.99 ($p < .0001$), more than 91% of repeated intraexaminer and interexaminer measurements were within a 0.3 cm limit of agreement, and more than 94% were within 0.5 cm.

IMPLEMENTATION STRATEGIES

Faulty practice cannot be expected to change simply because a guideline has been published. Strategies must be devised to enable practitioners to integrate the guideline into routine clinical practice. Cullen and Adams (2012) identified strategies for moving evidence-based practice through "four phases of implementation: creating awareness and interest, building knowledge and commitment, promoting action and adoption, and pursuing integration and sustainability to promote application by nursing and team leaders" (p. 223). According to the authors, strategies should target clinicians, organizational leaders, and key stakeholders. Accordingly, nurse practitioners are ideal role models for promoting evidence-based practice and are well positioned to implement real-world changes in the measurement and tracking of linear growth in children.

Education

Awareness that growth measurement is a powerful tool should be a key facet of implementation of the guideline. Continuing education programs, journal clubs, in-service sessions, and staff meetings are excellent formats for distributing evidence to staff who measure children and providers who interpret and make clinical decisions about growth patterns. During training sessions, team leaders should cover (a) the scientific rationale supporting best practices rather than traditional practices, (b) measurement instruments and techniques, (c) the consequences of growth measurement error, and (d) the benefits of growth surveillance. In addition, policies and procedures should be standardized so that staff can follow and track adherence to best practices.

Training sessions can benefit from real-life examples, which immediately demonstrate to staff the benefits of following the new guideline. The following two clinical scenarios, based on common cases, reveal how inaccurate measurement can cause both misdiagnosis and delayed recognition of a treatable, pathologic condition.

- A 16-year-old female adolescent was referred to endocrinology for primary amenorrhea. Clinical