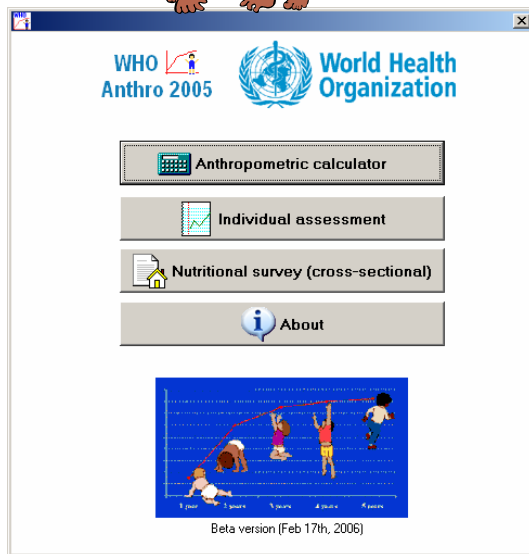


WHO Anthro 2005 for Personal Computers Manual

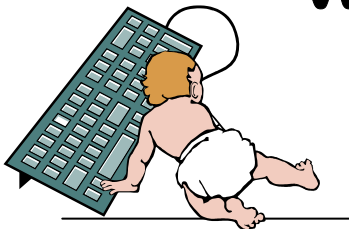
Have I now achieved a motor milestone?



Hey, I want to know how tall I am by WHO standards!



Software for assessing growth and development of the world's children



Let's get going!



World Health Organization

© World Health Organization 2006.
All rights reserved.

WHO Software Licence Agreement

On the use of the WHO Anthro 2005, Beta version 17th Feb, 2006. Software for assessing growth and development of the world's children. This End User License Agreement accompanies the WHO Anthro software 2005 for PC and all related documentation. It refers to this current software version and any upgrades or modified versions of it licensed by WHO. Please read this Agreement carefully before starting the installation. By installing this software you (the User) accept all the terms and conditions of this Agreement.

The software and all related documentation are and shall at all times remain the intellectual property of the World Health Organization. Nothing contained in this Agreement shall be deemed to convey to the User any title or ownership of the software or the related documentation. The software is being made available by WHO for use in its present form for the application of the WHO Child Growth Standards. With identification of the source, WHO Anthro 2005 may be freely distributed and copied, in part or in whole, but not for sale nor for use in conjunction with any commercial or promotional purpose.

The User is not permitted to modify, adapt, translate, reverse-engineer, decompile, disassemble, or otherwise attempt to discover the source code of the software, without prior permission from WHO. Users interested in developing any derived products are asked to contact: Department of Nutrition, World Health Organization, 20 Avenue Appia, 1211 Geneva 27, Switzerland (fax: +41 22 791 4156). In addition, the User is not permitted to use any part of the contents of the software to develop a product that is to be sold or licensed for a fee.

All reasonable precautions have been taken by the World Health Organization to verify the information contained in this software. However, the software is being distributed without warranty of any kind, either expressed or implied. The responsibility for the use of the software lies with the User. In no event shall the World Health Organization be liable for damages arising from its use.

Suggested citation

Any mention of the software in published reports should include the following citation of the source: *WHO Anthro 2005, Beta version Feb 17th, 2006: Software for assessing growth and development of the world's children. Geneva: WHO, 2006 (<http://www.who.int/childgrowth/software/en/>).*

WHO Anthro 2005

**Software for assessing growth
and development of the world's children**

Designed and developed by

Monika Blössner

Elaine Borghi

Mercedes de Onis

Adelheid Onyango

Amani Siyam

Hong Yang

Department of Nutrition

for Health and Development, Geneva, Switzerland

and

Jürgen Erhardt

SEAMEO TROPMED, Jakarta, Indonesia



**World Health
Organization**

**Department of Nutrition for
Health and Development**

Acknowledgments

We are grateful to the individuals who tested the release-candidate version and provided valuable feedback: Mr Jørn Klungsøyr (Software developer, Centre for International Health, University of Bergen, Norway), Mr Amir Moez Naïmi (IT consultant, ServiceGeneva, Switzerland), Mr Alain Pinol (Systems analyst, Les Noyettes, France), Dr Allen Shoemaker (Programme developer, Calvin College, Grand Rapids, USA) and Dr Cutberto Garza (Vice president and dean of faculties, Boston College, Chestnut Hill, USA).

The development of this software was financed as part of the grant attributed to the Department of Nutrition from the Bill and Melinda Gates Foundation.

Table of contents

What is WHO Anthro 2005	iii
Organization of this manual	iii
Typographic conventions	iv
1 The WHO Child Growth Standards.....	1
1.1 Background and innovative aspects	1
1.2 Technical details	1
1.3 Standardized measurement procedures.....	2
1.4 Motor development milestones.....	3
2 The Anthro 2005 software	4
2.1 Products and desktop requirements	4
2.2 Installation.....	4
2.3 Configurations.....	5
2.4 Overview of basic module functions	6
2.4.1 Data entry	6
2.4.1.1 Age.....	6
2.4.1.2 Weight.....	7
2.4.1.3 Oedema	7
2.4.1.4 Recumbent length and standing height	7
2.4.2 Results	7
2.4.3 BMI	8
2.4.4 Percentiles and z-scores.....	8
2.4.5 Colour coding.....	9
2.4.6 Graphs	9
2.4.7 Note on WHO standards versus NCHS reference.....	10
2.4.8 Motor development	11
2.5 Modules: use and functions	12
2.6 Anthropometric calculator	13
2.7 Individual assessment	15
2.8 Nutritional survey	32
3 References	47
4 Reporting of problems with Anthro 2005	48

Abbreviations

The following abbreviations are used in this manual:

BAZ	BMI-for-age z-score
BMI	Body mass index (weight in kg divided by height in metres squared)
DoB	Date of birth
DoV	Date of visit
FAO	United Nations Food and Agricultural Organization of the United Nations
HAZ	Length or height-for-age z-score
HC	Head circumference
HCZ	Head circumference z-score
ID	Identification number
LBW	Low birth weight
MGRS	WHO Multicentre Growth Reference Study
MM	Motor milestones
MS	Microsoft
MUAC	Mid-upper arm circumference
MUACZ	Mid-upper arm circumference z-score
NA	Not available
NCHS	National Center for Health Statistics
PKU	Phenylketonuria
SD	Standard deviation
SSF	Sub-scapular skinfold
SSFZ	Sub-scapular skinfold z-score
TSF	Triceps skinfold
TSFZ	Triceps skinfold z-score
USB	Universal Serial Bus (i.e. hardware interface for attaching peripheral devices). A USB stick (or drive) is a memory card that plugs into the computer's USB port.
WAZ	Weight-for-age z-score
WHO	World Health Organization
WHP	Weight-for-height percentile
WHZ	Weight-for-length and weight-for-height z-score

What is WHO Anthro 2005

WHO Anthro 2005 is a software for use on personal computers (PCs using MS Windows). It was developed to facilitate application of the WHO Child Growth Standards in monitoring growth and motor development in individuals and populations. This PC software can be used on desktop computers in office environments and on laptops in the field.

The software is intended for use to assess child nutritional status, to follow a child's development and growth over time, or to conduct and analyse nutritional surveys. This manual provides an overview of the software components, i.e. the WHO Child Growth Standards and the motor development milestones, and instructions on how to apply them using the software. Users unfamiliar with software installation and management will find relevant guidance. The manual also indicates in detail how best to move through the fields, enter data and derive results.

WHO Anthro 2005 replaces Anthro 1.02 (last updated in 1999), which used the NCHS/WHO reference population, was DOS-based and could import files only in dBase format (the manual refers to the NCHS/WHO reference as the "NCHS reference" to distinguish them from the WHO standards). Anthro 2005 applies, by default, the new WHO Child Growth Standards (the NCHS reference can be selected as an option), it is MS Windows-based, uses common icons and their functions, and allows importing of dBase and Epilnfo files, and exporting into excel.

For more information, please contact:

WHO Anthro 2005
Department of Nutrition
World Health Organization
Avenue Appia 20
1211 Geneva 27
Switzerland

fax: +44 22 791 4156

Or go to www.who.int/childgrowth

Organization of this manual

The first section of this manual provides background information on the essential software ingredients – the WHO Child Growth Standards and the gross motor development milestones – and presents their application.

The next part describes the various software products and provides information on general installation options and technical requirements.

Given that several software features and applications are common in all modules, particularly concerning data-entry, these are outlined beforehand.

A separate section describes the specifications of the PC platform with step-by-step working examples for each of the modules.

In the last section of this manual the user will find guidance on how to report any problems.

Typographic conventions

This manual uses the following typographic conventions:

Item	Example/description
Interface buttons	Click <Save>
Keyboard keys	Press <Ctrl + Alt + Delete>
Menu paths	Click <File → Open>
User input	Type [Jane] in the Name field

Whenever the manual refers to titles or names which appear on the software interface, these appear in *italics*.

Notes to users appear grey-shaded, as shown here, in contrast to the running text.

1 The WHO Child Growth Standards

1.1 Background and innovative aspects

In 1990 WHO constituted a Working Group on Infant Growth to develop recommendations for appropriate uses and interpretation of anthropometry in infants and young children. The Working Group (WHO, 1994) concluded that the National Centre for Health Statistics (NCHS)/WHO international reference was flawed since it failed to depict physiologic growth adequately; that its scientific weaknesses were sufficient to interfere with the sound nutritional management of young children; and that new growth curves were needed.

Consequently, the WHO Multicentre Growth Reference Study (MGRS) was designed to provide data that describe "how children should grow" by including in the study's selection criteria specific health behaviours that are consistent with current health promotion recommendations (e.g. breastfeeding norms, standard paediatric care, and non-smoking requirements) (de Onis et al., 2004). This approach is fundamentally different from that taken by traditional descriptive references. By adopting a *prescriptive* approach, the protocol's design went beyond an update of how children in presumably healthy populations grow at a specific time and place and explicitly recognized the need for *standards* i.e. criteria that enable value judgments by incorporating norms or targets in their construction.

Another key characteristic of the new standard is that it makes breastfeeding the biological norm and establishes the breastfed infant as the normative growth model. Health policies and public support for breastfeeding should be strengthened by having breastfed infants as the reference for normal growth and development.

The pooled sample from the six participating countries (Brazil, Ghana, India, Norway, Oman and USA) allowed development of a truly international standard and demonstrates yet again that children grow similarly across the world's major regions when their health and care needs are met.

The wealth of data collected allowed the replacement of the current international NCHS/WHO references on attained growth (weight-for-age, length/height-for-age, and weight-for-length/height) and the development of new standards for triceps and subscapular skinfolds, head and arm circumferences, and body mass index (BMI).

In addition, the development of windows of achievement for six gross motor development milestones provides a link between physical growth and motor development.

1.2 Technical details

The first set of WHO Child Growth Standards comprises the indicators: length/height-for-age, weight-for-age, weight-for-length, weight-for-height and BMI-for age, for boys and girls. The age-based standards cover the age group from birth to 60 completed months; weight-for-length standards range from 45 to 110 cm and weight-for-height standards from 65 to 120 cm.

For all standards involving length or height measurements, recumbent length should be used for children younger than 24 months and standing height for children 24 months and older. There is a specific box to tick alongside length or height to specify whether the measurement was taken recumbent or standing. The software will automatically convert height to length for a child younger than 24 months whose height has been measured instead of length, and length to height for a child aged 24 months or older whose length was measured instead of height.

If age is not known but the type of measurement – i.e. standing height or recumbent length – is provided, the programme uses that information to derive results. If survey data have records with age unknown and no information on the type of measurement, the software will assume that the measurement was recumbent length if the value is below 87 cm, or otherwise standing height. The cut-off point of 87 cm reflects the standards' median for boys' and girls' height-for-age z-score (HAZ) at 24 months. The WHO standards' median height is 87.1 cm for boys and 85.7 cm for girls, and median length is 87.8 cm for boys and 86.4 cm for girls. The mean of these four values is 86.75 cm, which was

rounded to 87 cm to obtain the cut-off point for shifting from length to height in case age and type of measurement are unknown.

The standards' data tables for all age-based indicators are graduated in days, and in 0.1 cm for weight-for-length/height. The tables and charts of the WHO Child Growth Standards are accessible in electronic format at www.who.int/childgrowth/en/standards. A full description of the technical aspects can be found elsewhere (de Onis et al., 2006; WHO, 2006).

1.3 Standardized measurement procedures

Standardized measurement procedures are recommended when using the WHO growth standards. Detailed measurement protocols can be found in:

Annex 2 of Physical status: the use and interpretation of anthropometry. Expert Committee Report. WHO Technical Report Series No. 854. Geneva: World Health Organization, 1995 (see [http://whqlibdoc.who.int/trs/WHO_TRS_854_\(annexes\).pdf](http://whqlibdoc.who.int/trs/WHO_TRS_854_(annexes).pdf)).

de Onis M, Onyango AW, Van den Broeck J, Chumlea WC, Martorell R for the WHO Multicentre Growth Reference Study Group. Measurement and standardization protocols for anthropometry used in the construction of a new international growth reference. Food and Nutrition Bulletin 2004;25(Supplement1):S27-36 (see <http://www.who.int/childgrowth/mgrs/en>).

The following are among the most important points to ensure the collection of accurate anthropometric data are:

1. Make sure that all equipment is correctly calibrated on a regular basis.
2. Conduct training based on recommended measurement protocols as well as standardization sessions for those who collect the data.
3. Take the child's date of birth from a written record if available. Otherwise ask for both the child's date of birth and age on the day measured, since the year of birth is frequently reported incorrectly. If birth dates are not recorded or known with certainty, probe the caretaker for the approximate date of birth based on local event calendars.
4. Measure recumbent length in children younger than 24 months of age and standing height from 24 months onwards. (In case this cannot be adhered to, e.g. a child is too sick to stand, the software is programmed to convert the measurement automatically.)
5. Always enter the information on whether recumbent length or standing height was measured.
6. If age is not known, children who can stand up and are willing to stand should be measured standing whereas children who cannot stand up or are too weak to do so should be measured in recumbent position.
7. Always indicate if the child has oedema or not.
8. After the age, sex, weight, and length/height information have been entered, the user should check results by using the graphing option to view single and multiple measurements. If a child appears to have extreme values beyond the flag boundaries s/he should be re-measured immediately.

1.4 Motor development milestones

The objective of the motor milestones interface in the software is to monitor the achievement of the following six gross motor milestones:

1. Sitting without support
2. Standing with assistance
3. Hands-and-knees crawling
4. Walking with assistance
5. Standing alone
6. Walking alone

These milestones are considered fundamental to acquiring self-sufficient erect locomotion and are relatively simple to evaluate (Wijnhoven et al., 2004). The software allows for two types of assessment: longitudinally via the *Individual assessment* module and cross-sectionally via the *Nutritional survey* module. Longitudinal assessments done in the context of routine health visits can be used to monitor the timing and sequence of milestone achievements by individual children. The latter module permits assessment of a child's achievement status (yes or no), where the six milestones could be assessed in a single episode.

The ideal age range to assess the achievement of motor milestones is between 3 and 24 months. Descriptions of the achievement criteria and standardized testing procedures for each milestone are outlined in the modules and can also be found elsewhere (Wijnhoven et al., 2004). The milestone is considered observed only if all the given criteria are met.

2 The Anthro 2005 software

2.1 Products and desktop requirements

This software was produced for personal computers and consists of the following modules:

- Anthropometric calculator
- Individual assessment
- Nutritional survey (cross-sectional)

The requirements for running the Anthro 2005 PC software, Beta version Feb 17, 2006 are:

- 1 Megabyte (Mb) hard disk space for the software
- 2 Mb for the manual.

The desktop should have at least a MS Windows 98 operating system or a more recent Windows version.

Software has also been developed for use on handheld computers working in MS PocketPC or MS Windows Mobile. This Anthro 2005 Mobile software and related manual can be downloaded from www.who.int/childgrowth/software.

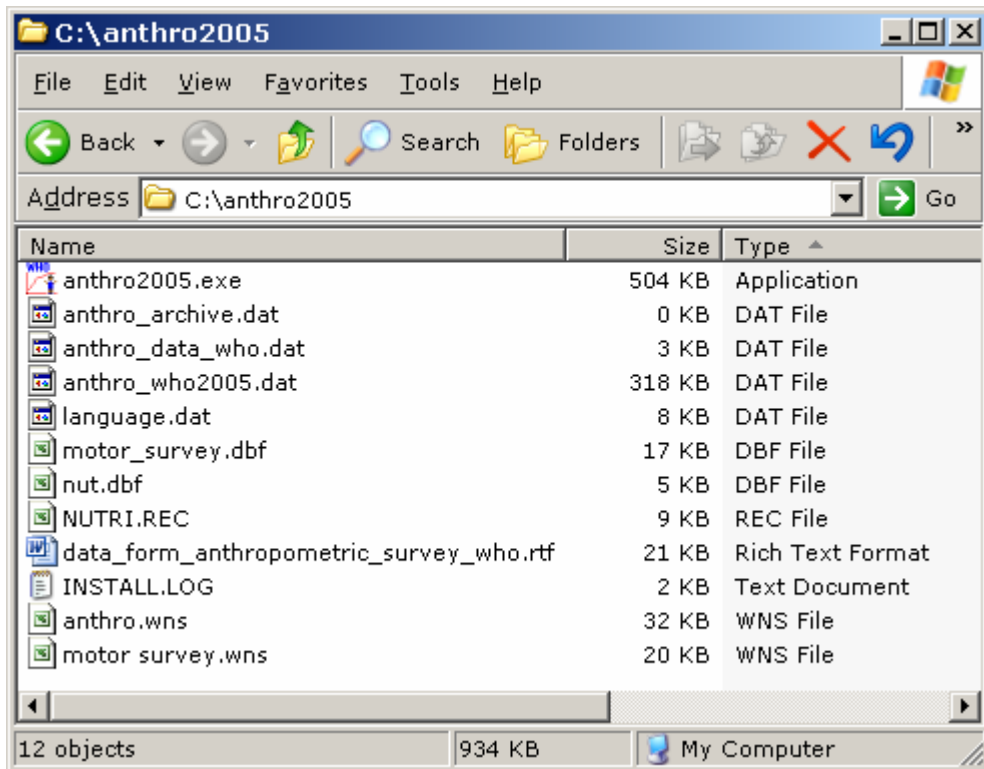
2.2 Installation

The user may choose either to download the software from the WHO web site of the Child Growth Standards web site www.who.int/childgrowth/en/software or to install the software from a CD-ROM.

The anthro.exe file needs first to be saved to a temporary folder. Clicking on this self-executable file will start the installation process, whereby a folder for the programme is created and an icon is inserted on the desktop. To start the programme the user needs to click on the icon, or double-click on the **anthro2005.exe** file.

Programme files

The folder Anthro 2005 contains the following 12 programme files:



2.3 Configurations

In the installation process the date format is automatically set to match the format selected on the set-up functions of the PC. Screen colours are fixed and cannot be altered.

Any output from the software automatically connects to MS Word and MS Excel. In case these programmes are not available, WordPad from Windows is used.

In the *Individual assessment* module the data are stored in the file anthro_data_who.dat. Every time the data are saved, backup files with the extension *.bak are made automatically. In the *Nutritional survey* module the data set of each survey is individually saved in a file with the extension *.wns.

The easiest way to back up the data is to save the whole Anthro2005 directory on a CD ROM or a USB stick.

2.4 Overview of basic module functions

The following section outlines the module functions that are similar throughout the software.

2.4.1 Data entry

The child's age, weight, oedema status (yes/no), length/height and type of measurement (recumbent or standing) are the basic variables required to derive nutritional status indicators.

2.4.1.1 Age

When the user opens a new record for data-entry, date of visit (DoV) is displayed as the current date. The user is asked to enter the child's exact date of birth (DoB). The date can be entered either by typing it in or selecting a date via the calendar window (see image below).



The software then uses DoB and DoV to derive age in completed months and displays this information for the user to double check. The software uses the same information to calculate the precise age in days. To account for leap years, age in months is calculated by dividing 365.25 by 12. Thus one month is equal to 30.4375 days; and a child born on 11/11/2004 and measured on 11/11/2005 appears as having an age of 11 completed months (365 divided by 30.4375 equals 11.99). The reason for deriving age in days is that the age-based indicator tables of the WHO Child Growth Standards are in units of days.

The software has been developed with the objective of enhancing the quality of age estimation. Thus, should the exact **day** of birth be unknown, the user should fill in the year and month of birth and tick the box indicating "estimated birthday". When that field is ticked, the software programme attributes a random day to complete the date of birth and this date is subsequently used to derive an exact age in days.

The child's age is an important piece of information and those collecting data should probe the child's caregiver to obtain at least an approximate date of birth (i.e. year and month). Only if there is absolutely no recollection of when the child was born should the user tick the box indicating "Date of birth unknown". If the user has ticked this box, none of the age-based indicators can be derived therefore only a weight-for-height z-score (WHZ) and percentile (WHP) will be calculated. The child will contribute to the overall prevalence on this indicator in a survey population (e.g. total WHZ, total rural WHZ).

Users wishing to develop a local calendar are referred to Annex 1 of the FAO field manual (FAO, 1990).

2.4.1.2 Weight

Measurements should be entered in kilograms with a maximum of 2 decimals.

2.4.1.3 Oedema

Children with oedema have swollen limbs and may look well fed. To determine whether oedema is present, grasp the foot so that it rests in your hands with your thumb on top of the foot. Press your thumb down gently for a few seconds. The child has oedema if a pit (dent) remains in the foot after you lift your thumb. If the child has oedema of both feet, fluid retention increases the child's weight, masking what may actually be very low weight. In case the child has oedema the user should tick the respective box in the data-entry screen. Consequently the software discards weight data entered for such a child and computes only length/height-for-age.

In Anthro 2005 the default status of every new child entered is "no oedema". If the child has oedema the user has to tick the respective radio button or fill in the column accordingly.

2.4.1.4 Recumbent length and standing height

Measurements should be entered in centimetres with a maximum of 2 decimals.

In line with recommended standard measurement procedures, the software derives length-based indicators for children younger than 24 months, and height-based indicators for children 24 months and older. However, there are settings and scenarios where it is not possible to comply with this recommendation and a child older than 24 months has to be measured lying down – for example when a child is too sick and too weak, or when, because of time/equipment constraints, it is faster to measure all children lying down. On those occasions the software makes the necessary adjustment by subtracting 0.7 cm from the child's length to derive an estimated height. Similarly, if a child is measured standing when s/he should be measured in the recumbent position, given his/her age, the software adds 0.7 cm to derive an estimated length. Therefore, the user should always tick the appropriate box, or enter the measurement variable indicating how the child was measured, i.e. recumbent or standing.

When interpreting the results the following should be kept in mind. The software programme converts the length/height measurement to conform to the foregoing recommendation and uses that converted value for deriving all relevant indicator results (including fixed BMI). The software interface always displays the corresponding indicator name, i.e. length-for-age for all children younger than 2 years (or up to 730 days inclusive) and height-for-age for all children 2 years and older (731 days or more). Therefore for a child that was measured lying down but is older than 2 years, the indicators will read: weight-for-height and height-for-age; and the fixed BMI as well as the BMI-for-age z-score are derived based on the height converted from length.

If age is not known, but the type of measurement (i.e. recumbent or standing) given, the software uses that information to derive either length- or height-based indicators. If neither age nor type of measurement is known, the software considers any measurement below 87 cm as length and any measurement 87 cm and above as height. The cut-off point of 87 cm reflects the standards' median of boys and girls height at 24 months. According to the WHO standards the median height is 87.1 cm for boys and 85.7 cm for girls and the median length is 87.8 cm for boys and 86.4 cm for girls. The mean of these four values is 86.75 cm.

2.4.2 Results

All modules enable the user to derive nutritional status information for the following basic indicators:

- Weight-for-length/height
- Length/height-for-age
- Weight-for-age
- BMI-for-age

For details on how to interpret each of the nutritional status indicators, users are referred to the WHO Technical Report Series 854, Physical status: the use and interpretation of anthropometry, chapter 5, pp.162-171 (WHO, 1995).

In addition the software derives the fixed BMI (weight in kg divided by length/height in meters squared) for the child and the parent(s) or caretakers.

All modules are designed in preparation for including the next set of standards, which will become available at a later stage: mid-upper arm circumference (MUAC)-for-age, head circumference-for-age, triceps skinfold-for-age, and subscapular skinfold-for-age. For the time being their result fields appear inactive (grey shaded). The Individual assessment and Nutritional survey modules, however, already facilitate the collection of those additional data, i.e. MUAC, head circumference, triceps and subscapular skinfolds. Hence, the user will be able to derive the respective indicators as soon as the standards for these measurements are incorporated into the software.

2.4.3 BMI

The software derives a fixed BMI value based on the measurements of weight in kg divided by length/height in meters squared. This index has been added as it is commonly used to assess nutritional status in older children, adolescents and adults. The fixed BMI is to be distinguished from the BMI-for-age z-score value which appears with the other indicator results. The BMI value is derived based on length for all children younger than 2 years, and on height for children 2 years and older. If a child younger than 2 years has been measured standing – the standard procedure advises measuring in recumbent position – 0.7 cm is added to the child's height and the converted length is used to calculate the fixed BMI. In case a child aged 2 years or older has length measured, 0.7 cm is subtracted to create a height measurement before the fixed BMI is derived. In case the age of the child is unknown the measurement in cm given is used without any conversion to derive the fixed BMI value.

The software also provides the option to derive parents' or caretakers' BMI to assist in interpreting of the child's nutritional status. For details on the measurements and the interpretation of results users are referred to the relevant WHO publications (WHO, 1995; WHO, 2003).

2.4.4 Percentiles and z-scores

The default classification system used to present child nutritional status is that of z-scores or standard deviation (SD) scores. WHO recommends this classification system for its ability to describe nutritional status including at the extreme ends of the distribution and allow derivation of summary statistics, i.e. means and SDs of z-scores (WHO, 1995).

Given the widespread use of percentiles in clinical settings, the software provides the option also to derive and display percentiles. Percentiles are derived based on exact z-scores. Therefore, use of the displayed z-score value (rounded to 2 decimals) to hand-calculate the percentile will yield a slightly discrepant result from that derived by the software.

Indicator z-scores appear as NA for the default standards when:

- child's age is above 60 completed months: all indicators are NA
- child's age is unknown: WAZ, HAZ and BAZ are NA
- child's length is <45 cm: weight-for-length is NA
- child's length is >110 cm and his/her age is less than 24 months: weight-for-length is NA
- child's height is >120 cm: weight-for-height is NA
- child's height is < 65 cm and his/her age is 24 months or older: weight-for-height is NA

Please note that percentiles read "NA" for all values with z-scores <-3 SD and >+3 SD because percentiles beyond ± 3 SD are invariant to changes in equivalent z-scores.

The cut-off points to measure the level of severity using the z-score classification system are for:

- Weight-for-age and length/height-for-age: <-3 SD, <-2 SD, >+2 SD and >+3 SD
- Weight-for-length/height and BMI-for-age: <-3 SD, <-2 SD, <-1 SD, and >+1 SD, >+2 SD and >+3 SD

In the percentile classification system for all indicators the following common cut-offs are used: 3rd, 15th, 50th, 85th and 97th percentiles.

2.4.5 Colour coding

The following colour codes are applied to visually distinguish the different levels of severity:

Colour	Applied to	z-scores	Percentiles
Green	• numeric range	≥ -1 and $\leq +1$ SD	15 th to 85 th percentile
	• graph line	Median	50 th percentile
Gold	• numeric range	≥ -2 and < -1 SD; or $> +1$ and $\leq +2$ SD	3 rd to 15 th or 85 th to 97 th percentile
	• graph line	-1 SD and +1 SD	3 rd and 85 th percentiles
Red	• numeric range	≥ -3 and < -2 SD; or $> +2$ and $\leq +3$ SD	$< 3^{\text{rd}}$ or $> 97^{\text{th}}$ percentiles
	• graph line	-2 SD and +2 SD	3 rd and 97 th percentiles
Black	• numeric range	< -3 or $> +3$ SD	NA*
	• graph line	-3 SD and +3 SD	NA

* NA = not available

2.4.6 Graphs

Graphs enable the observer to visualize the measurement in relation to the growth curves. This feature provides a means of sharing the result with the child's caretaker and also to assess visually the growth pattern over time. Furthermore, in view of the likely continuation of using child growth charts on paper, the graphing option enables the user to double-check that the entry made on the paper chart corresponds to the display on the computer screen.

The user can view the graph for each indicator using either the z-score or percentile classification system.

The graphs display:

- Weight-for-length between 45 and 110 cm
- Weight-for-height between 65 and 120 cm
- Adjacent length-for-age and height-for-age with a vertical line at 2 years of age to mark the separation of length and height; from birth to 5 years (0-60 completed months)
- Adjacent length- and height-based BMI-for-age with a vertical line at 2 years of age to mark the separation of length and height; from birth to 5 years (0-60 completed months)
- Weight-for-age from birth to 5 years (0-60 completed months)

The graphed curves correspond to the common cut-off levels. For the z-score classification system the lines displayed are:

- Weight-for-age and length/height-for-age: -3 SD, -2 SD, median, +2 and +3 SD
- Weight-for-length/height and BMI-for-age: -3 SD, -2 SD, -1SD, median, +1 SD, +2 SD and +3 SD

Note that measurements corresponding to missing z-score values, presented as "NA", are not plotted.

Using the percentile classification system for all indicators the following common cut-off lines are displayed: 3rd, 15th, 50th, 85th and 97th percentile.

Percentile values smaller than 0.135 and beyond 99.865 (equivalent to -3.00 and +3.00 SD) read "NA"; the anthropometric measurements, however, are plotted as long as they fall within the limits of age, cm and kg represented in the respective graphs.

2.4.7 Note on WHO standards versus NCHS reference

In the modules of *Individual assessment* and *Nutritional survey* the user can choose to apply either the WHO standards or the NCHS reference.

Note that the WHO standards are the default setting. Therefore, when the user selects NCHS, saves the record, exits from the module and comes back to the same child record later, the default z-scores that appear will be those based on the WHO standards.

When the NCHS reference is selected, results for weight-for-height can be derived for children up to approximately 11 years (145 cm for boys and 137 cm for girls); and weight-for-age and height-for-age from birth up to 18 years. Given that large age range, the graphs are programmed with an automatic zoom-in function that displays the results on a different scale compared to when using the WHO standards.

No fixed BMI and BMI-for-age are derived when the NCHS reference is selected.

When comparing results based on the WHO standards versus the NCHS reference the user has to bear in mind the different specifications of either, particularly concerning how weight-for-length/height z-scores are derived:

1. If age and type of measurement are known (following the recommended data collection method), WHO standards impose conversion from length (l) to height (h) or vice versa when needed (e.g. if a child younger than 2 years has been measured standing – while the standard procedure would advise to measure in recumbent position – and in case a child is aged 2 years or older but length has been measured), while the NCHS reference does not. A conversion factor of 1.0 cm was recommended for the NCHS reference but was hardly ever applied in the field (WHO, 1995).

Sex	Age group (months)	Type of measurement (l/h) ¹	Conversion	Data tables
WHO standard				
boys and girls	<24	l		Length table 45-110 cm
	<24	h	h + 0.7 cm	Length table 45-110 cm
	≥24	l	l – 0.7 cm	Height table 65-120 cm
	≥24	h		Height table 65-120 cm
NCHS reference				
Boys	<24	l		Length table 49-103 cm
	<24	h	None	Length table 49-103 cm
	≥24	l	None	Height table 55-145 cm
	≥24	h		Height table 55-145 cm
Girls	<24	l		Length table 49-101 cm
	<24	h	None	Length table 49-101 cm
	≥24	l	None	Height table 55-137 cm
	≥24	h		Height table 55-137 cm

¹ l = length; h = height

2. When only age is known but not the type of measurement:

Sex	Age group (months)	Data tables
WHO standard		
boys and girls	<24	Length table 45-110 cm
	≥24	Height table 65-120 cm
NCHS reference		
Boys	<24	Length table 49-103 cm

Sex	Age group (months)	Data tables
girls	≥24	Height table 55-145 cm
	<24	Length table 49-101 cm
	≥24	Height table 55-137 cm

3. When only type of measurement is known but not the age:

Sex	Type of measurement (l/h) ¹	Data tables
WHO standard		
boys and girls	l	Length table 45-110 cm
	h	Height table 65-120 cm
NCHS reference²		
boys		Length table 49-103 cm
		Height table 55-145 cm
girls		Length table 49-101 cm
		Height table 55-137 cm

¹ l = length; h = height

² NCHS reference users without access to software referred to the printed data tables

4. If neither age nor type of measurement is known:

Sex	Length/height (cm)	Data tables
WHO standard		
boys and girls	<87	Length table 45-86.9 cm
	≥87	Height table 87-120 cm
NCHS reference		
boys	<85	Length table 49-84.5 cm
	≥85	Height table 85-145 cm
girls	<85	Length table 49-84.5 cm
	≥85	Height table 85-137 cm

2.4.8 Motor development

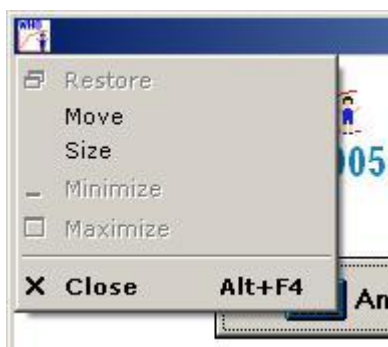
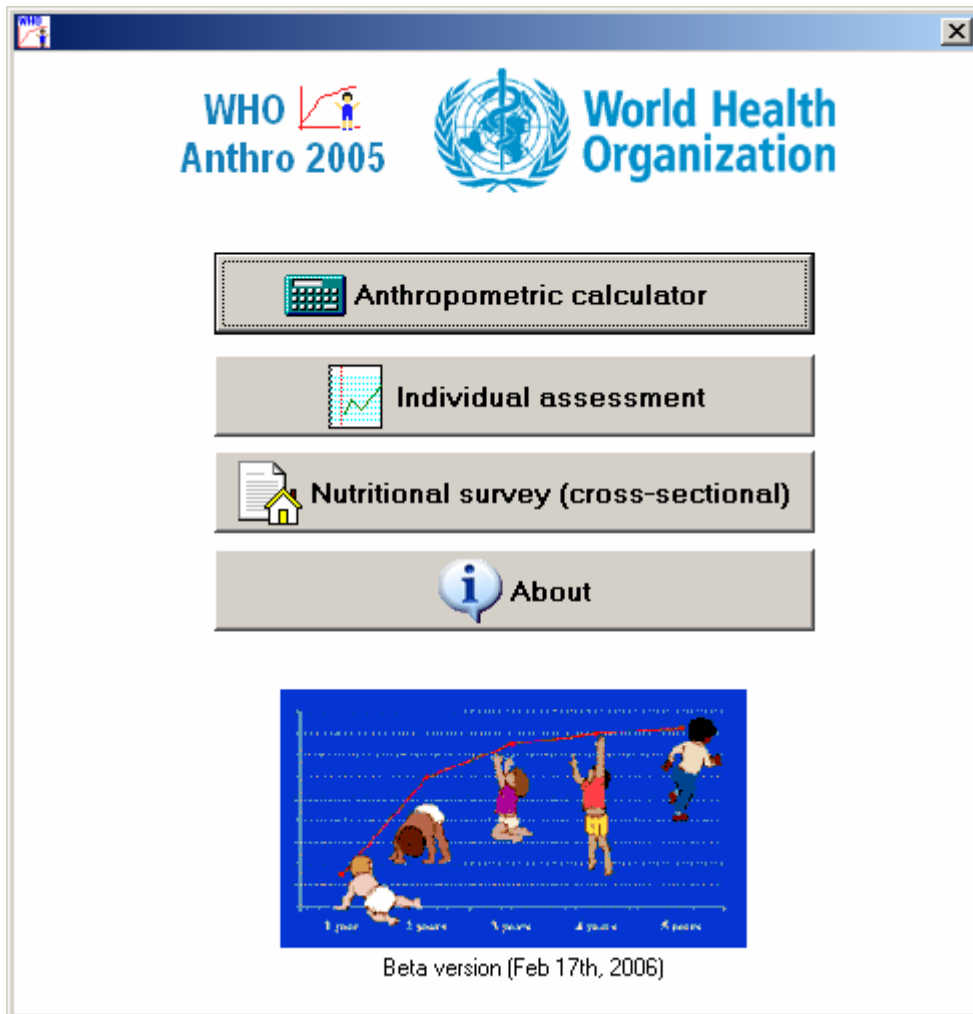
To complement the assessment and monitoring of a child's growth and nutritional status, the modules of the Individual assessment and the Nutritional survey enable the user to collect and analyse children's motor development. Windows of achievement for six gross motor milestones provide an evaluation of achievement status in terms of the following milestones:

1. Sitting without support
2. Standing with assistance
3. Hands-and-knees crawling
4. Walking with assistance
5. Standing alone
6. Walking alone

Use and interpretation of the windows of achievement are explained in detail elsewhere (WHO Multicentre Growth Reference Study Group, 2006).

2.5 Modules: use and functions

Double-clicking on the icon that was created on the desktop in the installation process or double-clicking on the "anthro2005.exe" file takes the user to the main screen of Anthro 2005. On that screen the user has to click on the respective buttons to start the distinct modules.



The icon in the top left corner has also the functions to move, resize and close the programme window.



The button in the top right corner has the common MS Windows function of closing the active window.

2.6 Anthropometric calculator

This module enables the user to derive ad hoc nutritional status information for an individual child based on the WHO standards for the basic anthropometric indicators. You cannot save any information in this module. In case you would like to keep a copy of the screen image, press the <Alt+ Print Screen> keys and paste the image into a MS Word file.

The user can move through the modules using the mouse or <Tab> key (<Shift + Tab> for going back). The module has two tab sheets: *Basic indicators* and *Additional indicators*. The latter is in preparation for the next set of growth standards. Until these are released this Tab window appears grey with all buttons inactive.

The interface of *Basic indicators*

Drop-down function to open calendar

Calculated age – in parentheses in completed months – is based on the entry of exact date of birth (DoB) and date of visit (DoV). i.e. fields above and to the left.

Click here to close and return to main menu.

Weight and height anchor values with scroll up/down buttons

Default radio buttons setting for type of measurement and oedema

Basic indicators and their results in percentiles and z-scores. Indicator names change according to whether the programme uses length or height.

- Percentiles in bar display and number with 1 decimal
- z-score values with 2 decimals

Buttons to open graphic display of measurement

Fixed BMI value based on kg/m^2

Scroll up/down buttons facilitate the entering of DoV and DoB. If the year and month of birth are known but it is impossible to obtain the exact day of birth, the observer is advised to tick the box *Estimated birthday*. The programme then randomizes a day within the given month and year.

Should it be impossible to trace even the month and year of birth, the user is advised to tick the box *Date of birth unknown*. This box is linked to the results and only weight-for-length/height and BMI, i.e. age-independent indicators, will be derived. Whenever this box is ticked the following message appears: "Please check dates!" The same warning message is displayed if the user accidentally enters a DoV that is earlier than a DoB.

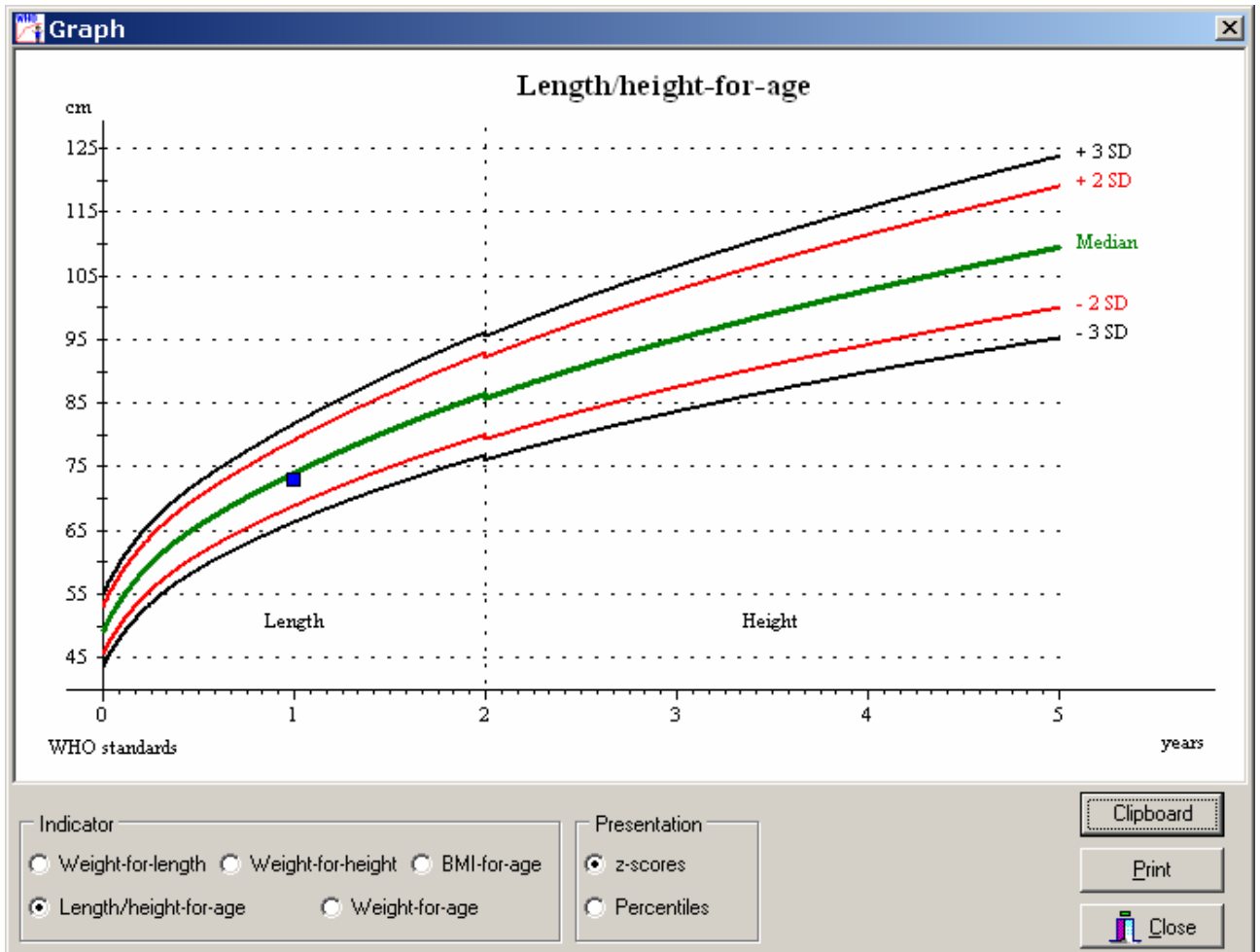
To fill in the weight and length/height data the user can either overwrite the anchor values (i.e. 9.0 kg and 73.0 cm) that appear when the software is opened, or use the scroll up/down buttons to select the exact measurement in cm and kg. The drop-down menu enables selection of measurements with one

decimal (most common level of precision) whereas the manual entering of data allows two decimal places.

The *Results* are displayed for the percentile and the z-score classification system based on the WHO standards. A blue diamond on a yellow bar gives the percentile position of the measurement within the range 0-100%, and to the right of each bar the corresponding percentile value is displayed rounded to one decimal. The next column presents the respective z-score value with two decimals.

Graphs

Clicking on the <Graph> buttons displays the respective measurement in relation to the WHO standards. At the bottom the user can select the indicator and whether to display the measurement relative to z-scores or percentiles.



This image can be sent to a clipboard and then copied into another programme or printed directly.

If a measurement cannot be plotted the message "*Value(s) out of range*" appears above the y-axis if:

1. measurement is outside the plotting range (but possibly valid z-score)
2. z-score is missing
3. z-score is "NA" because raw data are out of the standard tables' ranges (see p.8 **Percentiles and z-scores**)

2.7 Individual assessment

This module enables the collection of longitudinal data of children that are assessed repeatedly. The collected data can comprise both anthropometry and motor development or either alone. Nutritional status data can be derived and displayed based on the WHO standards (default setting) or the NCHS reference.

Besides using the mouse and the <Tab> key, in this module the user can use the <arrow> keys to select options or move within the spreadsheet. After filling data into a field the <Enter> key also moves the cursor to the next field.

Note that in case the user wants only to enter anthropometric data, it is recommended to press the <Tab> key to move through the spreadsheet as the cursor will then directly jump over the Motor milestones (MM) into the next line.

Good data management practice

Always save the results of an action before proceeding to the next step. To activate the calculation click on <Enter> after completing the cells in the spreadsheet. At present there are some example cases entered into the system. To avoid confusion we suggest deleting these cases once you have become familiar with the programme and start entering new child visit data.

Data-entry

Given that data-entry is case-sensitive, users should make sure that the child's first and family names are spelt correctly (i.e. use sentence case). If names have to be corrected later after the record has been saved, it is not possible to overwrite them, and instead the programme will create a new child record. Should this be necessary the user is advised to delete the old, incorrect record to avoid confusion and continue with the correct one. The listing of measured children appears in alphabetical order based on the family name.

Any measurement data from previous visits can be changed when the user opens an existing child record. Note that this can also happen unintentionally. In this case, or if the user is not sure whether an accidental change has been made, s/he is advised to exit the child record without saving and re-open the same record before proceeding to enter any new data. There is no <Undo> button.

Main interface

Spreadsheet for data-entry of child visit data (one row = one visit)

Active list of children with their ID number

Notes field to enter child-specific data (e.g. low birth weight)

Visit-specific clinical information on the child's health status can be added by clicking on this Tab sheet. After entering information in respective visit row always press <Enter> and <Save>.

Child weight and height anchor values can be overwritten or changed using the drop-down menu; similarly, oedema status and type of measurement.

→ Indicates whether WHO standards or NCHS reference is selected.

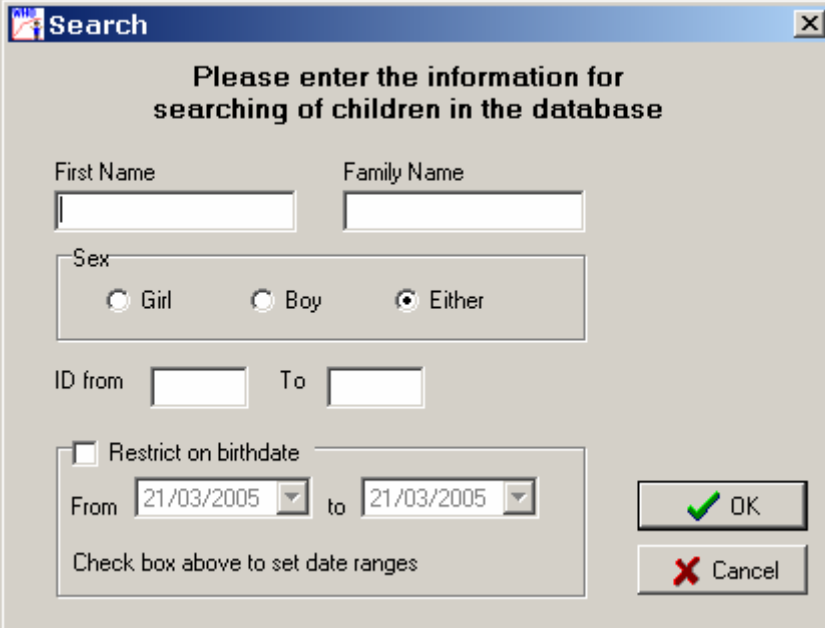
To open the MM data-entry screen click on this cell in the row of the active visit.

Notes

The information entered into the *Notes* field, below the parental BMI, is automatically carried over into the next visit, and when data are exported to Excel, this information will appear in all child record rows. Users are thus advised to enter here information that they would like to see each time the child appears for a visit (e.g. related to the child's birth such as low birth weight (LBW), metabolic disorders such as celiac disease or phenylketonuria).

<Search>

Clicking on the <Search> button below the active list of children opens a separate window (see below) which enables the user to search the active list for children by name, sex, ID and date of birth. Names are case-sensitive; ID and birthdate ranges are inclusive.



The screenshot shows a window titled "Search" with a close button (X) in the top right corner. The main heading inside the window reads "Please enter the information for searching of children in the database". Below this heading are several input fields and controls:

- Two text input fields labeled "First Name" and "Family Name".
- A "Sex" section with three radio buttons: "Girl", "Boy", and "Either". The "Either" option is selected.
- Two text input fields labeled "ID from" and "To".
- A checkbox labeled "Restrict on birthdate" which is currently unchecked.
- Below the checkbox, two date dropdown menus are shown, both displaying "21/03/2005".
- Below the date dropdowns, the text "Check box above to set date ranges" is displayed.
- Two buttons are located on the right side of the window: "OK" (with a green checkmark icon) and "Cancel" (with a red X icon).

<List All>

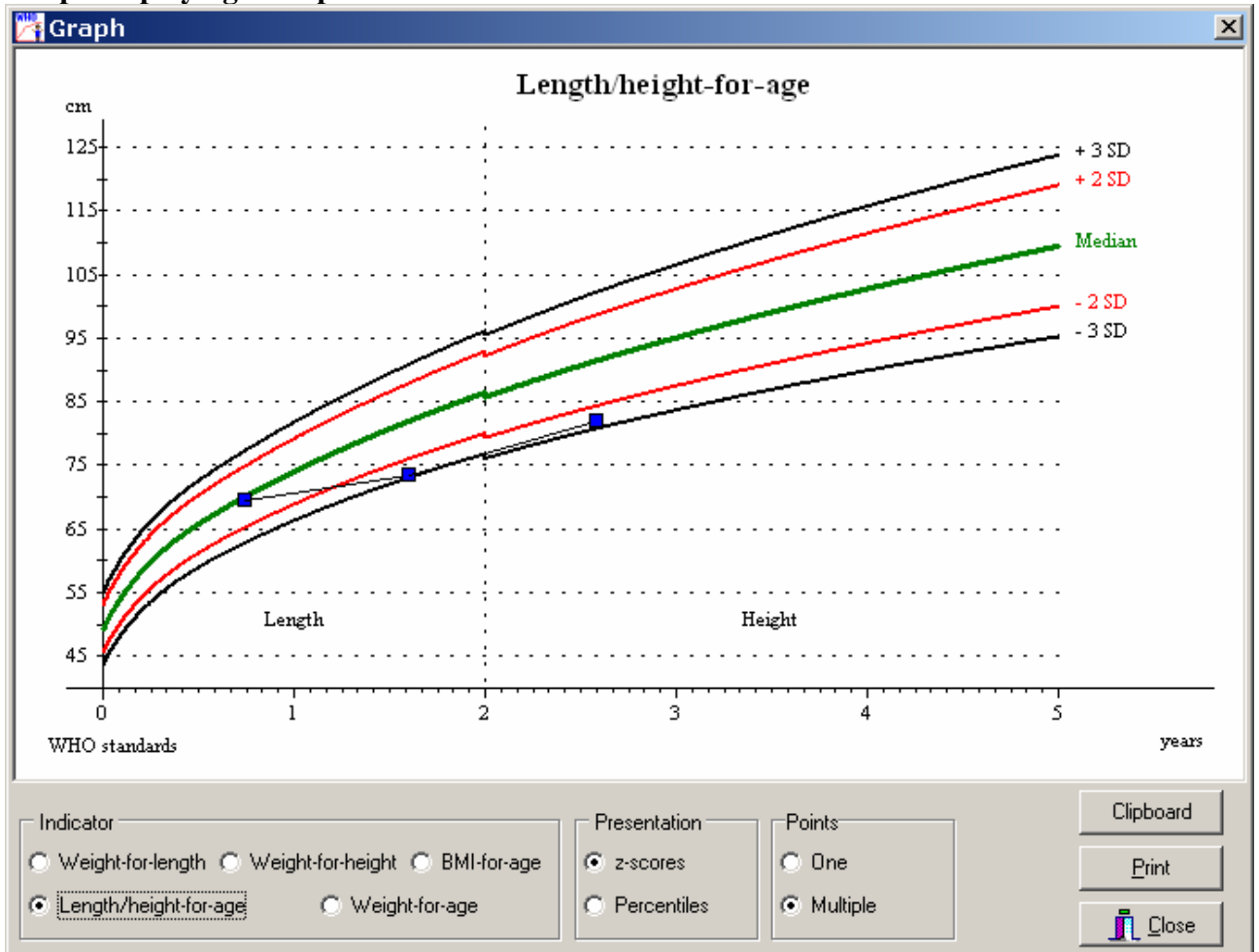
After a search click on the <List All> button to return to the list of all active children.

Results

The *Results* – in z-scores and percentiles – are displayed in the lower section of the window in the same way as in the *Anthropometric calculator*. The *Graph* button in this module enables the user to choose a display of single (active visit) or multiple measurements (including data from other visits), and z-scores or percentiles (see image below). If any of the visits has measurements that are out of range, a message saying "*Value(s) out of range*" appears in the top left corner of the graph and only the valid measurements are plotted.

Note: Don't click the multiple point option if data for one visit only are available. This can trigger an error message. If that happens click <OK> to close the error message window and to return to the menu.

Graph displaying multiple measurements

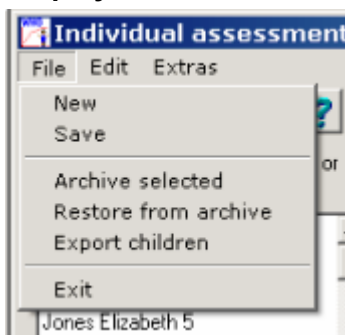


The user can print the graph or copy it to a clipboard and then paste the image into other software programmes. To produce graphs based on the NCHS reference, the user has to first change (in *Options*) the default setting of the WHO standards to the NCHS reference and then click on the *Graph* button. How to do this is explained in the *File* menu options below.

File menu options

The following functions can be started by clicking on the *File* menu options.

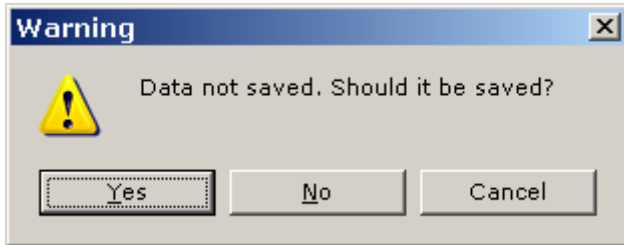
Display



Option	Function
New	→ Opens a new, blank record
Save	→ Saves a newly entered or updated child record
Archive	→ Moves a selected child from the active list into the archive
Restore	→ Moves one or several children from the archive back into the active list
Export	→ Exports all children of the active list with their information and results to an Excel file
Exit	→ Closes the <i>Individual assessment</i> module and returns the user to the main menu

To enter data on a new child, the user can overwrite the anchor values directly or use the drop-down menu to fill in the cells with the measurement results. In order to clear the first line in the spreadsheet with the anchor values place the cursor in any cell in that line and select <Edit> and <Delete line>, and then proceed to enter the new visit data.

Clicking the <Save> function on the file menu is one way to save the active record. As a safeguard the software warns the user on closing the module in case the data have not been saved (see image below).



An archive function enables users to take children off the active list, i.e. one child at a time. There is no space limit in the archive, but the user should be aware that operations may take longer to perform on this file as its size increases.

Children's records can be restored from the archive back into the active list by using the *Restore* function.

The Export children function, by default, exports the data of all children currently on the active list. This function uses the default selection of the results based on the WHO standards. The exported Excel file contains all basic data, the raw measurements including *Notes* and *Additional clinical data*, and results of anthropometric and motor development assessment. The motor milestones data are exported in 12 columns coded "n=No" and "y=Yes" to indicate for each of the six motor milestones whether it has been "Assessed" and "Observed".

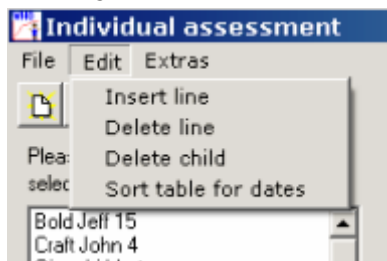
Note: Once a milestone has been achieved, i.e. the response is "y" in the "Observed" column, all subsequent visits will carry "n" for the "Assessed" column and "y" for the "Observed" column, respectively, because having been observed it is not reassessed.

If the user wants to print the follow-up visit data of one child only, the recommended way is to select the print icon on the menu while the child's record is open. This function creates a file in rich text format containing all the anthropometric visit data and indicator results pertaining to the child. This file can then be saved in *.doc, *.html, *.txt or other formats. The same function can be used to save the results of a child's nutritional status based on the NCHS reference.

Edit menu options

The functions in the *Edit* menu refer to actions within the spreadsheet and are self-explanatory.

Display



Option

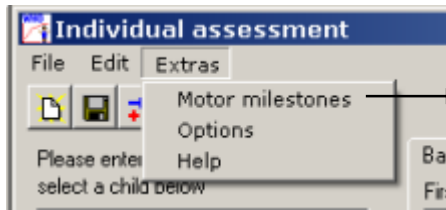
- Insert line
- Delete line
- Delete child
- Sort table for dates

Function

- Adds a line (e.g. to insert an earlier visit)
- Deletes a visit entry in the active child record
- Deletes the entire child record
- Sorts the spreadsheet by date of visit

Extras menu options

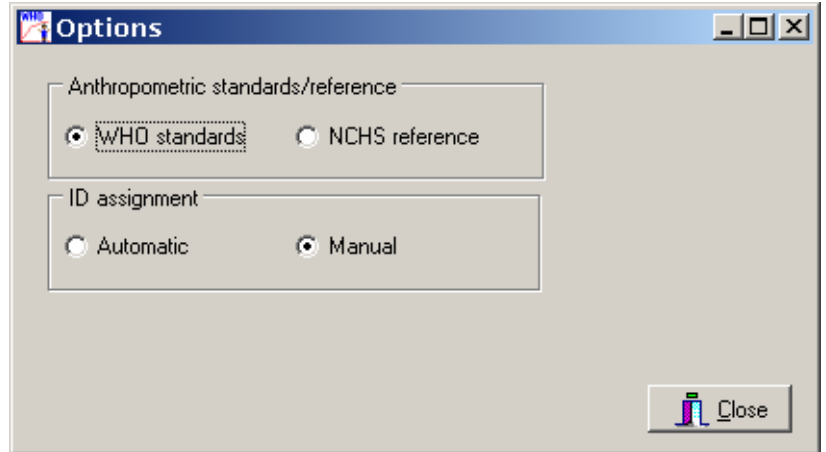
Under *Extras* the user can select the following functions:



Shortcut to the *Motor milestones* data-entry page

The *Options* enable the user to:

- Select the NCHS reference for deriving results
- Choose manual or automatic ID assignment in data-entry



Menu icons

To facilitate the most common operations, a number of icons have been included under the menu options to provide convenient shortcuts.

Icon Function



Opens new child record



Saves active child record



Inserts an empty line in the spreadsheet



Deletes active line in the spreadsheet



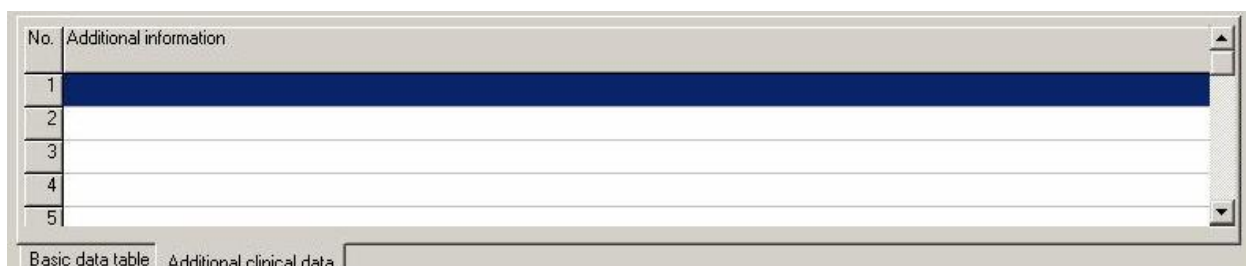
Deletes open child record



Prints active (open) child record

Additional clinical data

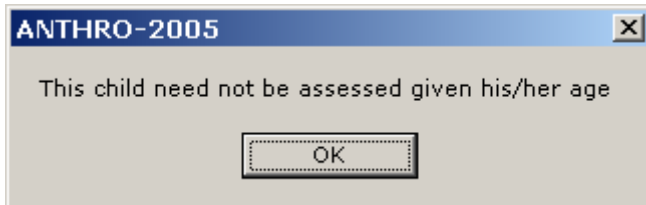
Clicking on the tab at the bottom opens the spreadsheet designed for entering visit-specific, additional clinical data, such as the child having diarrhoea, his/her vaccination status, specific micronutrient deficiencies, or receiving food aid (line No. 1 corresponds to visit 1, line No. 2 to visit 2 etc.). This field can also be used to include information on referral and follow-up action or the child's level of cooperation. After entering the text information press <Enter> or use file menu option to save the information before moving back to the *Basic data table*.



Individual child motor development assessment

To open the MM data-entry screen either the user can click the respective cell on the *Basic data table* – e.g. after entering the anthropometry data – or click on the shortcut under the *Extras* menu (as outlined above).

The data-entry for assessing MM in children is programmed with fixed upper age limit, i.e. if a child is 24 months or older the following message appears:



Once a child (commonly between 3 and 24 months of age) has been assessed for a MM and all the criteria are met, a milestone is saved as "observed" and this status is carried over to the subsequent visits. The software allows the user two forms of resetting an assessed and observed milestone:

- **on the spot**, if at a current visit, the user clicks on all criteria as met, confirms the achievement of the motor milestone, but then decides that this is not correct and s/he wishes to alter this information;
- **retrospectively**, if a milestone has been observed at previous visits and saved as achieved, but at present the child demonstrates a questionable state of attainment. In this case, the reset action resets the current visit entry of this milestone and backwards to the visit of its first observed achievement.

At each visit, the user is able to summarize the child's achievement status of the six motor milestones by clicking *<Results/graph>* to obtain an overview of the windows of achievement. These are broad bands, 5 to 10 months wide, to signal normal variation in the achievement of those milestones among healthy children. The windows are colour-coded to visualize the child's achievement status.

The colour scheme is as follows:

Grey: Not assessed or child uncooperative

Blue: Assessed but not observed and child's age below or within milestone's window

Red: Assessed but not observed and child's age above milestone's window

Green: Assessed and observed and child's age below or within milestone's window

Lime: Assessed and observed and child's age above milestone's window (or a former "Red")

Rose: Not assessed and a former "Red"

The example below shows step by step how to enter some anthropometric measurements and MM data of an individual child. Start with opening the *Individual assessment* module.

Enter the "First" and "Family" names for a new child, e.g. [Jane] and [Smith] born [14/02/2005]. The *Date of visit* defaults to the current date of the form -- in this example, "31/08/2005". Jane weighs 9 kg, has no oedema, measured 73 cm and the measurement is taken in recumbent position. The farthest column on the display labelled "*Motor Milestones*" shows that at present, zero assessments have been made and hence zero milestones observed "0 ass, 0 obs".

Individual assessment

Please enter data for a new child or select a child below

Craft John 4
Johnson Michael 9
Jones Elizabeth 5
Kafunga Moto 10
Meyer Joanne 7
Miller David 3
Mitchell Jennifer 6

Search List All

Basic data Parent/caretaker Address

First name: Jane
Family name: Smith
Date of birth: 14/2/2005
Estimated birthday:
Date of birth unknown:
Age: 0 yr, 6 mo (6 mo)
Female: Male:
ID no.: 12

Parental BMI

	Weight (kg)	Height (cm)	BMI
Mother	0.0	0.0	
Father	0.0	0.0	

Notes

No.	Date of visit	Observer ID	Wt (kg)	Oedema (y/n)	Measure (l/h)	Ln/Ht (cm)	MUAC (cm)	HC (cm)	TSF (mm)	SSF (mm)	Motor milestones click cell below
1	31/08/2005		9.0	n		73.0					0 ass., 0 obs.
2											
3											
4											
5											

Basic data table Additional clinical data

The following WHO child growth standards are not yet available

	Percentile	z-score	Graph		Percentile	z-score	Graph
Weight-for-length	61.4	0.29	Graph	MUAC-for-age	0		Graph
Length-for-age	99.8	2.82	Graph	HC-for-age	0		Graph
Weight-for-age	93.4	1.51	Graph	TSF-for-age	0		Graph
BMI-for-age (16.9)	49.4	-0.02	Graph	SSF-for-age	0		Graph







Click on the cell in this column to start entering the motor milestone assessment data.

The example of this child is already entered into the software. You can follow the steps in this example entering another name and then compare the results or else just look at the results by clicking on the respective MM cell of each visit.

Visit 1 (31/08/2005)

Motor milestones


Examination Date: 31/08/2005 Age: 6.5 Months Motor milestones Result/graph Close

<p>Sitting without support <input type="checkbox"/> Assessed <input type="checkbox"/> Observed <input type="button" value="Reset"/></p>  <p>Child sits up straight with her/his head erect for at least 10 seconds. <input type="checkbox"/></p> <p>S/he does not use arms or hands to balance body or support position. <input type="checkbox"/></p>	<p>Walking with assistance <input type="checkbox"/> Assessed <input type="checkbox"/> Observed <input type="button" value="Reset"/></p>  <p>Child is in upright position with her/his back straight. <input type="checkbox"/></p> <p>Child makes sideway or forward steps by holding onto a stable object (furniture) with one or both <input type="checkbox"/></p> <p>One leg moves forward while the other supports part of the body weight. <input type="checkbox"/></p> <p>Child takes at least five steps in this manner. <input type="checkbox"/></p>
<p>Standing with assistance <input type="checkbox"/> Assessed <input type="checkbox"/> Observed <input type="button" value="Reset"/></p>  <p>Child stands in upright position on both feet, holding onto a stable object (e.g. furniture) with both hands without leaning on it. <input type="checkbox"/></p> <p>Her/his body does not touch the stable object, and the legs support most of her/his body weight. <input type="checkbox"/></p> <p>Child thus stands with assistance for at least 10 seconds. <input type="checkbox"/></p>	<p>Standing alone <input type="checkbox"/> Assessed <input type="checkbox"/> Observed <input type="button" value="Reset"/></p>  <p>Child stands in upright position on both feet (not on the toes) with the back straight. <input type="checkbox"/></p> <p>Her/his legs support 100% of the child's weight. <input type="checkbox"/></p> <p>There is no contact with person or object. <input type="checkbox"/></p> <p>Child stands alone for at least 10 seconds. <input type="checkbox"/></p>
<p>Hands-and-knees crawling <input type="checkbox"/> Assessed <input type="checkbox"/> Observed <input type="button" value="Reset"/></p>  <p>Child alternately moves forward or backward on hands and knees. <input type="checkbox"/></p> <p>Her/his stomach does not touch the supporting surface. <input type="checkbox"/></p> <p>There is continuous and consecutive movements, at least three in a row. <input type="checkbox"/></p>	<p>Walking alone <input type="checkbox"/> Assessed <input type="checkbox"/> Observed <input type="button" value="Reset"/></p>  <p>Child takes at least five steps independently in upright position with the back straight. <input type="checkbox"/></p> <p>One leg moves forward while the other supports most of the body weight. <input type="checkbox"/></p> <p>There is no contact with person or object. <input type="checkbox"/></p>

The screen above presents an overview of the current status for the six gross motor milestones. The display shows the current examination date, age of the child in months and, for each milestone, a small picture depicting it adjacent to its achievement criteria. In this example, the child is 6.5 months old and she is eligible for assessment of all six motor milestones.

During the current visit the child was assessed for the milestone *Sitting without support* and she successfully met the two criteria outlined. The user clicks on the <Assessed> tick-box, which enables the criteria boxes; those are clicked in turn and the user is prompted with the message below.

Confirm

 Has the child achieved all the criteria listed for this milestone?


The user clicks on <Yes> and the entries are accepted. The user can progress to assess the other milestones as the following window indicates.

Motor milestones

Examination Date: 31/08/2005 Age: 6.5 Months Motor milestones

Result/graph Close


Sitting without support Assessed Observed



Child sits up straight with her/his head erect for at least 10 seconds.

S/he does not use arms or hands to balance body or support position.

Walking with assistance Assessed Observed




Child is in upright position with her/his back straight.

Child makes sideways or forward steps by holding onto a stable object (furniture) with one or both

One leg moves forward while the other supports part of the body weight.

Child takes at least five steps in this manner.

Standing with assistance Assessed Observed




Child stands in upright position on both feet, holding onto a stable object (e.g. furniture) with both hands without leaning on it.

Her/his body does not touch the stable object, and the legs support most of her/his body weight.

Child thus stands with assistance for at least 10 seconds.

Standing alone Assessed Observed




Child stands in upright position on both feet (not on the toes) with the back straight.

Her/his legs support 100% of the child's weight.

There is no contact with person or object.

Child stands alone for at least 10 seconds.

Hands-and-knees crawling Assessed Observed




Child alternately moves forward or backward on hands and knees.

Her/his stomach does not touch the supporting surface.

There is continuous and consecutive movements, at least three in a row.

Walking alone Assessed Observed



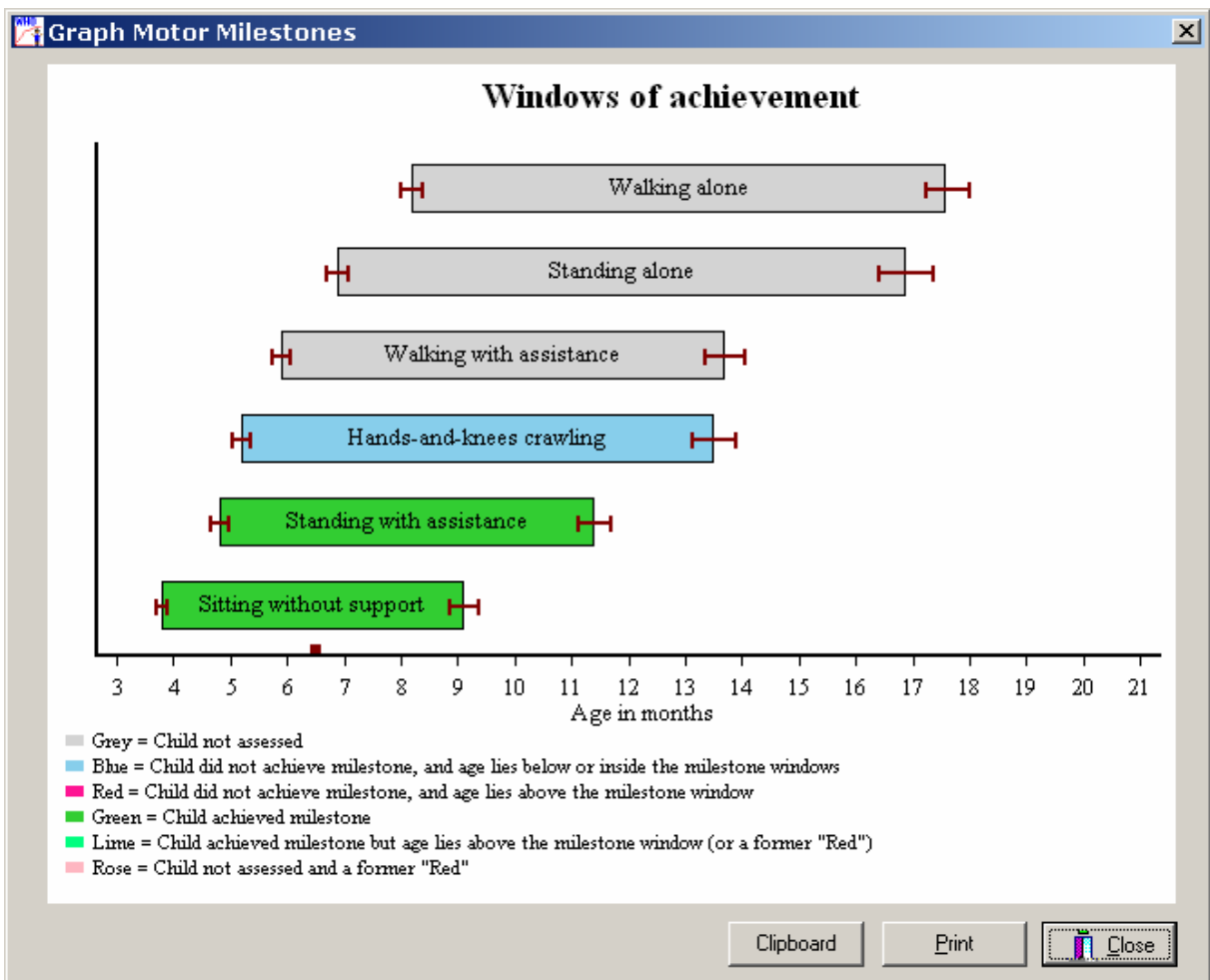
Child takes at least five steps independently in upright position with the back straight.

One leg moves forward while the other supports most of the body weight.

There is no contact with person or object.

The child also met the achievement criteria of the second milestone, *Standing with assistance*, but only one criterion of the milestone *Hands-and-knees crawling*. If only a few criteria are fulfilled the programme discards this information once the window is closed and retains only that the milestone was assessed. At the present visit, the child is too young to be assessed for the remaining milestones and the observer stops here.

The user can summarize the child's achievement thus far by clicking on the <Result/graph> icon (top right-hand side).



The *Windows of achievement* summarize the child's current achievement status. The red cursor on the x-axis indicates the child's age at examination (6.5 months). The colour scheme indicates that milestones *Walking with assistance*, *Standing alone* and *Walking alone* were not assessed (grey); milestone *Hands-and-knees crawling* was assessed but has not been achieved and the age of the child lies below or inside the window (blue); and milestones *Standing with assistance* and *Sitting without support* are achieved within the designated windows of achievement (green). The user can copy the graph onto the clipboard or print it directly.

Visit 2 (28/04/2006)

The second assessment of the child takes place 8 months later (dated 28/04/2006) and she is now 14.3 months old.

Individual assessment
x

File Edit Extras

Individual assessment

Please enter data for a new child or select a child below

- Craft John 4
- Johnson Michael 9
- Jones Elizabeth 5
- Kafunga Moto 10
- Meyer Joanne 7
- Miller David 3
- Mitchell Jennifer 6

Basic data | Parent/caretaker | Address

First name:

Family name:

Female Male

ID no.:

Date of birth: 14 / 2 / 2005

Estimated birthday

Date of birth unknown

Age: 1 yr, 2 mo (14 mo)

Parental BMI

	Weight (kg)	Height (cm)	BMI
Mother	<input type="text" value="0.0"/>	<input type="text" value="0.0"/>	<input type="text" value=""/>
Father	<input type="text" value="0.0"/>	<input type="text" value="0.0"/>	<input type="text" value=""/>

Notes:

No.	Date of visit	Observer ID	Wt (kg)	Oedema (y/n)	Measure (l/h)	Ln/Ht (cm)	MUAC (cm)	HC (cm)	TSF (mm)	SSF (mm)	Motor milestones click cell below
1	31/08/2005		9.0	n		73.0					3 ass., 2 obs.
2	28/04/2006		10.2	n		79.3					0 ass., 2 obs.
3											
4											
5											

Basic data table | **Additional clinical data**

The following WHO child growth standards are not yet available

Percentile				z-score				
Weight-for-length		60.9	0.28	<input type="button" value="Graph"/>	MUAC-for-age		0	<input type="button" value="Graph"/>
Length-for-age		82.0	0.91	<input type="button" value="Graph"/>	HC-for-age		0	<input type="button" value="Graph"/>
Weight-for-age		72.5	0.60	<input type="button" value="Graph"/>	TSF-for-age		0	<input type="button" value="Graph"/>
BMI-for-age (16.2)		54.3	0.11	<input type="button" value="Graph"/>	SSF-for-age		0	<input type="button" value="Graph"/>
WHO standards 0 25 50 75 100				0 25 50 75 100				


The *Motor milestones* cell for the visit row indicates the current status of the milestones as "0 ass, 2 obs." – clicking on the cell launches the overview window which shows that the child is eligible for assessment of 4 milestones, given that 2 have already been achieved.

Motor milestones

Examination Date: 28/04/2006 Age: 14.3 Months Motor milestones


Result/graph Close

Sitting without support Assessed Observed




- Child sits up straight with her/his head erect for at least 10 seconds.
- S/he does not use arms or hands to balance body or support position.

Walking with assistance Assessed Observed




- Child is in upright position with her/his back straight.
- Child makes sideway or forward steps by holding onto a stable object (furniture) with one or both
- One leg moves forward while the other supports part of the body weight.
- Child takes at least five steps in this manner.

Standing with assistance Assessed Observed




- Child stands in upright position on both feet, holding onto a stable object (e.g. furniture) with both hands without leaning on it.
- Her/his body does not touch the stable object, and the legs support most of her/his body weight.
- Child thus stands with assistance for at least 10 seconds.

Standing alone Assessed Observed




- Child stands in upright position on both feet (not on the toes) with the back straight.
- Her/his legs support 100% of the child's weight.
- There is no contact with person or object.
- Child stands alone for at least 10 seconds.

Hands-and-knees crawling Assessed Observed



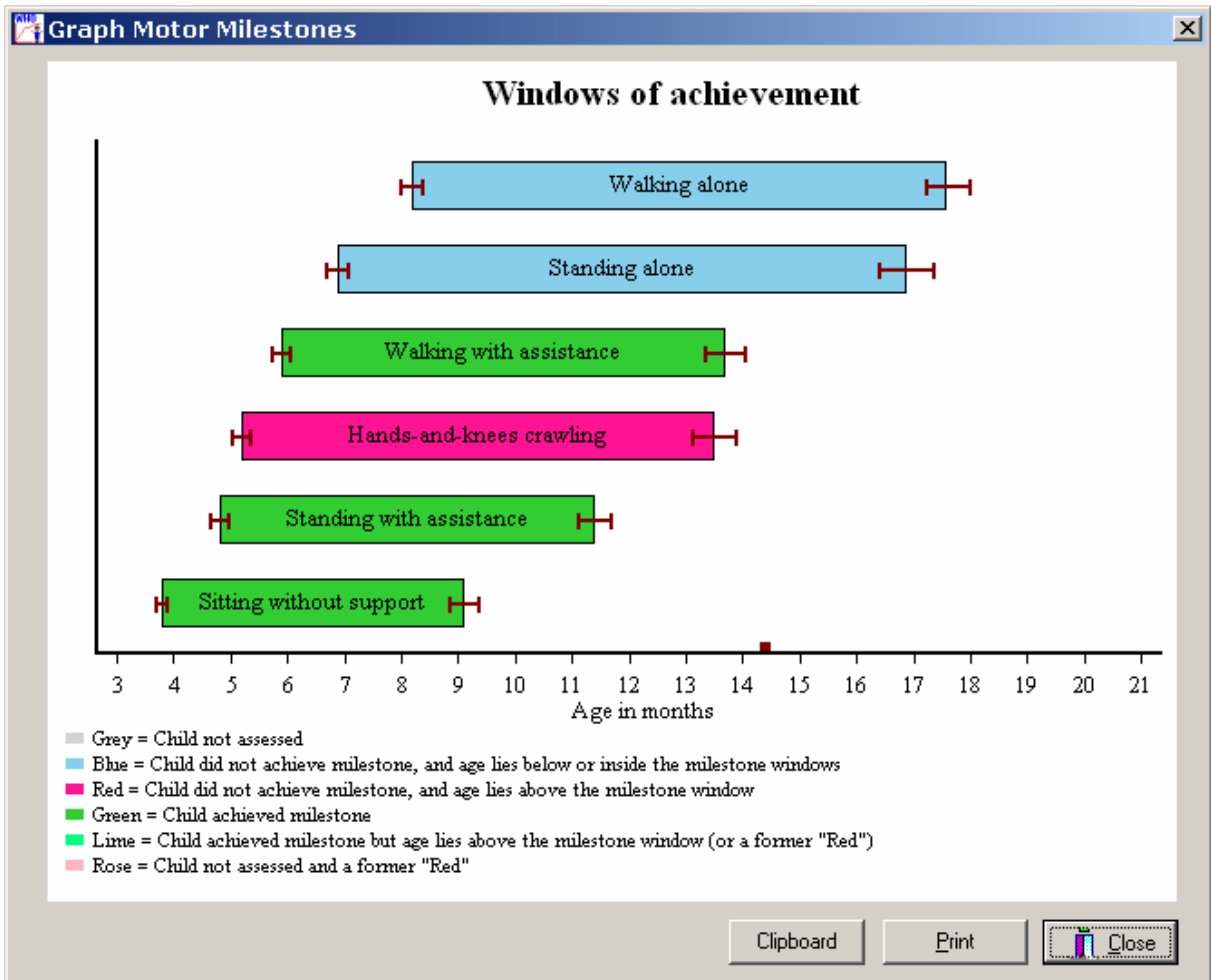
- Child alternately moves forward or backward on hands and knees.
- Her/his stomach does not touch the supporting surface.
- There is continuous and consecutive movements, at least three in a row.

Walking alone Assessed Observed



- Child takes at least five steps independently in upright position with the back straight.
- One leg moves forward while the other supports most of the body weight.
- There is no contact with person or object.

The child was assessed and was able to meet two of the three criteria required for milestones *Hands-and-knees crawling*, and *Standing alone*, 1 of the three criteria for the milestone *Walking alone* and the full criteria of the milestone *Walking with assistance*. Clicking on the <Result/graph> icon, the following graph appears.



The graph indicates that the child achieved the milestone *Walking with assistance*, but not *Standing alone* or *Walking alone* (which is normal at her age). The other two unachieved milestones are coloured blue because the child's age is below their upper age boundaries. As she is still not able to perform *Hands-and-knees crawling* and her age is above the upper limit expected for this milestone, the window is coloured red.

Note: About 4.3% of the children in the WHO Multicentre Growth Reference Study were never observed to crawl on hands and knees. Other studies also report that this milestone is sometimes not performed and that instead some other type of locomotion is used, such as bottom shuffling or crawling on the belly (WHO Multicentre Growth Reference Study Group, 2006).

The user can close the graph and the overview windows to proceed to enter a third visit.

Visit 3 (28/07/2006)

The child returns for her third visit (dated 28/07/2006), aged 17.3 months, and has three milestones remaining to be assessed.

Individual assessment

File Edit Extras

Individual assessment

Please enter data for a new child or select a child below

Craft John 4
Johnson Michael 9
Jones Elizabeth 5
Kafunga Moto 10
Meyer Joanne 7
Miller David 3
Mitchell Jennifer 6

Search List All

Basic data Parent/caretaker Address

First name: Jane
Date of birth: 14/02/2005
Family name: Smith
Estimated birthday:
Date of birth unknown:
Age: 1 yr, 5 mo (17 mo)
Female: Male:
ID no.: 12

Parental BMI
Mother: Weight (kg) 0.0 Height (cm) 0.0 BMI
Father: Weight (kg) 0.0 Height (cm) 0.0 BMI
Notes:

No.	Date of visit	Observer ID	Wt (kg)	Oedema (y/n)	Measure (l/h)	Ln/Ht (cm)	MUAC (cm)	HC (cm)	TSF (mm)	SSF (mm)	Motor milestones click cell below
1	31/08/2005		9.0		n	l	73.0				3 ass., 2 obs.
2	28/04/2006		10.2		n	l	79.3				4 ass., 3 obs.
3	28/07/2006		11.9		n	l	80.7				0 ass., 3 obs.
4											
5											

Basic data table Additional clinical data







The following WHO child growth standards are not yet available

	Percentile	z-score	Graph		Percentile	z-score	Graph
Weight-for-length		95.0 1.64	Graph	MUAC-for-age	0	0	Graph
Length-for-age		58.7 0.22	Graph	HC-for-age	0	0	Graph
Weight-for-age		90.4 1.30	Graph	TSF-for-age	0	0	Graph
BMI-for-age (18.3)		94.9 1.64	Graph	SSF-for-age	0	0	Graph

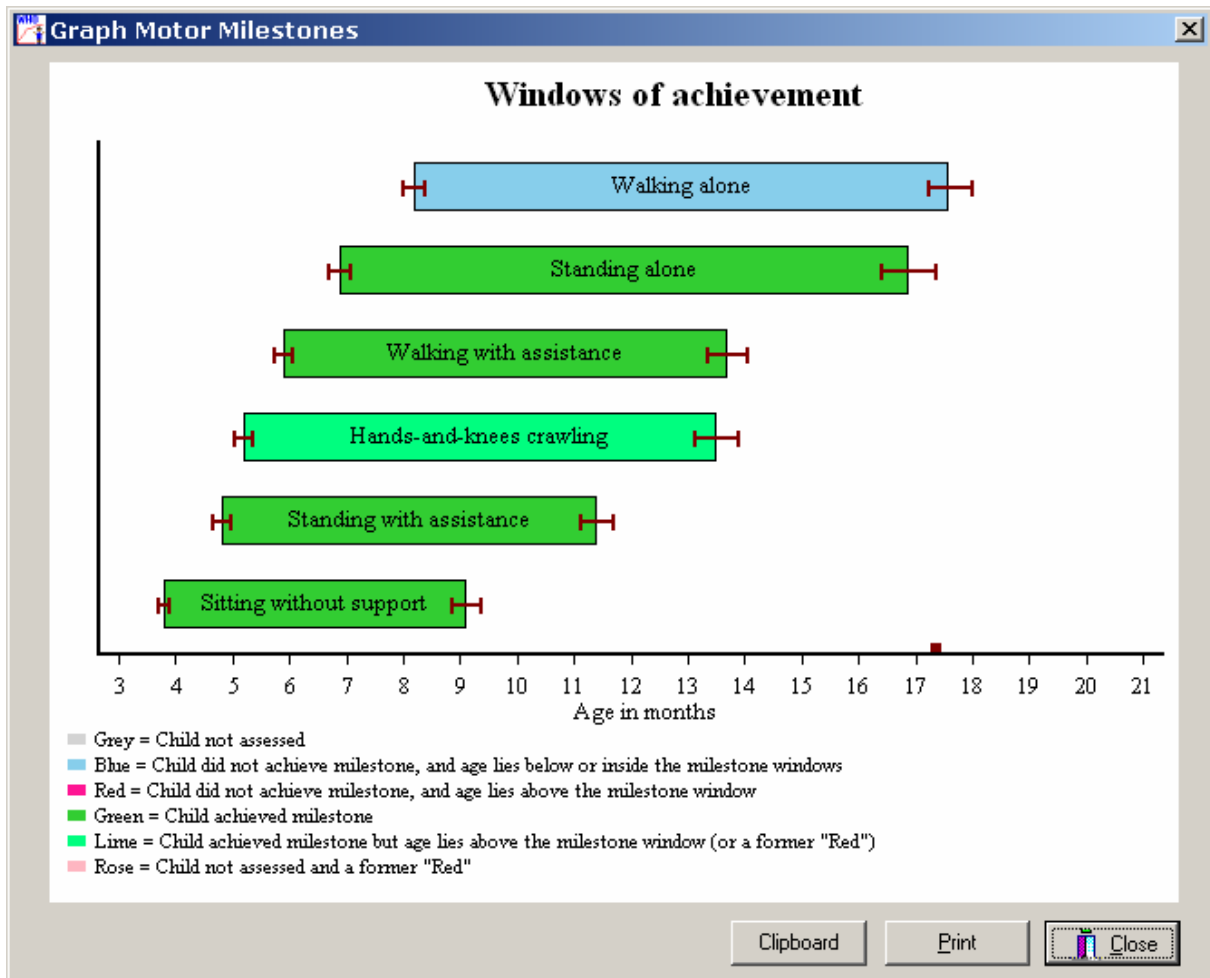
WHO standards 0 25 50 75 100

Clicking on the MM cell indicating 0 ass., 3 obs. opens the data-entry sheet.

She can now successfully crawl on hands-and-knees and stand alone, but not yet walk alone according to the set criteria.

Motor milestones	
Examination Date: 28/07/2006	Age: 17.3 Months
<input checked="" type="checkbox"/> Result/graph <input type="checkbox"/> Close	
Sitting without support <input type="checkbox"/> Assessed <input checked="" type="checkbox"/> Observed <input type="button" value="Reset"/>	Walking with assistance <input type="checkbox"/> Assessed <input checked="" type="checkbox"/> Observed <input type="button" value="Reset"/>
 <p>Child sits up straight with her/his head erect for at least 10 seconds. <input checked="" type="checkbox"/></p> <p>S/he does not use arms or hands to balance body or support position. <input checked="" type="checkbox"/></p>	 <p>Child is in upright position with her/his back straight. <input checked="" type="checkbox"/></p> <p>Child makes sideways or forward steps by holding onto a stable object (furniture) with one or both hands. <input checked="" type="checkbox"/></p> <p>One leg moves forward while the other supports part of the body weight. <input checked="" type="checkbox"/></p> <p>Child takes at least five steps in this manner. <input checked="" type="checkbox"/></p>
Standing with assistance <input type="checkbox"/> Assessed <input checked="" type="checkbox"/> Observed <input type="button" value="Reset"/>	Standing alone <input checked="" type="checkbox"/> Assessed <input checked="" type="checkbox"/> Observed <input type="button" value="Reset"/>
 <p>Child stands in upright position on both feet, holding onto a stable object (e.g. furniture) with both hands without leaning on it. <input checked="" type="checkbox"/></p> <p>Her/his body does not touch the stable object, and the legs support most of her/his body weight. <input checked="" type="checkbox"/></p> <p>Child thus stands with assistance for at least 10 seconds. <input checked="" type="checkbox"/></p>	 <p>Child stands in upright position on both feet (not on the toes) with the back straight. <input checked="" type="checkbox"/></p> <p>Her/his legs support 100% of the child's weight. <input checked="" type="checkbox"/></p> <p>There is no contact with person or object. <input checked="" type="checkbox"/></p> <p>Child stands alone for at least 10 seconds. <input checked="" type="checkbox"/></p>
Hands-and-knees crawling <input checked="" type="checkbox"/> Assessed <input checked="" type="checkbox"/> Observed <input type="button" value="Reset"/>	Walking alone <input checked="" type="checkbox"/> Assessed <input type="checkbox"/> Observed <input type="button" value="Reset"/>
 <p>Child alternately moves forward or backward on hands and knees. <input checked="" type="checkbox"/></p> <p>Her/his stomach does not touch the supporting surface. <input checked="" type="checkbox"/></p> <p>There is continuous and consecutive movements, at least three in a row. <input checked="" type="checkbox"/></p>	 <p>Child takes at least five steps independently in upright position with the back straight. <input checked="" type="checkbox"/></p> <p>One leg moves forward while the other supports most of the body weight. <input checked="" type="checkbox"/></p> <p>There is no contact with person or object. <input type="checkbox"/></p>

Clicking on the *Results/graph*, it indicates the child's current status. As she can now successfully *crawl on hands-and-knees* the window appears lime-coloured to indicate that the achievement age was *outside* its window; and she can successfully *Stand alone*, but not yet *Walk alone* according to the set criteria, so the respective window colours are green and blue.



As for this example, the user may wish to complete the child's motor milestones assessment at the next visit.

Notes on the assessment of the motor milestones:

- The recommended ages for motor assessment are 3 to 24 months.
- Even though the x-axis on the graph is presented only up to 21 months – which is already beyond the upper-most confidence bound – the display functions for children up to 24 months.
- The functionality of the <Reset> button allows the user to correct a previous or current entry of an "Assessed" and "Observed" milestone. Note that if a milestone is "Assessed" but not "Observed", the <Reset> button remains "disabled" i.e. grey-shaded. If at a later visit an assessed and observed milestone needs to be reset, the user has to click on the <Reset> button and s/he will be prompted with a message: "*You are about to reset an observed milestone, Yes or No?*" Clicking on <Yes> will reset that milestone to unobserved for all visits between the "Observed (visit date)" and the present date. This change will be reflected in the overview MM graph depending on the age of the child at the visit the reset took place. If the child's age is below or within the reset milestone window, it will appear blue; if the child's age is above the upper bound of the reset milestone window, it will appear red. The status of the reset milestone will remain "Assessed" **but not** "Observed" until in a subsequent visit, ideally, the milestone is "Assessed" **and** "Observed". The new status information is then saved and carried forward until the end of the follow-up period.

To enter data for a new child always select the menu option <File → New>. In case an existing child's record is already activated there is a risk that the entered data will overwrite the information of the active child and the data of this child will be lost.

2.8 Nutritional survey

This module enables the user to collect nutritional survey data, to open already existing surveys, to import old survey data files in dBase (.dbf) and EpiInfo (.rec) formats, to analyse the data, and to produce a standardized output of analysis results. It contains various options which allow the user to tailor the analysis output to specific needs.

To move through the module one can either use the <Tab> key (<Shift+Tab> to go back) or the <Enter> key. The latter also activates the updating of any calculation process.

Good practice

It is recommended always to save any action performed before proceeding to the next step. This is particularly important before running any analysis of data either imported or opened to which the user has made any changes after the import/open process.

If a data file contains many variables, it is recommended to import – or copy and paste – into Anthro 2005 only the relevant data variables needed for deriving z-scores and then export the data back to Excel or use the copy and paste function to add the resulting z-scores to the original file. In case the user wants to run an analysis of only a data subset, e.g. a selected age group, s/he should import only the data needed for this specific analysis. This is quicker and less cumbersome than importing big data files and then using the filter function.

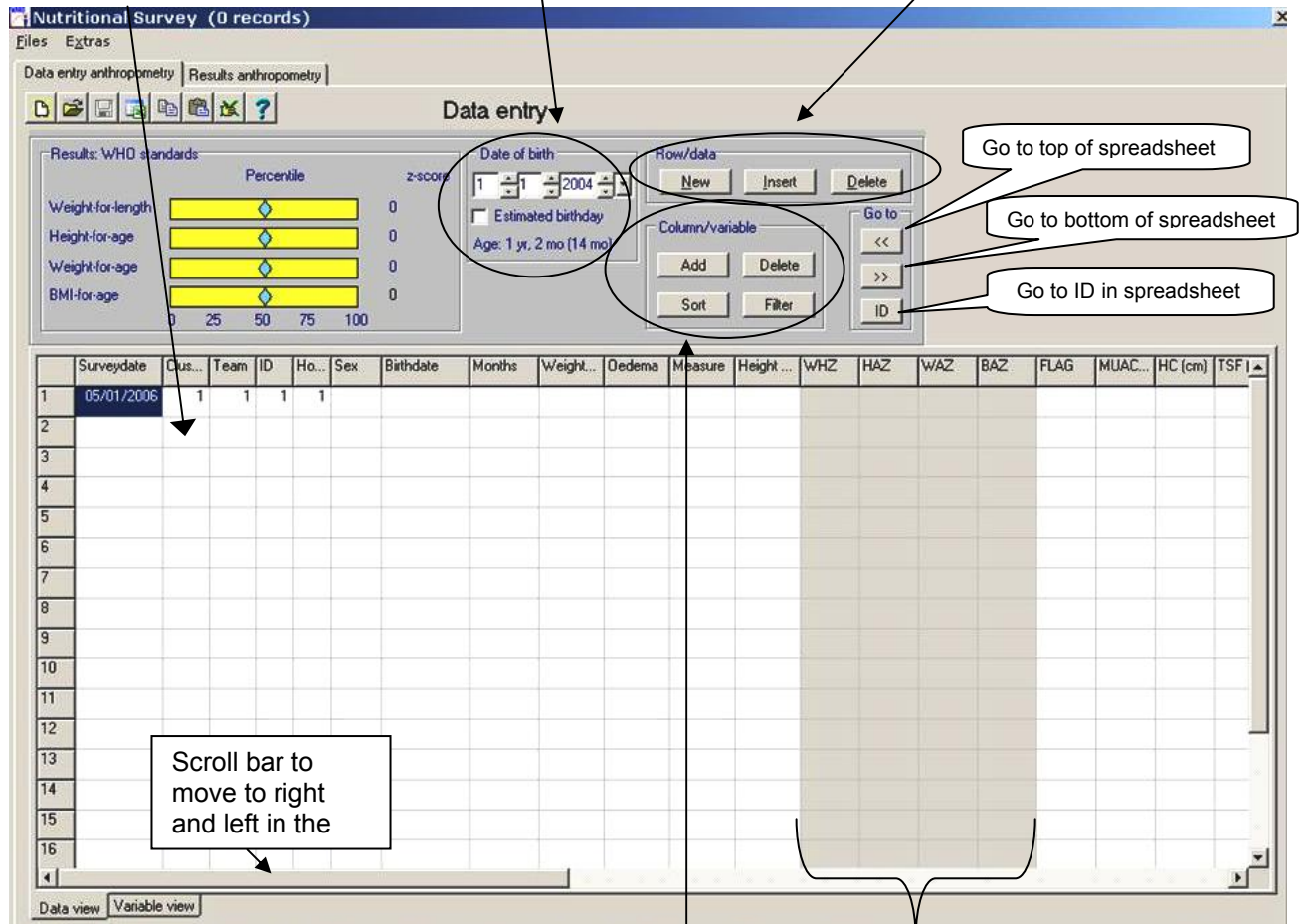
Main interface

Clicking on the *Nutritional survey* button on the main menu screen opens the module's interface.

Spreadsheet for data-entry of survey data
(one row = one child record)

Date of birth and age information for active child record

Buttons for editing the survey data on the spreadsheet



The first 33 variables and their columns are fixed. To <Add>, <Delete>, <Sort> or activate a <Filter> on columns or variables within the active data set, the user can use these command buttons.

z-score results columns are read-only and grey-shaded

Row/data menu options:

<New>

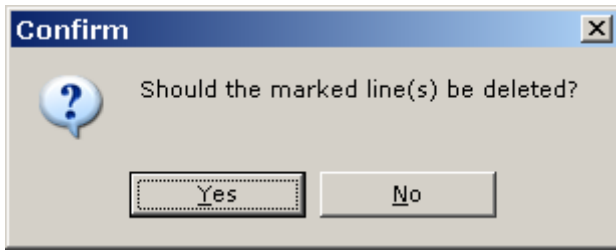
Inserts a new line at the bottom of the spreadsheet. By default those cells under *Options* (sub-menu under *Extras*) that are selected will automatically be filled in.

<Insert>

Inserts a line below from where the cursor is set.

<Delete>

Highlights the record on which the cursor sits and asks the user whether this record should be deleted (see image below). Once confirmed the record is deleted and cannot be recovered.



Column/variable menu options:

<Add>

To include further survey variables, the user can add columns to the right of the 33 fixed ones by pointing the cursor on an empty cell and pressing <Add> under *Column/variable*. Adding new columns enables the user to collect additional variables, e.g. father's and mother's weight and height. The parental BMI could then be derived after exporting to Excel. The upper limit of the number of columns per spreadsheet is 256, the same as in Excel.

<Delete>

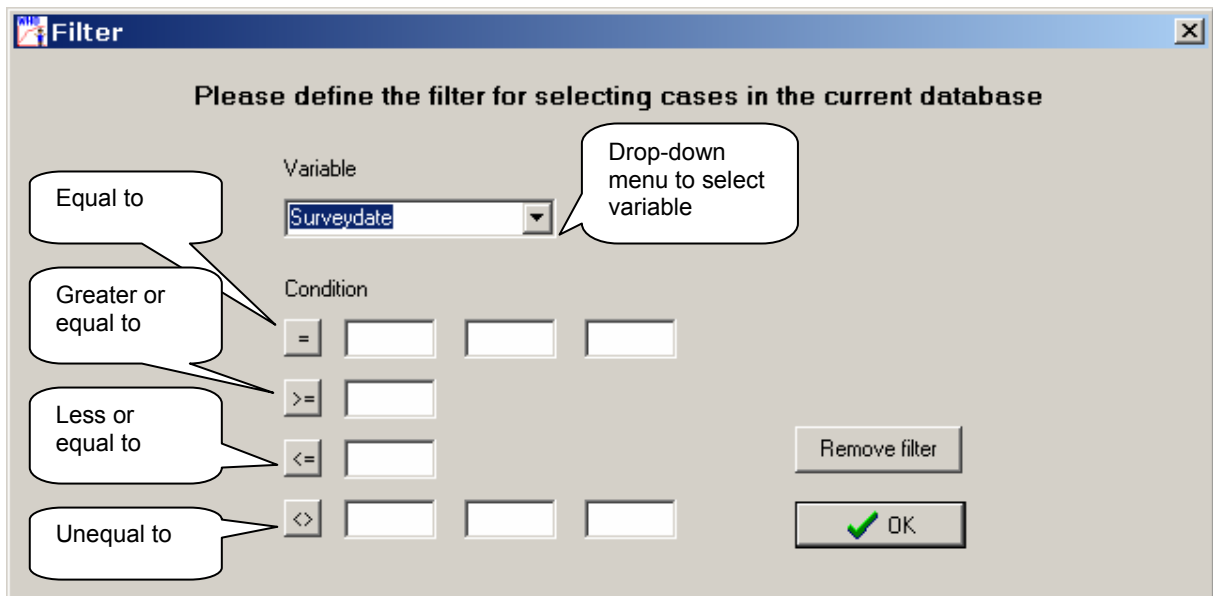
Deletes the column on which the cursor is pointing. Given that none of the 33 standard columns can be deleted, this applies only to columns to the right of these fixed ones. Once a data column has been deleted it cannot be recovered.

<Sort>

To sort by a specific variable the cursor has to be on the column of that variable. This function sorts numeric variables from lowest to highest value, and character values in alphabetical order (A-Z).

<Filter>

This function enables the user to select a specific subset of data based on user-specified criteria. To disable the filter (i.e. to use all records) the user has to click on <Remove filter>.



Age

The *Date of birth* can be entered into the cells on top using the drop-down menus or by keying the date directly into the spreadsheet cell. If the date is known, it is fastest to enter it directly into the spreadsheet. In case the observer has to estimate the *Day of birth* then it is useful to use the drop-down menus on top. Ticking the relevant box will trigger the randomization process that derives a random day of birth. Whenever the drop-down menu is used, the user should make sure that the date is correctly carried over into the spreadsheet cell below. The fact that the randomization process was used to derive a day of birth is reflected in the spreadsheet, and the programme automatically enters

"y" for yes into the column EDOB, which stands for "estimated day of birth". If the child's age is unknown, the relevant cell in the spreadsheet should be left empty.

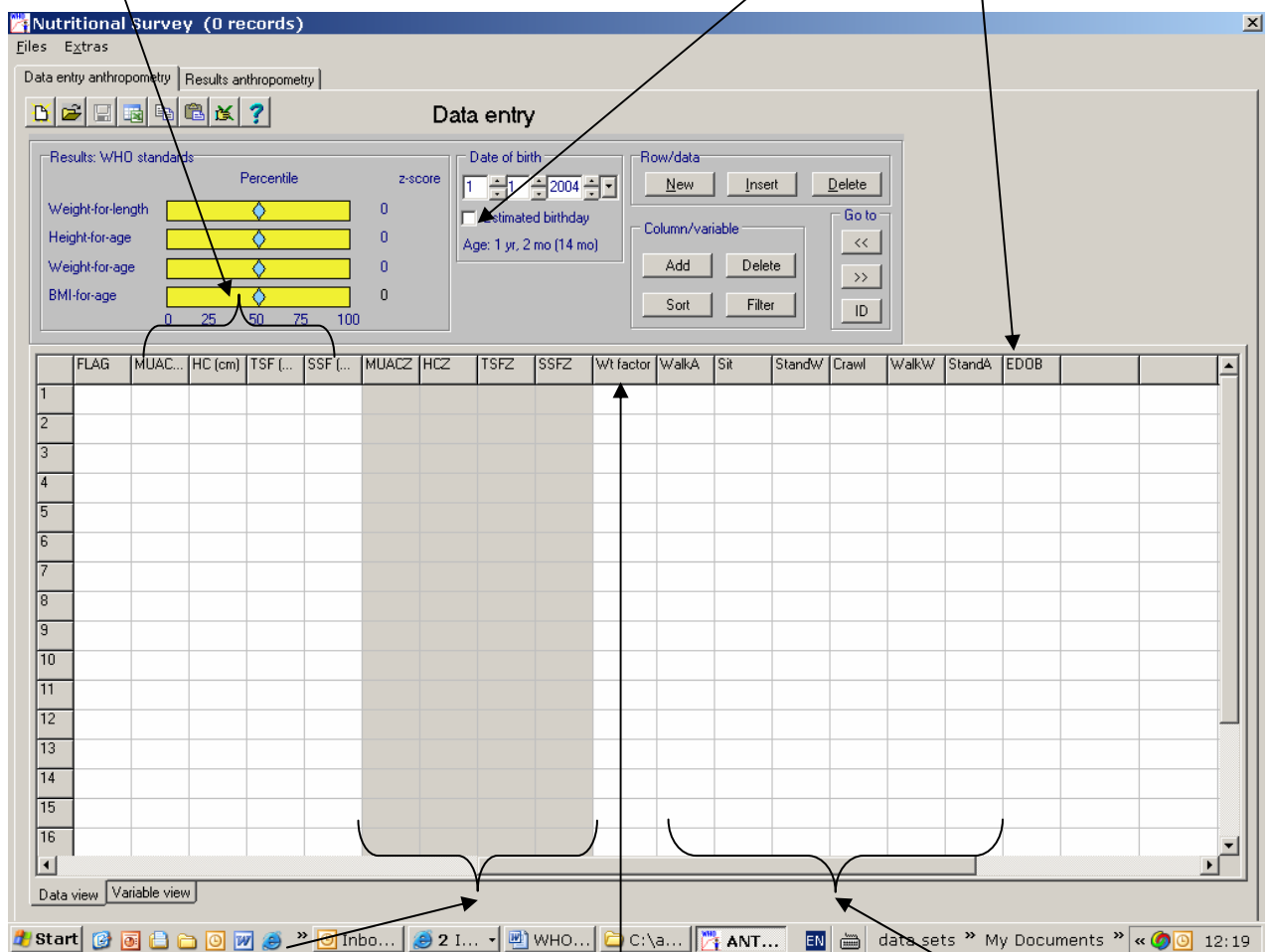
The entry in the *Surveydate* column is automatically set to today's date. Once the date is entered (or changed) for the first record, this date is automatically carried over into the next rows.

Spreadsheet

Scrolling the spreadsheet to the right shows the next columns. The grey-shaded result columns contain the z-score values. As mentioned earlier, the first 33 columns in the spreadsheet are fixed and cannot be deleted nor can other columns be added between them. For the additional indicators, the users can already collect the raw data for MUAC, head circumference, triceps and subscapular skinfolds, but their grey-shaded results columns remain inactive until these standards have been incorporated into the software, which will happen later.

Columns for collecting raw data for the additional indicators

Estimated date of birth column is automatically filled in when this box is ticked



The additional indicators' z-score result columns are grey-shaded and inactive

Weighting factor

MM data-entry columns

In order to ensure valid z-score calculations and summary reports, during data-entry users should pay attention to the following:

Only numbers should be entered for the numerical fields, particularly for the CLUSTER field since it is an essential variable for the summary report that requires numeric values for a disaggregated analysis.

Make sure the DoB entry from the cells above (if used for obtaining randomized day of birth) is carried over correctly into the spreadsheet.

Icons

The following icons provide convenient shortcuts for common functions in the *Nutritional survey* module:

Icon Function



Starts new survey



Opens existing survey



Saves survey



Copies active spreadsheet to Excel



Copies marked data from spreadsheet onto clipboard



Pastes data from clipboard into spreadsheet

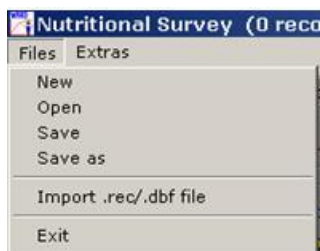


Produces standard report of survey data in Excel

The *Variable view* provides the definitions for variable names used in the spreadsheet and specifies each variables type and range.

Name	Type (n.c.d)	Label	Values	Range low	Range high
Surveydate	date	Date of survey			
Cluster	numeric	Survey cluster (region number)		1	99
Team	numeric	Team number		1	10
ID	numeric	Identification number			
Household	numeric	Household identifier			
Sex	character	Sex			
Birthdate	date	Date of birth			
Months	numeric	Age in months		0	60
Weight (kg)	numeric	Weight		3	31
Oedema	character	Oedema			
Measure	character	Recumbent length, standing height			
Height (cm)	numeric	Length or height			
WHZ	numeric	Weight-for-length/-height z-score		-5	5
HAZ	numeric	Length/-height-for-age z-score		-6	6
WAZ	numeric	Weight-for-age z-score		-6	5
BAZ	numeric	BMI-for-age z-score		-5	5

Files menu



New	→	Opens new survey spreadsheet
Open	→	Opens existing survey data (*.wns files)
Save	→	Saves active survey data as [NAME].wns file
Save as	→	Saves active survey data file with a chosen name
Import	→	Imports *.rec (EpiInfo) or *.dbf (dBase) files
Exit	→	Exits the module and returns to main menu

If the user has saved one survey and wants to open a blank spreadsheet s/he clicks on <New>. This command acts like a reset.

The user is advised to study the pertinent sections on data-entry in the Overview chapter of this manual before entering new data.

Special to this module is that for the type of length/height measurement the user can also enter 1 and 2 which will be converted automatically to "l" or "h", respectively.

Import

When importing existing survey data the user has to select the data file from the folder where it is located. Once the file is selected, the user is asked to match the variables from the original (e.g. *.dbf) to the Anthro 2005 variable names (see image below). To do that the user clicks on the drop-down menu buttons on the right column. Given that the programme derives the results and attributes flag values during import, it may take some time when importing large data sets.

Notes to ensure a smooth import:

- Cluster data should be integer values (even if they are not integer, the programme will treat them as such).
- The accepted length/height specification is either "l" or "h". Note that the programme is case-sensitive and capital "L" and "H" are not correctly imported. Numeric data, e.g. 1=standing, 2=lying down, 9= missing have to be recoded to "l", "h", and blank, respectively.
- Sex information can be imported as either character, i.e. m=Males and f= Females, or numeric, i.e. 1=m, 2=f. When data for these variables are missing, the fields should be left empty.
- If survey data have no sampling weight, the software attributes a sampling weight=1 (*Wt factor*). If a child record should be excluded from the analysis, the user is advised to insert "0" into the record's *Wt factor* cell.
- Missing values in DoV, DoB, MONTHS, WEIGHT and HEIGHT should appear as blank cells.

Please change the assignment if it is not correct

Anthro2005	.dbf file
Surveydate	DOV
Cluster	DOV
Team	AGEYRS
ID	WEIGHT
Household	L_H
Sex	HEIGHT
Birthdate	URB_RUR
Months	REGION
Weight (kg)	SEX
Oedema	
Measure	
Height (cm)	WEIGHT
MUAC (cm)	
Wt factor	HEIGHT

OK

Note the variable names of the import file are changed to those attributed by Anthro 2005. The *Cluster* column can be used to import regional codes for disaggregated analysis purpose.

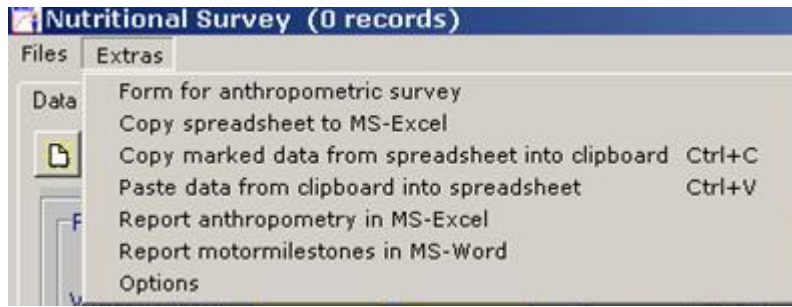
In the importing process the programme highlights in purple any extreme or potentially wrong z-scores in the grey-shaded results columns (see p. 41, **Flagging**). In addition the programme highlights in purple any child weights less than 3.0 kg that are imported.

Save and Save as

For best practice, users should save the files by selecting "Save as" and store their survey data in a separate directory distinct from the Anthro 2005 programme. If a user creates a new directory for saving his/her data the programme defaults to it when opening or saving the next file. Under the **Files menu** the last four files used are listed and the programme will automatically save the open file back to the same directory. Files are saved as *.wns. This abbreviation stands for WHO Nutritional Survey and the format is ASCII.

The programme creates backup files in the Anthro 2005 programme directory, labelled as *.bak.

Extras menu



Clicking on *Form for anthropometric survey* opens a table in rich text format; this can be printed on paper for collecting data in the field in the absence of electronic equipment.

Clicking on *Copy spreadsheet to MS-Excel*, copies the open survey into Excel with header row and survey records.

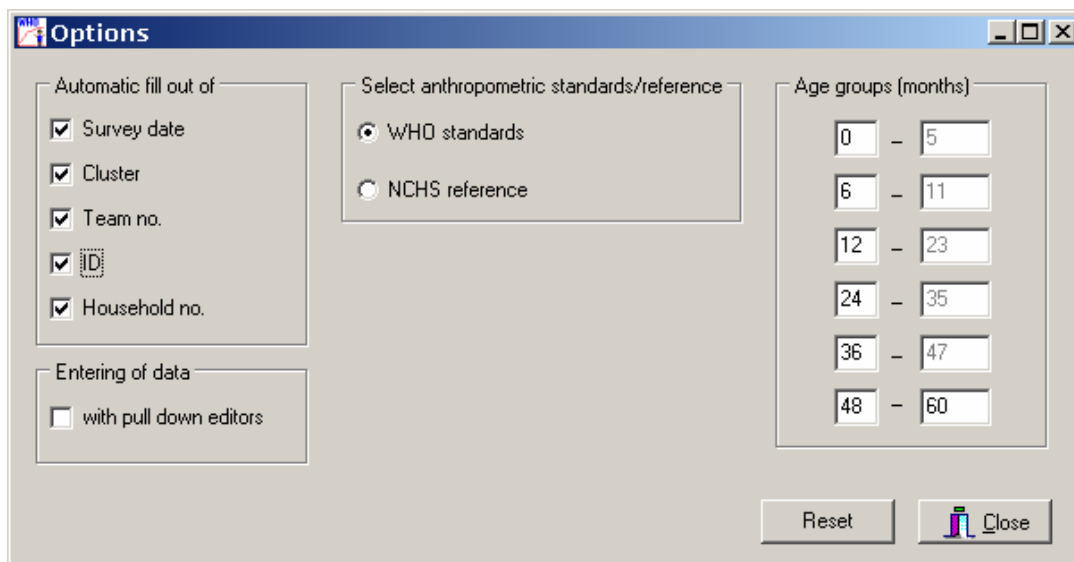
The left mouse button or <Shift + Scroll> keys enable the user to mark a number of rows and columns. By clicking the icon *Copy marked data from spreadsheet into clipboard*, or by using the shortcut <Ctrl+C>, selected data can then be inserted into an Excel, Word or other file format. Note that the header row cannot be selected and hence cannot be copied in that process.

To *Paste data from clipboard into spreadsheet* the user can either select that function from the *Extras* or use the shortcut <Ctrl+V>.

Clicking on *Report anthropometry in MS-Excel* produces the standard table report based on the nutritional survey that is currently open. The standard analysis uses all valid z-scores and presents the results by indicator with 95% confidence intervals. Prevalences are presented for common cut-offs by age groups, by sex and age groups, and by clusters (if applicable).

Selecting *Report motor milestones in MS-Word* opens a file in rich text format with the summary results of the motor development assessment of the survey data.

Clicking on *Options* opens a new window (see below) with the following choices:



The automatic fill-out options refer to the spreadsheet and are ticked by default, i.e. the user does not have to complete these cells on the spreadsheet as the programme carries over this information into the next row. If the user does not wish to carry over the information s/he has to open the *Options* window and un-tick the respective selection.

The *ID* and *Household numbering* are continuous numeric variables while *Cluster* and *Team no.* need to be overwritten. When the values for *Cluster* and *Team no.* are changed in a given row they are copied over into subsequent rows.

If users prefer *Entering data with pull-down editors*, they can select this option by ticking the appropriate box. Consequently, drop-down menus appear when they double-click on the fields of *Sex*, *Birthdate* (calendar appears), *Oedema* and *Measure*.

The selection of the WHO standards is the default setting, and if the user wants to analyse the data using the NCHS reference s/he needs to change the setting in the *Options* window. Note that if the NCHS reference is used there are the following 3 flag limits that need to be changed in *Variable view*: WHZ lower and upper limits should be changed to -4 and +6, respectively; and WAZ upper limit should be changed to +6.

The age groups for the anthropometric report can be tailored by changing the default groups. Note that the overall age group does not need to be entered here as it is always automatically produced. Both the lower and upper age group limits are inclusive, i.e. 12-23 months comprises all one-year-olds to children just under 2 years old (i.e. 23.99 months or <24 months).

Clicking the <Reset> button restores the default settings.

Results

For calculating z-scores, the following 4 essential variables have to be available:

1. Sex
2. Weight [in kg]
3. Age in months, or DoB and DoV
4. Length or height [in cm]

Ideally two more variables should be included in the data set:

5. Measure (measurement of recumbent length or standing height) [l/h]
6. Oedema (yes/no) [y/n]

For further residential disaggregation of the data the information needed would be:

7. Region, urban/rural, or cluster

As the data are being entered or imported the software derives the z-scores and displays their values by indicator in the grey-shaded, read-only results columns of the spreadsheet.

Note on z-score calculations:

1. If *Sex* is missing the observation is excluded from analysis.
2. If *Weight* is missing, no WHZ, WAZ and BAZ are calculated, and the programme derives only HAZ.
3. If *Height* is missing, no WHZ, HAZ and BAZ are calculated, and the programme derives only WAZ.
4. To calculate age the following procedure is applied:
If both, date of birth (DoB) and date of visit (DoV) are valid, then the software calculates:
$$\text{Age (in days)} = \text{DoV} - \text{DoB}$$

and the result is used for obtaining z-scores.
5. For any child records with missing age only WHZ will be calculated.
6. If a child has oedema only his/her HAZ is calculated.
7. The way the software handles the variables *Height* and *Measure* depends on what is available in the data set:
 - i. If a data set has both, the variables for length/height (**cm**) and type of measurement (**l/h**), then the programme will use both pieces of information and convert length to height or vice versa according to age if required. For example if a child aged 24 months or more has a length measurement, 0.7 cm is subtracted to derive an

estimated height. Similarly, if a child younger than 24 months is measured standing, the software adds 0.7 cm to derive an estimated length.

- ii. If type of measurement (l/h) is missing, the software will convert the length/height cm if required following the scheme below:

Height/length in cm	Age		missing
	<24 months (or <731 days)	≥ 24 months (or ≥ 731 days)	
Length	no conversion	Length - 0.7 cm	no conversion
Height	Height + 0.7 cm	no conversion	no conversion
Unspecified	no conversion; assume measure = length	no conversion; assume measure = height	if < 87 cm assume measure = length; if ≥ 87 cm assume measure = height

Flagging

The software flags out in purple any extreme, potentially incorrect or out-of-range values. The following lower and upper bounds have been fixed to identify these extreme or potentially incorrect z-score values.

Indicator	Lower bound	Upper bound
WHZ	-5	+5
HAZ	-6	+6
WAZ	-6	+5
BAZ	-5	+5

These default boundary values can be changed (if needed) in the *Variable view*.

If z-scores appear as flagged the user is advised to check for potential data-entry errors (age, weight, length/height) and, if possible, to correct the data before proceeding. To apply any change in the flag values after editing a file or altering the flag limits, the user is advised to save the file, then re-open and scroll through the *FLAG* column to ensure that all changes have been applied and are correctly displayed in the data file before proceeding to the analysis. All flagged z-scores will be excluded from the analysis.

Missing z-score values appear as blank cells and are taken into consideration in assigning flag codes (see below).

Flag codes

In the *FLAG* column adjacent to the z-scores the software displays record-specific flag values. The codes of the *FLAGs* attributed to the child record are derived using the following logic:

Code	Indicator flagged				Notes
	Weight-for-length/height	Length/height-for-age	Weight-for-age	BMI-for-age	
0					No indicators flagged
1	Y				WHZ flagged
2		Y			HAZ flagged

Code	Indicator flagged				Notes
	Weight-for-length/height	Length/height-for-age	Weight-for-age	BMI-for-age	
3			Y		WAZ flagged
4	Y	Y			WHZ and HAZ flagged
5	Y		Y		WHZ and WAZ flagged
6		Y	Y		HAZ and WAZ flagged
7	Y	Y	Y		WHZ, HAZ and WAZ flagged
8				Y	Only BAZ flagged

Interpretation of flags and their use for error tracking

Flag 0: Valid z-scores were derived for all indicators.

Flag 1 Check for the minimum and maximum limits of length (45 cm and 110 cm) and height limits (65 cm and 120 cm). If the child's length or height is within those limits, this could be an extremely thin or heavy child. If height is incorrect, the HAZ would be expected to be close to an extreme value (but not extreme enough to be flagged), and if weight is incorrect, then the WAZ would be expected to be close to an extreme value (but not extreme enough to be flagged).

Flag 2 This could be an extremely short or tall child, but it is recommended to double-check the height data on the computer file to ensure that it is correct and consistent with the data collection form. Alternatively, the age could be incorrect; one should thus look at the WAZ value to see if it appears to be extreme. Also, the user is advised to look at the WHZ value: if height is incorrect, the WHZ value may be close to -3.09 or 3.09.

Flag 3 Either weight or age may be incorrect. If weight is incorrect, then the WHZ may be near an extreme value (but not extreme enough to be flagged), and if age is incorrect, then HAZ may be near an extreme value.

Flag 4 Length or height is most likely incorrect or missing.

Flag 5 Weight is likely to be incorrect or missing.

Flag 6 Age information is most likely incorrect, missing, or out of range. This flag may particularly occur in populations where it is difficult to obtain accurate age information.

Flag 7 This may indicate that sex is unknown or incorrectly recorded, or at least two of the variables – age, weight and height – are missing, incorrectly recorded, extreme, or beyond the limits of the growth standards.

Flag 8 This may indicate an unusual combination of WAZ and HAZ. Given the close association between BAZ and WHZ, however, in most cases where WHZ is flagged BAZ also will be flagged.

Preparation of data sets for standard analysis

The user has to make sure that the essential variables as outlined above (see p. 40, **Results**) are available in the data set.

The default age groups for the standard analysis are: 0-5, 6-11, 12-23, 24-35, 36-47, 48-60 months.

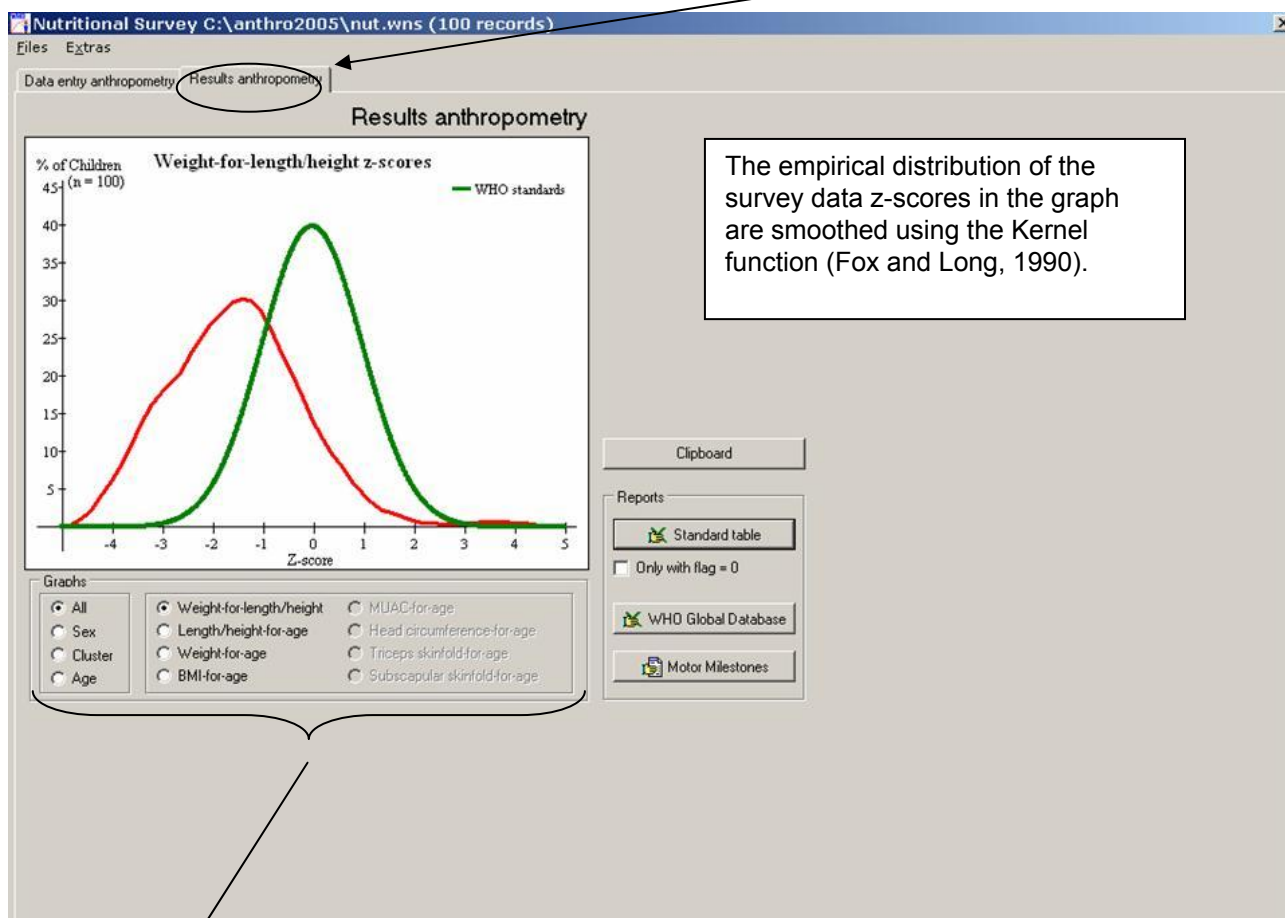
A special note concerning age:

- If the day in DoB is missing, the user may consider entering day=15 (i.e. the middle of the month). The software also enables the user to use the *Estimated birthday* tick box after entering the given month and year of birth, and the software derives a random day of birth. The date of birth is then automatically transferred into the column on the spreadsheet and the EDOB column cell of this child record to the right of the spreadsheet is filled with "y". The user should check that this date transfer is correct and, if necessary, copy the obtained DoB into the first column so that the programme can derive all age-dependent z-scores. For invalid DoB/DoV (e.g. negative result for age in months), the user is advised to check the record for data-entry errors. If the correct date cannot be traced and there is no other age variable available, the age of the child will have to be set to missing.
- If DoB or DoV is missing but another age variable (in months or years) is available this can be used instead. If the available age is in completed months, this value is multiplied by 30.4375 to derive age in days (rounded to complete days) that the software uses to derive the individual z-scores. Later, however, to classify the results into age groups the completed months are used and not age in days.
- If age is available in years, the user has to translate the value into months, multiplying the number of years by 12. This value should be imported into the *Months* column.

The user may define alternative age groupings under *Options*. The age groups should be formed to cover the complete sample used for the analysis. If this is not the case the total sample size will not match the sum of the defined age groups' sample sizes. For example, if a survey contains children with up to 59 completed months of age, the user has to change the upper limit of the last age group in the *Option, Age groups* window. Consequently, the total age group will cover 0-59 months and the last age group in the stratified table will read "47-59".

Results

To move from the open spreadsheet to *Results anthropometry* click on the <Tab> button.



Options to select graphed distributions by indicator and further disaggregations

The graphs in the *Results anthropometry* window are based on the standard analysis, i.e. using all valid z-scores; this may result in sample sizes varying among different indicators. The Ns are weighted in case of a weighted analysis. Any of the displayed graphs can be copied to a clipboard for further use in different software programmes. To do that click on <Clipboard>.

Report options

The software is designed to produce pre-defined survey reports: The "*Standard table*" and the "*WHO Global Database*" report.

The *Standard table* report makes maximum use of the collected data. This standard analysis includes all children with at least one valid z-score (i.e. not flagged). The report derives for each indicator estimates of prevalence with 95% confidence intervals, means and SDs of z-scores. Due to the inclusion of all valid z-scores, and not just records with FLAG=0, the sample sizes per indicator in the result tables may differ. Child records with missing age contribute to both the total sample sizes and WHZ statistics.

To stratify the results by age groups, age will be used following the procedure outlined on page 43, under **A special note concerning age**.

To produce a *Standard table* result report based on a more restricted survey sample analysis, i.e. only using child records with Flag=0 the user has to tick the box next to *Only with flag = 0*.

The *WHO Global Database* report provides the user with the survey results already inserted into the standard data-entry form designed for those wishing to submit their data to the WHO Global Database on Child Growth and Malnutrition. The information on inclusion criteria for this database and submission address can be found at www.who.int/nutgrowthdb. This analysis procedure also uses all valid z-scores to make full use of the available data in the survey, similar to the *Standard table*. What it does not include are the 95% confidence intervals. The sample sizes pertaining to the weight-for-age indicator are used as the overall and disaggregated N for reporting purposes in this database.

Although children with oedema have no weight-based indicator z-scores, they are taken into account in the sample sizes and prevalences of low weight-for-length/height, low weight-for-age, and low BMI-for-age, i.e. $\% < -3$ SD and $\% < -2$ SD. However, oedema cases are excluded from the calculation of summary statistics, i.e. means and SDs of z-scores, for these indicators. If the record indicates that the child has oedema but his/her age is unknown, then the child contributes to the **overall** sample size and prevalence of low weight-for-length/height, low weight-for-age, and low BMI-for-age, i.e. $\% < -3$ SD and $\% < -2$ SD. That is, this child will not be considered for the age disaggregated sample sizes and prevalences. The software indicates in a footnote to the tables the number of children included in the Total that have been classified as oedema cases.

Note: There is no possibility to produce a standard report using the NCHS reference.

Motor milestones

In the *Nutritional survey* spreadsheet the motor assessment data are assigned the columns *WalkA* (chosen as the first milestone to assess), followed by *Sit*, *StandW*, *Crawl*, *WalkW* and, lastly, *StandA*, which are defined below. Although in sequence milestone *WalkA* (*Walks alone*) is the latest to be achieved, it is used here as a trigger to whether earlier milestones would require assessment. That is, if the child is younger than 24 months and is observed or reported as able to walk alone, it will be assumed that all earlier milestones have already been achieved.

Name	Label
WalkA	Walks alone
Sit	Sits without support
StandW	Stands with assistance
Crawl	Crawls on hands-and-knees
WalkW	Walks with assistance
StandA	Stands alone

Each column allows 5 possible entries per milestone:

- Blank** Child was not assessed and no caretaker report was made on the milestone
- "0"** Child was assessed by the observer and was unable to meet the criteria of achievement.
- "1"** Child was assessed by the observer and met the criteria of achievement.
- "2"** Child could not be assessed by the observer, but was reported by the caretaker as not yet able to perform the milestone.
- "3"** Child could not be assessed by the observer, but was reported by the caretaker as able to perform the milestone.

The software can summarize the data in the *Results anthropometry* window by clicking on *<Motor milestones>*. The report provides a prevalence of non-achievement with an estimated 95% confidence interval based on the boundaries of the window of achievement for each milestone. The prevalence is derived using as denominator the sum of children aged above the upper limit of the milestone's window of achievement and younger than 24 months; and as numerator the sum of those within that group who have not achieved the milestone (indicated by "0" or "2" above). The report also provides a prevalence of composite failure. This prevalence is derived using as denominator the sum of children aged above the upper limit of the earliest milestone "*Sits without support*" (9.4 months) and younger than 24 months; and as numerator, the sum of those within that group who have not achieved at least one milestone. This prevalence shows the proportion of children who "ever failed to achieve" a milestone relative to the windows of achievement.

The MM data may also be imported and will be appended to the end of the spreadsheet. Prior to importing, it is advisable that the user arranges the MM data columns in the same order as that of Anthro 2005 for a swift copy-and-paste process. After the import, the user has to copy the imported columns into the appropriate MM columns (i.e. *WalkA*, *Sit*, *StandW*, *Crawl*, *WalkW*, *StandA*). To copy any columns, first mark them using the keys *<Shift + Scroll>* then click on the icon or use the menu bar *<Extras → Copy marked data from spreadsheet onto clipboard>*. Then move the cursor to the appropriate starting cell and click on the insert icon or use the menu bar *<Extras → Paste data from the clipboard into spreadsheet>*. The user may also wish to copy and paste the MM data straight from a spreadsheet (for example, Excel) into the Anthro 2005 spreadsheet via the clipboard function. Only when the milestones data are pasted in the preset columns will the MM report button derive the summary results as outlined above.

3 References

An evaluation of infant growth. WHO Working Group on Infant Growth. WHO/NUT/94.8. Geneva, Switzerland: World Health Organization, 1994.

Physical status: the use and interpretation of anthropometry. Expert Committee Report. WHO Technical Report Series No. 854. Geneva: World Health Organization, 1995
(http://whqlibdoc.who.int/trs/WHO_TRS_854.pdf).

de Onis M, Garza C, Victora CG, Bhan MK, Norum KR, editors. The WHO Multicentre Growth Reference Study (MGRS): Rationale, planning, and implementation. Food and Nutrition Bulletin 2004;25(Supplement 1):S3-S89.

de Onis M, Garza C, Onyango AW, Martorell R, editors. WHO Child Growth Standards. Acta Paediatrica Supplement 2006;450:S5-S101.

Wijnhoven TMA, de Onis M, Onyango AW et al. Assessment of gross motor development in the WHO Multicentre Growth Reference Study. Food and Nutrition Bulletin 2004;S37-S44.

WHO Child Growth Standards: length /height-for-age, weight-for-age, weight-for-length, weight-for-height and body mass index-for-age. Methods and development. Geneva, Switzerland: World Health Organization, 2006.

Diet, nutrition and the prevention of chronic diseases. Report of a joint WHO/FAO Expert Consultation. Technical Report Series No. 916. Geneva: World Health Organization, 2003
(http://whqlibdoc.who.int/trs/WHO_TRS_916.pdf)

de Onis M, Onyango AW, Van den Broeck J, Chumlea WC, Martorell R. Measurement and standardization protocols for anthropometry used in the construction of a new international growth reference. Food and Nutrition Bulletin 2004;25(Supplement 1):S27-36.

Conducting small-scale nutrition surveys: A field manual. Nutrition planning, assessment and evaluation service. Nutrition in Agriculture No. 5. Rome, Italy: Food and Agricultural Organization, 1990.

Describing univariate distributions. In: Modern Methods of Data Analysis, ed. J. Fox and J. S. Long, 58-125. Newbury Park, CA: Sage Publications, 1990.

WHO Multicentre Growth Reference Study Group. WHO Motor Development Study: Windows of achievement for six gross motor development milestones. Acta Paediatrica Supplement 2006;450:86-95.

4 Reporting of problems with Anthro 2005

Even though we did our best to ensure that this software works properly, virtually all software programs have "bugs". We would appreciate users notifying any problems encountered (random or systematic) when using Anthro 2005.

Identified bugs will be aggregated and posted on the web site www.who.in/childgrowth/software/. We therefore recommend always to check this list before reporting a problem. Should the same problem already appear in the list, there will be no need to send a report. However, if the problem is not yet listed then we kindly ask you to send a bug-report describing in detail:

1. The problem found
2. Whether the problem appeared systematically or randomly
3. Where exactly and in what module interface it occurred
4. How it occurred, including what sequence of commands and/or buttons led to it
5. What the expected result would have been
6. If you managed to circumvent/solve the problem, how you did that

Please send the bug-report to the following address:

Anthro 2005
Department of Nutrition
World Health Organization
Avenue Appia 20
1211 Geneva 27
Switzerland

fax: +44 22 791 4156

Anthro2005@who.int

Please note: This is not a helpline address.