UNICEF Target Product Profile
Height/length Measurement Device(s)

UNICEF Supply Division Innovation Unit

Version: 2.0

Date: October 2017

Purpose of the UNICEF Target Product Profile (TPP):

UNICEF creates Target Product Profiles (TPPs) to communicate requirements for products which are currently not available on the market but which fulfil a priority need to be used in the unique context in which UNICEF and its partners operate. TPPs include information on how the new product will be used, by or for whom, and the minimum and ideal performance criteria. The purpose of TPPs is to guide industry to develop products that meet UNICEF's needs, however they do not act as the final procurement specifications but rather as a list of desired requirements that combined describes the ideal product considering the context. UNICEF recognizes that innovation is an iterative process, and that suppliers must balance sometimes competing requirements against product development progress. To allow for creativity, and the innovation process to take its course, TPPs are less prescriptive than procurement specifications, and can therefore be challenged by the industry.

For more information please visit our TPP page

Problem Statement/Need for the Product

Portable, accurate and precise height/length measurement devices are needed to support regular UNICEF programming as well as anthropometric data collection in the field, such as the UNICEF supported Multiple Indicator Cluster Survey (MICS) Programme, the USAID supported Demographic and Health Surveys program (DHS) and the World Bank Group's Living Standard Measurement Study (LSMS) programme. [1] Recent reviews of household survey data quality have shown that the current techniques and devices used to measure height and length of infants, children and adults may not produce accurate results.

UNICEF is therefore seeking solutions that will respond to the requirements of both use cases and are capable of producing highly accurate recorded readings.

While standardized protocols are in place, anthropometric data collection continues to be challenging due to the limitations of the equipment and the context and environment of the assessments. Several areas of improvement for the user, such as making the measurement equipment easier to transport and operate have also been identified, however, the main challenge remains being able to adequately produce, read and record correct and reliable measurements in the field.

The main reasons which lead to inaccurate measurements using traditional measuring boards have been identified as:

- Inaccurate positioning of the body against the board
- Infant and children moving during the measurement assessment
- Inaccurate readings caused by:
    - Reading the measurement from an incorrect angle

    - Difficulty seeing and reading the measuring tape which in some cases lead to rounding up or down to the nearest 5 or zero (digit preference)[1]
    - Assessment performed in dim light settings
- Inability to document/estimate correct age
- Data entry error

It is important to note that UNICEF is not looking for a solution that only focuses on the accuracy of a device, but rather on a device's capability to accurately record readings in the hands of trained health workers/survey staff, in the given context by eliminating all, or as many of the above mentioned reasons for error as possible. UNICEF is therefore looking for virtually foolproof device(s) that supports accurate measurements and readings by minimizing the possibilities of human error.

Programmatic Relevance for UNICEF

Monitoring the growth and development of pregnant women, infants and children is central to providing reliable estimates of anthropometric indicators such as the prevalence of stunting[2] and wasting[3] among children, in order to track the progress of long-term and short-term health and nutrition interventions. In addition, anthropometric indicators are used to monitor global progress toward the Sustainable Development Goals (SDGs) of ending all forms of malnutrition, eradicating poverty and improving health.

Current Products or Response Used by UNICEF:

UNICEF Supply Division currently procures and supplies a range of anthropometric equipment including three portable height/length measuring systems to support growth monitoring through various programmes and surveys.

The three systems are:

• A portable baby/child length and height measuring board, made of wood. Accuracy/Precision of the device: ± 0.2 cm.[4] Range 0-120cm.

• A portable baby/child/adult length and height measuring board, made of wood. Accuracy/Precision of the device: ± 0.2 cm. [4] Range 0-210cm. (2 items: main board + extension).

• A portable baby/child length/height Stadiometer, made of plastic. Accuracy/Precision of the device: ± 0.2 cm. [4] (2 devices: one for length measurements and one for height).

More information is available in the UNICEF Supply Catalogue.

Volume & Potential Impact

Household surveys are used to collect nationally representative data on nutrition in many low and middle-income countries, meaning that the accuracy of portable measuring devices is of great significance. For example, the USAID supported Demographic and Health Surveys (DHS) Programme has collected height and weight data in 238 surveys in 77 countries since 1986 to date, and the

[1] Digit preference is a departure from a uniform distribution across final digits that indicates a preference for one or more digits, such as 0 and 5, in the reporting of height and weight, over others.
[2] A reduced growth rate in human development; Moderate and severe - below minus two standard deviations from median height for age of reference population.
[3] Moderate and severe – between minus two and minus three (moderate) and below minus three (severe) standard deviations from median weight for height of reference population.
[4] Accuracy/Precision levels are provided by the suppliers but recent reviews of field measurements proves that such levels cannot be sustained when applied to the context of UNICEF (see use case A & B below).

UNICEF supported Multiple Indicator Cluster Survey (MICS) Programme has carried out 288 surveys in 108 countries, most collecting height and weight data. In addition to these, the Living Standards Measurement Study (LSMS) and many national nutrition surveys all require accurate and portable measuring equipment.
UNICEF Supply Division has supplied 131,353 height/length measurement devices for a value of 12,654,607 USD between 2012 – 2016. Local procurement and procurement by other UN organisations and NGOs are excluded from these figures which means that the total procurement volume is higher.

Use of Product in UNICEF Context

Use Case A: Household Surveys:

- **User description:** Measurers and their assistants (interviewers) can be of either sex and are normally aged 20-50 years, but younger and older field workers may sometimes be used. A minimum level of fitness is recommended, but not required. Good eyesight is also recommended.
- **Level of training/education:** Typically secondary school graduation is the minimum requirement for any position on field teams, but field workers with a higher level of education are common, and occasionally field workers may have less than a high school education due to the country context as well as to the specific tasks of the Measurer. MICS teams receives 4 weeks of training prior to the survey of which 1 week is fully dedicated to training in taking anthropometric measurements.
- **Use environment:** The Height Measurement Devices (HMDs) will travel on vehicles including motorbikes, and be carried on foot, often encountering rough terrain. They will be used typically indoors in family homes, though poor lighting and/or poor levelling or firmness of ground in such homes may require setting up outdoors. Temperatures range from extreme heat (and exposure to sunlight) often combined with high humidity, to freezing, though extreme freezing is very uncommon.
- **Geographic location:** Any and all. Surveys are conducted anywhere in the populated world.

Field survey teams normally travel by car between data collection areas (known as “clusters”) but sometimes go by boat, motorbike or by public transportation. Even within a cluster, field staff may have to walk long distances between households, although in other cases households may be a few meters apart.

Field survey teams may struggle to find a suitable place to perform the measurements. The currently used device (wooden board) should be on a flat surface and, for height measurement, rest against a wall or other flat surface for support. This implies finding a 90 degree angle which may not exist in the settings where measurements are taken. Furthermore, data collection may take place at night and/or in dimly lit settings thereby making reading of measurements difficult when using the current device.

Under ideal circumstances, two trained measurers will work together to position the body, measure the child, and then record the measurement. In some cases, however, the trained measurer will need to work with an untrained person, such as the child’s parent assisting.

It can be stressful to take the measurements due to a number of factors. Children may for example be uncooperative, crying or moving. Some of the children are afraid of the measuring board and run away when they see it. Positioning the body correctly can be extremely challenging: this is particularly true of newborns, whose bodies cannot be easily straightened out, but also older children, where there is distress.

This type of fieldwork can make device maintenance challenging. The currently used boards get dirty, both due to the subjects’ feet (particularly in places where shoes may be less commonly worn) but also due to dust and dirt in the general environment. Boards may also be subject to temperature extremes,

particularly if they are left in vehicles, and humidity and rain. All these factors can cause the accuracy of the measurements to decrease. As the boards are constantly being moved, they are subjected to harsh usage. Even where backpacks or cases are available, they will not be used all the time – for example, while transporting shorter distances (such as house to house) or in locales with security issues such as Afghanistan and Pakistan (where they can be mistaken for weapons). It is therefore important that new solutions used for household surveys are robust and durable enough to withstand temperature extremes and significant usage but also portable and child-friendly to increase efficiency for the interviewing teams.

Use Case B: Health Clinic:

- **User description:** [2] Healthcare providers including physicians, nurses and health assistants, but also nutritionists, dietitians, public health specialists, child and health advocates, and researchers of either sex.
- **Level of training/education:** Measurers have a wide range of education. Many have medical or nursing degrees but there are no standard global minimum education requirements for health assistants although employers may have literacy and arithmetic proficiency requirements. Training of measurers varies greatly depending on the healthcare facility setting.
- **Use environment:** HMDs will be in use typically indoors, in public and private health facilities at every tier of the health system. These include primary, secondary and tertiary care facilities. These range from community health centres and centres with inpatient capability, to district hospitals with higher clinical capacity, and regional or national hospitals and medical centres, equipped with physicians and specialists, more beds for inpatient care and advanced technological capabilities. Regardless of the tier, access to clean water and uninterrupted electricity varies among facilities. HMDs will be transported on vehicles and carried on foot for use in the community, in both indoor and outdoor environments. Temperatures range from extreme heat (and exposure to sunlight) to freezing, though extreme freezing is very uncommon.
- **Geographic location:** Any and all. [3] HMDs are utilized to monitor the growth of children worldwide, regardless of ethnicity, socioeconomic status and type of feeding.

Health centre staff (e.g. doctors, nurses, health extension workers, etc.) take the measurements of the children. They may do so either in a fixed health facility but also in community settings as part of out-reach or mobile clinics.

For in-clinic use, in most cases, the measurements are easier to facilitate as the equipment can be set up against a 90 degree wall and rest on a solid floor. Most of the clinics have decent lighting and access to water.

For out-reach or mobile clinics, health centre staff would need to travel, either by vehicle or by foot to a fixed location such as a smaller facility where outreach clinics are held or also possibly to an open area in a village or similar location. Challenges related to these scenarios are similar to the challenges described for field survey staff under use case A.

Requirements

The purpose of the TPP is to enable development and subsequent procurement of both low and high tech devices responding to the Use Case Requirements in the table below.
Desired solutions are:

1. Improvements of current type of designs (measurement boards, stadiometers, etc.) with a digital output.
2. Innovative devices using technologies such as laser, infrared, ultrasound and optics for height/length measurement.

Attribute	Minimum Performance	Ideal Performance
Operational/Functional Requirements		
Key function(s)	Provides reliable length/height measurements of human subjects (infants, children and adults).	
Application	Growth monitoring (Length and height measurement).	
Operating Conditions	Stored and used in a wide-ranging climate (heat, cold, humid, dry, dust, wet). Used at health clinics and for mobile field use. Often moved in and out of vehicles; carried over distance on harsh and bumpy terrain.	
Method of Use	a) Recumbent length of a baby up to 24 months old. b) Height of a child aged 24 months and up in vertical position. c) Height of adults in vertical position.	Measurement of height/length regardless of position and performed with a single device.
Power requirements	Rechargeable battery lasting for minimum 24 hours	Rechargeable battery lasting minimum 48 hours including a/c plug, DC 12 volt plug (for recharge through a car battery) solar powered battery, or a combination.
Battery saving function	Auto shutoff	
Notifications	Low power	Low power, remaining time of functionality indicated.
Calibration	Manual	Automatic or not necessary
Output	Digital display in cm with one decimal digit (mm). E.g. 176.3 cm.	
Data storage & storage capacity	Storage capacity minimum 1GB	Supports Windows compatible data download from device (USB Stick), Wi-Fi and/or Bluetooth transfer and retains measurement with timestamp. Storage capacity of data 5GB
Ready for operational use (Assembly + calibration)	Within 3 minutes by one person	Immediate
Performance Requirements		
Accuracy of device	Measurement of static object ± 3 mm	Measurement of static object ± 1mm
Accuracy of recorded readings	Field measurement of humans (infants, children and adults) recorded by trained surveyors within ± 3mm	Field measurement of humans (infants, children and adults) recorded by trained surveyors within ± 1mm
Precision	± 2 mm	± 1mm
Range	30-215 cm.	
Time for Result	Immediate	
Product Requirements		
Storage life	Minimum 12 months	Minimum 24 months
Operational life (after first use)	Minimum 3 years	Minimum 5 years
Operational climactic conditions	-10˚- +45˚C - 80% relative humidity	
Durability	The device must be able to withstand the intended use during its operational life without compromising functionality or accuracy. The durability can preferably be demonstrated by being compliance to EN 62262 IK 09 or equivalent for impact resistance and compliance to IEC standard 60529, IP53 for water particle size permeability.	

Physical characteristics	The device must be child-friendly and designed to avoid distress or harm of the individual by use of factors such as soft edges and surfaces, colours and children friendly illustrations which are gender neutral and appealing to all cultures.	
Maintenance	The device must be easy to maintain both in terms of daily cleaning and small repairs. Repairs must be possible with simple tools available in the described context.	No maintenance required with the exception of light cleaning.
User Requirements		
Portability	The device is comfortably and easily relocated from one site to another by the use/support of handles, straps of backpacks. Max. 6 kg.	The device is comfortably and easily relocated from one site to another by the use/support of handles, straps of backpacks. Max. 2 kg.
Assembly/setup	Assembly and setup is managed by one person without tools	
Operational by	Subjects can be positioned, measured, and readings documented accurately by 2 persons.	Subjects can be positioned, measured, and readings documented accurately by 1 person.
Output Display	Clear digital read out in dimly light settings	Back-lit LCD screen or similar for low light Anti-glare screen with high contrast for bright light reading
Data download	Reading to remain on the display until device is activated again.	-Outputs are automatically recorded and data automatically transferred to preferred device, even with low battery power. (See *Data Storage Capacity under* Operational/ Functional Requirements). -Connectivity range within 10m -Preferably meeting IEC 60601-1:2015 or equivalent Standards for medical Electrical equipment
Training Requirements	1day training that can be understood by non-technical users.	Less than 1 day training that can be understood by non-technical users.
Supply Chain Requirements		
Packaging	High packing density. Compatible with standard pallet sizes. To improve packing density, packaging can contain up to 2 devices.	
Environmental Footprint	Device including packaging must be made of environment friendly and safe materials, preferably recyclable.	
Commercialization Requirements		
Regulatory approvals and compliance to standards	• Should include evidence of accuracy/precision with reference to international standards appropriate to specific device. • Compliance with regulatory requirements for marketing clearance, i.e. GMPALS (Australia), Device License (Canada, Japan), CE Class (EU), FDA (USA). • ISO13485 Quality Management Systems for Medical Devices or ISO9001:2008 QMS for Medical Scales and Measuring Systems • ISO 14001: Environmental management	

	• IEC 60601-1 General requirements for basic safety and essential performance or equivalent. For further information refer to UNICEF Technical Provisions document (see references).	
Safety Requirements	The device including all components and packaging must be non-hazardous and non-toxic. The device must be child-friendly e.g. no exposed sharp edges or protruding hardware, avoid moving parts close to the body and rough materials etc.	
Target Unit price	150-200 USD	300 USD
Children's Rights and Business Principles	Adherence to UNICEF's Children's Rights and Business Principles.	

References

1. An Assessment of the Quality of DHS Anthropometric Data, 2005-2014. Available here: http://www.dhsprogram.com/publications/publication-mr16-methodological-reports.cfm
2. "Training Course and Other Tools." World Health Organization. Available here: http://www.who.int/childgrowth/training/en/
3. "The WHO Child Growth Standards." World Health Organization. Available here: http://www.who.int/childgrowth/en/
4. UNICEF General Technical Provisions for Medical Devices https://www.unicef.org/supply/files/UNICEF_Technical_Provisions_-_Medical_Devices_2012.pdf
5. Children's Rights and Business Principles http://childrenandbusiness.org/