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NSW GOVERNMENT Family & Community Services Ageing, Disability & Home Care

Considerations for Using Anthropometrics to Determine Modifications for Children

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1st ed. May 2005

ISBN: 1 86487 563 1

www.homemods.info

Publication History

1st edition Considerations for Using Anthropometrics to Determine Modifications for Children by Catherine Bridge, May 2005.

Reprinted June 2014.

Contribution of Authors

This is the first edition of the Occasional Paper: Considerations for Using Anthropometrics to Determine Modifications for Children, replacing the original publication of the same name, authored by Catherine Bridge (2005) for the Home Modification Information Clearinghouse, City Futures Research Centre, UNSW Australia.

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Acknowledgements

This material has been published by the Home Modification Information Clearinghouse within the City Futures Research Centre, Faculty of the Built Environment, UNSW Australia (University of New South Wales).

This material was produced with funding from the Australian Department of Social Services (DSS), and Ageing, Disability & Home Care (ADHC), a part of the NSW Department of Family and Community Services (FACS).

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The original research was funded by the Commonwealth of Australia and the New South Wales governments under the former Home and Community Care program.

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Contents

May 2005; 2nd printing June 2014
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Introduction

Disability anthropometrics are at a minimum seven times more variable than so called normal anthropometric data for obvious reasons. Consequently assumptions underpinning anthropometrics and growth have to be understood and integrated into Occupational Therapy professional reasoning for good outcomes. Some of the knowledge which is needed follows.

What is the primary health condition and its impact on limb segment proportions, muscle development and range of movement?

A: For instance in some such conditions i.e. Dwarfism (achondroplasia) means that a linear relationship between bone segments cannot be assumed eg. large head, short legs. The normal proportions of growth are typified by the "2, 3, 4, 5 height rule." (2x head and neck, 3x trunk; 4x arm; and 5x leg).

Have the childs bone epiphysis fused yet and has their growth slowed or stopped?

A: Generally growth of the skeleton does not entirely cease at the end of the adolescent period. In humans, the epiphysis's of the long bones close completely and cannot afterwards be stimulated to grow again. This varies (i.e. approximately 12-18 for girls and 15-25 for men). However vertebral column continues to grow from age 20 to 30 years by apposition to the tops and bottoms of the vertebral bodies. Thus height typically increases by 3-5 mm during these years.

To what extent might I be able to accurately predict the child's body composition and muscle density?

A: Skeletal muscle can change dramatically throughout life. At birth skeletal muscle is predominately water and has very poor neural control. Muscle quickly increases its relative percent of contractile proteins. Motor control strategies develop over many years. Muscle is able to hypertrophy and atrophy tremendously in response to altered loading conditions.

What time of day did I take my anthropometric measurements and what activities was this directly after?

A: Time of day and the type of activities being observed change anthropometric measurements. Stature varies in the 24-hour day. Humans are generally tallest in the morning due to a lack of gravitational forces causing vertebral disc compression. Children are measurably shorter after vigorous play.

How regular are my client's growth cycles?

A: The regularity or otherwise of the growth curve is very important. Growth is an exceedingly regular process. Growth, development and maturation are pretty

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consistent for all children. Many children show a regular seasonal variation with a 6-month rhythm - an increase in the spring and a decrease rate in the autumn. A child grows 3 times faster in his/her annual time of greatest growth than in his/her slowest time of the year.

There are a few other things that make modification reasoning about children different to reasoning about adults these include:

1. Knowledge about the development of skills and abilities, to fail to factor these in, may lead to secondary disabilities. For example a primary condition which results in lack of autonomous mobility may also lead to lack of development of cognitive development, i.e. cause and effect relations. A Nordic RCT study showed that placing such children very early into motorised chairs impacted cognitive function positively.
2. Activities of childhood are different in terms of dependence-independence continua and the degree of supervision and safety required. For instance it is relatively common for a child to accidentally poison themselves but this is rare for adults even with severe dementia.
3. Activities such as explorative play and physical stimulation are not typically part of adult modifications but are needed for growth and development i.e. tactile (eg. sand, water play etc.) and proprioceptive and vestibular (eg. swings, slides etc.).

OK... so what does all of this mean?

At present, there is no reliable way of predicting normal growth patterns in children and adolescents, making it difficult to prevent secondary disability and plan modification interventions. For instance spinal curvatures like scoliosis and kyphosis impact both stature and reach ranges. Typically, once spinal curvature has been detected in a child, the curve must be evaluated for its potential progression. Such progression is more likely to occur in girls, and generally occurs during the rapid adolescent growth spurt.

So what do I do with this information?

1. Reason with ALL the above information in relation to your particular client and ensure that documentation states and guardians and funders are made aware of the imprecise nature of measurements and predictions for disabled children. For instance, for adults I would normally make recommendations that are valid for a least the next five years and which are not foreseeably likely to do any harm to the client or any third parties. However, for children I would argue that this needs to be reappraised annually. Your assessment is of course a snapshot in time, and thus only valid for the period in which it is intended (Note: I would advise documenting timeframes etc.).

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2. Check out standard child growth charts if normal assumptions can be made http://pediatrics.about.com/od/growthcharts2/ or http://depts.washington.edu/growth/index.htm

   Check specialist ones if not, i.e.:

   - Trisomy Growth Charts members.optushome.com.au/karens/growth.htm
   - Prader-Willi syndrome - www.disability.vic.gov.au/dsonline/dsarticles.nsf/pages/Prader-Willi_syndrome?OpenDocument
   - Down Syndrome Growth Chart www.kidsgrowth.com/resources/articledetail.cfm?id=304

3. Reflect on the purpose of the intervention, i.e. sit to stand transfer versus, aid to balance, versus aid to orientation etc.

4. Reflect on the optimal actions, i.e. push versus pull in relation to muscle strength, range of movement and muscle integrity. For instance, all the recent research says pull is more effective biomechanically than push, and forward position is more effective than lateral position. They also infer for actions where leverage and transfer of the centre of balance is critical. Slightly higher positioning of grab rails is more efficient than lower positioning, as a high grab rail can reduce shoulder depression and spinal curvature in standing. In terms of grab rail orientation for sit to stand, generally optimum forces are transferred to the rail when the client is comfortably seated, their feet are supported by the floor, their knees are no higher than their hips, the spine is in neutral and their arm is extended in the forward (anterior) plane. For specifics see 'Basic biomechanical and anatomical principles underpinning grabrail prescription for sit-to-stand transfers' at www.homemods.info

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