Standard methods for the collection and collation of anthropometric data in children

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Contents

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Abbreviations

AIHW……Australian Institute of Health and Welfare

AFNMU…….Australian Food and Nutrition Monitoring Unit

BMI……Body Mass Index

N/a……..Not applicable

NHMRC…….National Health and Medical Research Council

SD……..Standard deviation

WHO……..World Health Organization

Preface

Anthropometric measures are routinely used for assessment of growth and body composition in children and adolescents, with applications in both clinical and population settings. The *NHMRC review of child health surveillance and screening* (1993) recommended developing a nationally agreed and standardised set of anthropometric measures and data collection procedures for child health surveillance. This report addresses the recommendation.

Associate Professor Peter Davies led the technical development and consultation processes, convening an Expert Panel to advise on the specifications. The Panel comprised experts with both clinical and public health perspectives, and representatives from state and national agencies. The aim of the standard definitions and protocols developed for the core child anthropometric measures is to make data collection activities more efficient and effective. This provides a basis for different agencies and investigators to collect data that is comparable and appropriate to its purpose.

The NHMRC recommendation and this report are part of a broader governmental effort to improve the comparability, consistency and relevance of national information on the health and well-being of Australians. The National Health Information Management Group and the National Public Health Information Group in collaboration with the Australian Institute of Health and Welfare (AIHW) have made significant advances in the development and maintenance of standards, models, definitions and structures for health information.

Nationally agreed and approved data definitions and standards are readily available in the National Data Dictionaries and in the AIHW Knowledgebase. These documents contain agreed standards for use in governmental reporting and are recommended for use by others involved in the collection, analysis and reporting of health information.

The standard definitions and protocols recommended in this report will be submitted for inclusion in the Knowledgebase, adding to the specifications already included for anthropometric measures for adults and infants.

This report should be considered in conjunction with the outcomes of another project recently commissioned by the Commonwealth Department of Health and Aged Care: *Australian standard definition for child and adolescent overweight and obesity.*

This report was produced as part of a program of work by the Australian Food and Nutrition Monitoring Unit (AFNMU) and funded by the Commonwealth Department of Health and Aged Care.

Dr Geoffrey Marks
Director, Australian Food and Nutrition Monitoring Unit

Introduction

In March 2001 the Australian Food and Nutrition Monitoring Unit (AFNMU) invited the Children's Nutrition Research Centre's Scientific Director Associate Professor Peter SW Davies to chair an Expert Panel to develop standard methods for the collection and collation of anthropometric data in children in Australia. This work is being undertaken by the AFNMU as part of a program of work funded by the Commonwealth Department of Health and Aged Care to progress the development of a national food and nutrition monitoring and surveillance system.

The Expert Panel comprised state representatives and experts from clinical and public health spheres.

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Members of the Australian Food and Nutrition Monitoring Unit and the Advisory Committee of the National Food and Nutrition Monitoring and Surveillance Project also provided valuable advice and feedback on the content of the report.

Recommendations

Following detailed discussion, the Expert Panel made the following recommendations based on authoritative sources and consensus.

Recommendation 1

That standard definitions for key anthropometric measurements be included in the Australian Institute of Health and Welfare Knowledgebase in the form required by the National Health Information Model. These key anthropometric variables are:

Height/stature/supine length

Body weight

Head circumference

Waist circumference

And the derived variable Body Mass Index

The recommended inclusion in the Knowledgebase is detailed in the remainder of the report.

Recommendation 2

That use in an independent review be conducted of the growth standards and growth references for use in Australia. This was beyond the scope of the Expert Panel's responsibility but it was agreed that this needed to be addressed urgently. Measures of growth, especially height, weight and derived BMI, when collected will inevitably be related to a reference or standard.

There are a number of datasets worldwide that could be used as a reference, but the term 'standard' indicates some measure of desirability in terms of growth status or growth velocity. It was felt that there were far fewer, if any, current datasets that fulfilled the criteria of being an acceptable growth standard for use in Australia.

Height – Measured

Data Element ID: N/a

Type: Data Element

Status: Draft
June 2001

Definition: A child's measured height.

Height: measured is a continuous variable measured to the nearest 0.1cm.

In order to ensure consistency in measurement, the measurement protocol described under Data Collection Methods should be used. Data collection methods are shown later in this text.

Context: Public health and individual health care.

Height is an indicator of nutritional and health status of the individual and the community at large. Changes in the mean height of a community over a period of 5-10 years or more (secular trend) reflect changes in the nutritional and health status of that community. Changes in the height of an individual over a period of 3-12 months (height velocity) reflect changes in the nutritional and health status of that individual. The height and height velocity of an individual can be used in screening for a variety of health and nutritional disorders and can be used to monitor response to therapy.

Disease, nutritional, genetic and environmental factors all exert an influence on the height (stature) of an individual hence this variable together with its related variable weight (mass), is of unique value in child health surveillance.

Measurements of height and its derivative height velocity should be assessed in relation to the child's age and pubertal status.

Height is also important in the calculation of Body Mass Index (BMI). The BMI (weight/height in metres squared) is a measure of body size and an indirect index of body composition, ie percentage fat and fat-free mass.

Self-reported or parentally reported height should be used cautiously if at all.

Comment: This data element applies to persons aged 18 years or less. It is recommended for use in population surveys and health care settings.

Presentation of Data:	Means, standard deviations, 95% confidence intervals, and medians should be reported to one decimal place.
Data type:	Numeric
Representational Form:	Quantitative value
Representation Layout:	NNN.N
Maximum Size:	4
Minimum Size:	3
Guide for Use:	If measured height is not able to be collected, code as 999.9
Validation Rules:	N/a
Related Data References:	Forms part of a calculation for height velocity and Body Mass Index.
Submitting Organisation:	The Expert Panel for Project 14 for AFNMU
Date of Submission:	June 2001
Source Documents:	The measurement protocol described by the World Health Organization (WHO Expert Committee 1995), that was adapted from Lohman et al (1988).
Source Organisations:	World Health Organization.
Responsible Organisation:	National Health Data Committee. National Data Standards Unit, Australian Institute of Health and Welfare.

Data Collection Methods

Measurement protocol:

(Adapted from WHO, *Physical Status: the use and interpretation of anthropometry: report of a WHO expert committee*, World Health Organization, Geneva, 1995)

Height measurements can be based on recumbent length or standing height. In general, length measurements are recommended for children under 2 years of age and height measurements for others. This is partly because these are the procedures used in the current NCHS/WHO international reference (*Measuring change in nutritional status: guidelines for assessing the nutritional impact of supplementary feeding programmes*, Geneva, World Health Organization, 1983). However, it can be difficult to obtain accurate height measurements in some children – especially when they are uncooperative – and many surveys now measure the length of children up to 5 years of age.

For the measurement of supine length of children up to and including 2 years of age, two observers are required. One observer positions the head correctly while the other ensures the remaining position is correct and brings the measuring board in contact with the feet. The subject lies in a supine position on a recumbent length table or measuring board. The crown of the head must touch the stationary, vertical headboard. The subject's head is held with the line of vision aligned perpendicular to the plane of the measuring surface. The shoulders and buttocks must be flat against the table top, with the shoulders and hips aligned at right angles to the long axis of the body. The legs must be extended at the hips and knees and lie flat against the table top and the arms rest against the sides of the trunk. The measurer must ensure that the legs remain flat on the table and must shift the movable board against the heels. In infants care has to be taken to extend the legs gently. The length is recorded to the nearest 0.1cm. In some older children two observers may also be required.

In general, length or height is measured and reported to the nearest 0.1cm. For any child, the length measurement is approximately 0.5-1.5cm greater than the height measurement. It is therefore recommended that when a length measurement is applied to a height-based reference for children over 24 months of age (or over 85cm if age is not known), 1.0cm be subtracted before the length measurement is compared with the reference.

It is also recommended that if it is known that all previous measurements have been of length when the first height measurement is taken, a supine measure should also be taken at the same time to enable growth velocity to be calculated accurately.

The measurement of height requires a vertical metric rule, a horizontal headboard and a non-compressible flat, even surface on which the subject stands. The equipment may be fixed or portable and should be described and reported.

The graduations on the metric rule should be at 0.1cm intervals and the metric rule should have the capacity to measure up to at least 210cm. Measurement intervals and labels should be clearly readable under all conditions of use of the instrument.

Apparatus that allows height to be measured while the subject stands on a platform scale is not recommended.

The subject should be measured without shoes and socks and wearing little clothing so that the positioning of the body can be seen. In girls it is not necessary to remove pantyhose. Where possible the equipment should have a 0.5kg weight on top to apply sufficient pressure to compress hair. Anything that may affect or interfere with the measurement should be noted on the data collection form (eg hairstyles and accessories, or physical problems). Time of day should also be recorded on the data collection form. This is important as the recommendation below indicate that no upward pressure should be applied.

The subject stands with weight distributed evenly on both feet, heels together and the head positioned so that the line of vision is at right angles to the body. The correct position for the head is in the Frankfort horizontal plane. The arms hang freely by the sides. The head, back, buttocks and heels are positioned vertically so that the buttocks and the heels are in contact with the vertical board. To obtain a consistent measure, the subject is asked to inhale deeply and stretch to their fullest height. The moveable headboard is brought onto the top of the head with sufficient pressure to compress the hair. For consistency with methods used to collect the recommended reference data, no additional upward pressure is exerted on the mastoid processes. Ensure that the head remains positioned so that the line of vision is at right angles to the body and the heels remain in contact with the base board. In younger children a second observer is useful to ensure accurate measurement of height.

The measurement is recorded to the nearest 0.1cm. Take a repeat measurement after asking the subject to step off and step back onto the stadiometer. If the two measurements disagree by equal to or more than 0.5cm then take a third measurement. All raw measurements should be recorded on the data collection form. If practical, it is preferable to enter the raw data into the database as this enables intra- and, where relevant, inter-observer errors to be assessed. The subject's measured height is subsequently calculated as the mean of the two observations or the mean of the two closest measurements if a third is taken. If only a mean value is entered into the database then the data collection forms should be retained.

It may be necessary to round the mean value to the nearest 0.1cm. If so, rounding should be to the nearest even digit to reduce systematic over-reporting. For example, a mean value of 122.25cm would be rounded to 122.2cm while a mean value of 122.35cm would be rounded to 122.4cm.

It is recommended that in population surveys, socio-demographic data including ethnicity should be collected.

Date of birth and date of measurement should also be recorded. This allows decimal age to be calculated if required.

Validation and quality control measures:

All equipment, whether fixed or portable, should be checked prior to each measurement session to ensure that both the headboard and floor (or footboard) are at 90 degrees to the vertical rule and calibration performed as recommended by manufacturer. With some types of portable anthropometers it is necessary to check the correct alignment of the headboard during each measurement by means of a spirit level.

Within- and, if relevant, between-observer variability should be reported. This can be assessed by each observer repeating the measurement of the same subject (within-observer variability) or different observers measuring the same subject (between-observer variability). The standard deviation of replicate measurements (technical error of measurement) between observers should not exceed 5mm and be less than 5mm within observers.

Extreme values at the lower and upper ends of the distribution of measured height should be checked both during data collection and after data entry. Individuals should not be excluded on the basis of true biological difference.

Last digit preference and preference or avoidance of certain values, should be analysed in the total sample and (if relevant) by observer, survey site and over time if the survey period is long.

Weight – Measured

Data Element ID: N/a

Type: Data Element

Status: Draft
June 2001

Definition: A child's measured weight (body mass) without any clothing or in light indoor clothes.

Weight: measured is a continuous variable measured to the nearest 0.1kg.

In order to ensure consistency in measurement, the measurement protocol described under Data Collection Methods should be used. Data collection methods are shown later in this text.

Context: Public health and health care.

Weight (or mass) is an overall measure of body size that does not distinguish between fat and muscle. Weight is an indicator of nutritional status and health status. In general, change in weight in children is of interest because it indicates changing health status and growth and development.

It enables the calculation of Body Mass Index (weight/height in metres squared) which requires the measurement of height and weight.

(Adapted from WHO, *Physical Status: the use and interpretation of anthropometry: report of a WHO expert committee*, World Health Organization, Geneva, 1995)

Two commonly used anthropometric indices are derived by comparing weight measurement with reference curves: weight-for-age and weight-for-height. Although these indices are related, each has a specific meaning in terms of the process outcome of growth impairment. Moreover, the ranges of the deficit of physical status based on each index vary significantly across populations. In non-emergency situations, prevalence levels of low weight-for-age tend to be substantially greater than those of weight-for-height (The worldwide magnitude of protein-energy malnutrition: an overview from the WHO Global Database on child growth, *Bulletin of the World Health Organization*, 1993, 71: 703-172).

Deficits in one or more of the anthropometric indices are often regarded as evidence of 'malnutrition'. However, it should not be assumed that such deficits are solely the result of nutrient or energy

	deficit (often, in turn, equated with a lack of food intake). A significant deficit in a physical measurement indicating past or current malnutrition at the cellular level could be due to a primary lack of food, to an increased rate of nutrient utilisation (as in many infectious diseases) and/or to impaired absorption or assimilation of nutrients. The combination and interaction of these processes contribute to much of the deficit in growth or physical status observed in less developed areas. Thus, anthropometric findings alone do not define the specific processes that are leading to malnutrition: interpretation of a growth deficit depends on the indices used, on the causes of the deficit, and on the socio-economic status of the population under study.
Comment:	This data element applies to persons aged 18 years or less. It is recommended for use in population surveys and health care settings. Self-reported or parentally reported weight should be used cautiously if at all. Interpretation of weight data are potentially compromised if a subject is pregnant.
Presentation of Data:	Means, standard deviations and medians should be reported to one decimal place.
Data type:	Numeric
Representational Form:	Quantitative value
Representation Layout:	NNN.N
Maximum Size:	4
Minimum Size:	3
Guide for Use:	If measured weight is not able to be collected, code as 999.9
Validation Rules:	N/a
Related Data References:	Forms part of a calculation for Body Mass Index
Submitting Organisation:	The Expert Panel for Project 14 for AFNMU
Date of Submission:	June 2001
Source Document:	World Health Organization
Responsible Organisation:	National Health Data Committee. National Data Standards Unit, Australian Institute of Health and Welfare.

Data Collection Methods

Measurement Protocol:

All equipment used should be described and reported. Scales should have a resolution of no more than 0.1kg and should have the capacity to weigh up to the maximum weight expected within the population being studied. Measurement intervals and labels should be clearly readable under all conditions of use of the instrument. Scales should be capable of being calibrated across the entire range of measurements. Precision error should be no more than 0.1kg. Scales should be calibrated on each day of use. Manufacturers' guidelines should be followed with regard to the transportation of the scales.

For infants, birth weight and gender should be recorded with gestational age. During infancy a levelled pan scale with a beam and movable weights or digital scales capable of measuring to two decimal places of a kilogram are acceptable. Birth weight should be determined within 12 hours of birth. The infant, with or without a nappy or diaper is placed on the scales so that the weight is distributed equally about the centre of the pan. When the infant is lying or suspended quietly, weight is recorded to the nearest 10 grams. If the nappy or diaper is worn, its weight is subtracted from the observed weight: reference data for infants are based on nude weights.

For children who can stand, the subject stands over the centre of the weighing instrument with the body weight evenly distributed between both feet.

Heavy jewellery should be removed and pockets emptied. Light indoor clothing can be worn excluding shoes, belts, and sweaters.

If the subject has had one or more limbs amputated, record this on the data collection form. If they are wearing an artificial limb, record this on the data collection form but do not ask them to remove it. Similarly, if they are not wearing the limb, record this but do not ask them to put it on.

During weighing, any variations from light indoor clothing (eg heavy clothing, such as kaftans or coats worn because of cultural practices) should be noted on the data collection form. Adjustments for non-standard clothing (ie other than light indoor clothing) should only be made in the data checking/cleaning stage prior to data analysis.

In children the measurement is recorded to the nearest 0.1kg. If the scales do not have a digital readout, take a repeat measurement. If the two measurements disagree by more than 0.5kg, take a third measurement. All raw measurements should be recorded on the data collection form. If practical, it is preferable to enter the raw data into the data base as this enables intra- and, where relevant, inter-observer errors to be assessed. The subject's measured weight is subsequently calculated as the mean of the two observations or the

mean of the two closest measurements if a third is taken, and recorded on a form. If only a mean value is entered into the database then the data collection forms should be retained.

It may be necessary to round the mean value to the nearest 0.1kg. If so, rounding should be to the nearest even digit to reduce systematic over reporting. For example, a mean value of 72.25kg would be rounded to 72.2kg while a mean value of 72.35kg would be rounded to 72.4kg.

Date of birth and date of measurement should also be recorded. This allows decimal age to be calculated if required.

It is recommended that in population surveys, socio-demographic data including ethnicity should be collected.

Validation and quality control measures:

It is desirable that equipment is checked daily using at least three objects of known weight in the range to be measured. It is recommended that the scale be calibrated at the extremes and in the mid range of the expected weight of the population being studied.

Within- and, if relevant, between-observer variability should be reported. This can be assessed by each observer repeating the measurement of the same subject (within-observer variability) or different observers measuring the same subject (between-observer variability) under standard conditions after a short time interval. The standard deviation of replicate measurements (technical error of measurement (Cameron 1978) between observers should not exceed 0.5kg and be less than 0.5kg within observers.

Extreme values at the lower and upper end of the distribution of measured weight should be checked both during data collection and after data entry. Individuals should not be excluded on the basis of true biological difference.

Last digit preference and preference or avoidance of certain values should be analysed in the total sample and (if relevant) by observer, survey site and over time if the survey period is long.

Head Circumference – Measured

Data Element ID:	N/a
Type:	Data Element
Status:	Draft June 2001
Definition:	A child's measured head circumference. Circumference: measured is a continuous variable measured to the nearest 0.1cm. In order to ensure consistency in measurement, the measurement protocol described under Data Collection Methods should be used. Data collection methods are shown later in this text.
Context:	Public health and health care. A routine measurement of head circumference is intended to aid the detection of two groups of disorders: those characterised by a large head and those indicated by a small head. These conditions cannot be diagnosed by measurement of the head circumference alone. Since three percent of normal children have a head circumference above the 97^{th} percentile and three percent are below the third percentile, other evidence must be sought to determine whether a particular measurement is of clinical significance. Conditions with enlargement of the head include familial large head (the most common), hydrocephalus, subdural effusion and haematoma, and a number of less common conditions associated with dysmorphic syndromes and other disorders.
Comment:	This data element applies to persons aged 18 years or less. It is recommended for use in population surveys and health care settings.
Presentation of Data:	Means, standard deviations and medians should be reported to 1 decimal place.
Data type:	Numeric
Representational Form:	Quantitative value
Representation Layout:	NN.N
Maximum Size:	3
Minimum Size:	3

Guide for Use:	If measured head circumference is not able to be collected, code as 99.9
Validation Rules:	N/a
Related Data References:	N/a
Submitting Organisation:	The Expert Panel for Project 14 for AFNMU
Date of Submission:	June 2001
Source Documents:	World Health Organization (WHO Expert Committee 1995), which was adapted from Lohman et al (1988).
Source Organisations:	International Society for the Advancement of Kinanthropometry and the World Health Organization.
Responsible Organisation:	National Health Data Committee. National Data Standards Unit, Australian Institute of Health and Welfare.

Data Collection Methods

Measurement protocol:

(Adapted from WHO, *Physical Status: the use and interpretation of anthropometry: report of a WHO expert committee*, World Health Organization, Geneva, 1995)

Head circumference is measured with the child held or seated on the lap of the mother or other caretaker. Objects such as hairpins are removed from the hair. The tape, which should be flexible but inelastic, is positioned just above the eyebrows and above the supraorbital ridge and placed posteriorly to give the maximum circumference. It should be pulled sufficiently tightly to compress hair and yield a measure that 'approximates' cranial circumference.

The measurement is recorded to the nearest 0.1cm. Take a repeat measurement after taking off the tape and replacing it again. If the two measurements disagree by equal to or more than 0.3cm, then take a third measurement. All raw measurements should be recorded on the data collection form. If practical, it is preferable to enter the raw data into the database as this enables intra- and, where relevant, inter-observer errors to be assessed. The subject's measured head-circumference is subsequently calculated as the mean of the two observations or the mean of the two closest measurements if a third is taken. If only a mean value is entered into the database then the data collection forms should be retained.

It may be necessary to round the mean value to the nearest 0.1cm. If so rounding should be to the nearest even digit to reduce systematic over-reporting.

It is strongly recommended that a flexible but inelastic tape be used.

We recommend that the head circumference of the infant be recorded before discharge from hospital following birth. This is an important measurement and should be performed and recorded carefully. If there is excessive oedema or moulding of the scalp following birth this fact should also be recorded and if possible the measurement should be repeated a few days later. Head measurement should subsequently be undertaken at approximately six weeks of age. It should be plotted on the chart and also written in figures. If there is no concern at this time no further routine measurements are needed but the head circumference should always be measured and recorded if there is any concern about a baby's growth, health, or development.

If the growth line is crossing the percentiles upwards and the child shows symptoms or signs compatible with hydrocephalus or other abnormality, specialist opinion is essential. If there are no accompanying symptoms or signs, two measurements over a four-week period are acceptable. Beyond this time limit, a decision must be made either to accept the situation as normal (usually on the basis of the fact that the baby is big and that the parents have big heads), or alternatively the child should be referred for specialist

examination. There is no justification for repeated measurements spread over many months because it creates undue anxiety. Modern imaging techniques make it simple to obtain a definitive diagnosis at an early stage.

A head circumference above the + 3SD line or below the –3SD line at any stage is an indication for more detailed assessment. There is an important exception: in some ethnic groups a small head may be a reflection of genetic characteristics and the parents' head measurements should always be checked. If they are also small and the baby appears to be developing normally, referral may not be necessary. If the growth line crosses percentiles downwards but the baby is otherwise well and thriving, no special arrangements need to be made. Concern should be expressed to the parents only if it becomes clear that the growth line is not only below the third percentile but is also falling away from it.

These apparently straightforward monitoring procedures must not be regarded as simple screening tests. Skill and judgement are required to interpret the measurements and no single pass/fail criterion can be proposed.

Date of birth and date of measurement should also be recorded. This allows decimal age to be calculated if required.

It is recommended that in population surveys, socio-demographic data including ethnicity should be collected.

Validation and quality control measures:

All equipment should be checked prior to each measurement.

Waist Circumference – Measured

Data Element ID:	N/a
Type:	Data Element
Status:	Draft June 2001
Definition:	A child's measured waist circumference. Circumference: measured is a continuous variable measured to the nearest 0.1cm. In order to ensure consistency in measurement, the measurement protocol described under Data Collection Methods should be used.
Context:	It has been established in adults at least that a more central body fat distribution is associated with increased morbidity and mortality. It has been suggested that waist circumference as an index of truncal adiposity may have certain advantages over other measurements of adiposity in predicting obesity related diseases.
Comment:	This data element applies to persons aged 18 years or less. It is recommended for use in population surveys and health care settings. Data collection methods are shown later in this text.
Presentation of Data:	Mean ± standard deviation
Data type:	Numeric
Representational Form:	Quantitative value
Representation Layout:	NNN.N
Maximum Size:	4
Minimum Size:	3
Guide for Use:	If measured waist circumference is not able to be collected, code as 999.9
Validation Rules:	N/a
Related Data References:	N/a
Submitting Organisation:	The Expert Panel for Project 14 for AFNMU

Date of Submission:	June 2001
Source Documents:	The measurement protocol described below is recommended by the International Society for the Advancement of Kinanthropometry as described by Norton et al (1996) and the World Health Organization (WHO Expert Committee 1995) which was adapted from Lohman et al (1988).
Source Organisations:	International Society for the Advancement of Kinanthropometry and the World Health Organization.
Responsible Organisation:	National Health Data Committee. Nation Data Standards Unit, Australian Institute of Health and Welfare.

Data Collection Methods

Measurement protocol:

(Adapted from WHO, *Physical Status: the use and interpretation of anthropometry: report of a WHO expert committee*, World Health Organization, Geneva, 1995)

The subject is to stand comfortably with his or her weight evenly distributed between both feet and the feet about 25-30cm apart. The measurement is taken on the line of the umbilicus in a horizontal plane. The observer sits by the side of the subject and fits the measuring tape snugly but not so tightly as to compress underlying soft tissues. It is strongly recommended that a flexible but inelastic tape be used. The circumference is measured to the nearest 0.1cm at the end of normal expiration. Minimal clothing should be worn and preferably no clothing over the measurement site.

The measurement is recorded to the nearest 0.1cm. Take a repeat measurement after taking off the tape then repositioning it again. If the two measurements disagree by equal to or more than 0.3cm then take a third measurement. All raw measurements should be recorded on the data collection form. If practical, it is preferable to enter the raw data into the database as this enables intra- and, where relevant, inter-observer errors to be assessed. The subject's measured height is subsequently calculated as the mean of the two observations or the mean of the two closest measurements if a third is taken. If only a mean value is entered into the database then the data collection forms should be retained.

It may be necessary to round the mean value to the nearest 0.1cm. If so rounding should be to the nearest even digit to reduce systematic over-reporting. For example, a mean value of 102.25cm would be rounded to 102.2cm while a mean value of 102.35cm would be rounded to 102.4cm.

Date of birth and date of measurement should also be recorded. This allows decimal age to be calculated if required.

It is recommended that in population surveys, socio-demographic data including ethnicity should be collected.

Validation and quality control measures:

All equipment should be checked prior to each measurement.

Body Mass Index (BMI)

Data Element ID: N/a

Type: Derived Data Element

Status: Draft
June 2001

Definition: A child's weight (body mass) relative to height. It is a measure of body mass corrected for height which is used to assess the extent of weight deficit or excess. Body Mass Index (BMI) also provides a practical indicator of adiposity and hence overweight or obesity. Data collection methods are shown later in this text.

Context: Public health and health care.

BMI is used as an indicator of both underweight, overweight and obesity. On a population basis, in adults, there is a strong association between BMI and health risk.

There are however many individuals for whom BMI is an inappropriate measure of body fatness. These are individuals whose high body mass index is due to excess muscle rather than excess body fat or in those with osteoporosis who will have a lower than usual BMI, or those who have a different body build (eg individuals with unusually long or short legs or a different body fat distribution) (WHO Expert Committee 1995). It is unlikely that these problems arise to the same degree in children but they might be influential in adolescence. This is particularly important when assessing individuals but should also be taken into account in interpreting data from populations.

Epidemiological research shows that there is a strong association between BMI and health risk. Excess adipose tissue in adults is associated with excess morbidity and mortality from conditions such as hypertension, dyslipidaemia, diabetes mellitus, coronary heart disease, some cancers, gall bladder disease, and osteoarthritis. It may also lead to social and economic disadvantage as well as psychosocial problems. It is a major public health issue in most industrialised societies.

In population based surveys, BMI may be used:

- to indicate the prevalence of thinness and overweight and in conjunction with socio-demographic information, to identify their socio-demographic distribution;
- to evaluate health promotion and disease prevention programs (assessment of interventions);
- to monitor progress towards national health goals and targets;

- to ascertain determinants and consequences of thinness and overweight; and
- in nutritional surveillance and long-term planning.

Comment: This data element applies to persons aged 18 years or less. It is recommended for use in population surveys and health care settings. It must be noted that BMI varies substantially with age during infancy and childhood. At birth the median BMI is as low as 13, at 12 months of age it is 17, at 6 years of age it is 15.5 and at 20 years of age it is 21kg/m^2. (Cole TJ, Bellizi MC, Flegal KM & Dietz WH 2000, Establishing a standard definition for child overweight and obesity worldwide: international survey, *British Medical Journal*, 320:1-6.)
Results of measurements should therefore be age and gender specific.

Presentation of Data: Means, standard deviations, medians and percentiles should be reported to one decimal place.

It should be remembered that the range of BMI found within the population varies with age and gender so the data should be presented taking this into account.

Body mass index can be calculated from self-reported or parentally reported height and weight but this is not recommended for use in children.

Body mass index tends to be underestimated when based on self-reported rather than measured height and weight. This is due to the fact that, in general, height tends to be overestimated and weight tends to be underestimated by respondents.

Data type: Numeric

Representational Form: Quantitative value

Representation Layout: NN.N for BMI calculated from measured height and weight

Maximum Size: 3

Minimum Size: 3

Guide for Use: Body mass index cannot be calculated if either component necessary for its calculation (ie weight or height) is unknown or has not been collected (ie code as 888.8 or 999.9)

Validation Rules: N/a

Related Data References: Calculated from weight-measured

Submitting Organisation:	The Expert Panel for Project 14 for AFNMU
Date of Submission:	June 2001
Source Documents:	N/a
Source Organisations:	N/a
Responsible Organisation:	National Health Data Committee. National Data Standards Unit, Australian Institute of Health and Welfare.

Data Collection Methods

BMI should be derived from the data entry of weight and height. It should be stored on the raw data set as a continuous variable and should not be aggregated or rounded.

It is recommended that in population surveys, socio-demographic data including ethnicity should be collected.

Date of birth and date of measurement should also be recorded. This allows decimal age to be calculated if required.

References

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