

Child Growth Monitoring: How is it done in a Changing World?

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Master in International Health
September 8, 2008 – August 14, 2014

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Amsterdam, The Netherlands

Number of words: 8571

Declaration

Child Growth Monitoring: How is it done in a changing world?

A thesis submitted in partial fulfilment of the requirement for the degree of Master in International Health by

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Declaration:

Where other people's work has been used (either a printed source, internet or any other source) this has been carefully acknowledged and referenced in accordance with departmental requirements. The thesis: *Child Growth Monitoring: How is it done in a changing world?* is my own work.

Signature:

A handwritten signature in blue ink that reads "S.J.N. van Zadelhoff". The signature is written in a cursive style with a long horizontal flourish underneath.

Total word count: 8571

Date: August 10, 2014

Abstract

Worldwide nutritional status is changing. This change in nutritional status is represented in different stages of nutrition transition. Concurrent with socioeconomic development a country's stage of nutrition transition changes. Especially in countries undergoing the nutritional transition from stage 3 to 4 obesity levels are rising rapidly. Growth monitoring is a widely applied tool to assess a child's nutritional status. This research investigates if and how the change in nutrition transition is reflected in growth monitoring practice, especially regarding context assessment. Growth monitoring protocols of three countries in a different stage of nutrition transition, Tanzania, India and The Netherlands, are assessed and compared.

Results: Growth monitoring parameters, charts and criteria differ between the three countries. General advices regarding child feeding and care are similar. Context assessment in growth monitoring is different, reflected in different goal, approach, local application/adjustments and integration of growth monitoring in the health system. With stage of nutrition transition the goal changes from underweight intervention to overweight intervention and pathology detection. The approach changes from a directive approach to more informative and preventive. In higher stages of nutrition transition the protocol is more applied to the local situation. With increasing stage of nutrition transition the integration within the health system and in different sectors increases.

Conclusion: Consideration of context in growth monitoring is insufficient in the earlier stages of nutrition transition. Whereas in the highest stage of nutrition transition maybe too many different influencing factors are considered. To improve growth monitoring more growth promotion programs, adjusted to the stage of nutrition transition, and integration in different sectors is needed.

Key words: *child growth monitoring, nutrition transition, determinants of health, nutritional status, global*

Word count: 8571

Abbreviations

ADI	Average Dietary Intake
ANM	Auxillary Nurse Midwife
ASHA	Accredited Social Health Activist
AWC	Anganwadi Centre
AWW	Anganwadi Worker
BMI	Body Mass Index
BOFT	stimulating breastfeeding, physical activity and having breakfast and to reduce (sweetened) soda's, fast food, watching television/gaming and (energy rich) snacks (stimuleer Borstvoeding, Bewegen en Ontbijten, verminder Frisdrank, Fastfood, Televisie/gamen en Tussendoortjes)
CBS	Central Bureau for Statistics
CDC	Center of Disease Control
CIA	Central Intelligence Agency
DRCH	Division of Reproductive and Child Health
GGD	Community Health Service (Gemeentelijke Gezondheidsdienst)
GNP	Gross National Income per capita
HC	Head Circumference
HIC	High Income Country
HIV	Human Immunodeficiency Virus
IIPS	International Institute for Population Sciences
IAP	Indian Academy of Pediatrics
ICDS	Integrated Child Development Scheme
IOTF	International Obesity Task Force
JGZ	Youth Health Care (Jeugdgezondheidszorg)
JOGG	Youth at healthy weight (Jongeren Op Gezond Gewicht)
LIC	Low Income country
LMIC	Low- and Middle-Income Countries
MCPC	Mother-Child Protection Card
MCH	Mother and Child Health
MIC	Middle Income country
MGRS	Multicentre Growth Reference Study
MoWCD	Ministry of Women and Child Health
MoNHW	Ministry of National Health and Welfare
MoHFW	Ministry of Health and Family Welfare
MoHSW	Ministry of Health and Social Welfare
MoHWS	Ministry of Health, Welfare and Sports
MTCT	Mother-to-Child Transmission
MUAC	Middle Upper Arm Index
NBJ	National Bureau of Statistics
NCHS	National Center of Health Statistics
NCJ	Dutch Centre for Youth Health
PMTCT	Prevention of Mother-to-Child Transmission
RDA	Recommended Dietary Allowance

RIVM	National Institute for Public Health and Environment (Rijksinstituut voor Volksgezondheid en Milieu)
SD	Standard Deviation
SDS	Standard Deviation Score
SHG	Self Help Group
SES	Socio-economic Status
SNP	Supplementary Nutrition Programme
TBA	Traditional birth attendant
TNO	Applied Nature Scientific Research (Toegepast Natuurwetenschappelijk Onderzoek)
UNDP	United Nations Development Programme
WHO	World Health Organization
WCPV	Law for collective prevention of public health (Wet Collectieve Preventie Volksgezondheid)

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1. Introduction

Routinely growth monitoring is a widely supported practice and performed by health professionals in almost every country around the world (Panpanich & Garner, 2009). It is used to assess a child's nutritional status. Although the purpose of growth monitoring is often not clearly indicated, historically the main aim was to detect malnutrition and identify problems leading to malnutrition in order to reduce child mortality (Panpanich & Garner, 2009). In developing countries still more than 50% of the under-fives mortality is correlated with malnutrition (De Onis, Garza, & Habicht, 1997). Currently growth monitoring is also often used to detect obesity or growth disorders, especially in developed countries with a high prevalence of overweight and obesity, and identify the underlying problems. By the routine process of regularly measuring weight (and height), plotting in a graph and responding with appropriate intervention if growth deviates growth monitoring should be able to restore or improve children's growth, health and well-being. However, despite the widespread use there is still controversy about the effectiveness of growth monitoring (Panpanich & Garner, 2009).

Growth monitoring is done on the basis of growth charts derived from a reference population. Starting from the 70s the World Health Organization (WHO) aimed to create an international growth standard. In the 90s this effort resulted in the WHO-Child Growth Standards (WHO-CGS). These sex-specific charts are based on a large reference population of children from different continents, with the same affluent background and fed according WHO standards. This reference population would have the optimal circumstances to experience unconstrained growth and would represent a standard how all children *should* be able to grow, all around the world (De Onis, Garza, & Habicht, 1997; Garza & De Onis, 2004). With the charts we would be able not only to compare but also judge nutritional status of populations and individuals (De Onis & Yip, 1996). Sex and feeding mode (e.g. breast or formula fed) are determinants of growth which can significantly alter a child's growth pattern (De Onis & Yip, 1996) and thus considered in the selection of the reference population. Ethnicity, on the other hand, has relatively minor impact on growth during the first 5 years of life, especially compared to socioeconomic status and environmental factors (De Onis & Yip, 1996). Growth patterns of children with different ethnic background but fed according WHO standards and living under the same optimal environmental circumstances are quite similar (WHO Working Group on the Growth Reference Protocol and WHO Task Force on Methods for the Natural Regulation of Fertility, 2000). To achieve cross-nationally biological and genetic variability children were selected from the different continents, but all living under the same affluent circumstances. These children are considered to achieve their maximal growth potential. To date, 125 countries, containing 75% of world's under fives population, state to have adopted WHO-CGS (De Onis, et al., 2012).

As mentioned above, socioeconomic status and environmental factors can be of substantial influence on child growth. For example obesity is correlated with socioeconomic status (SES). This relationship is not straightforward. It can vary by gender, age and country. In high income countries overweight is inversely related to SES whereas in low income countries there is a positive relationship (Monteiro, Conde, Lu, & Popkin, 2004; Wang & Lim, 2012). Contextual factors at a higher level, like macroeconomic characteristics of a country (e.g. gross national income and Gini-coefficient), appear to influence the association between obesity and SES. Especially the middle income countries draw attention since here the

association shifts. Several studies found a lower risk for obesity in low SES group of lower middle income countries, whereas this group experiences a higher risk in the upper middle income countries (Due, et al., 2009; Monteiro, Conde, Lu, & Popkin, 2004). Also direct environment and family characteristics seem to influence growth. For example a study from Brazil found that crowding (number of people living in one house) was the mediating factor through which SES influenced energy utilization of a child (Haisma, et al., 2006). Also the phenomenon of co-existence of underweight and overweight within one family, discovered the last decade in countries experiencing the nutrition transition, especially amongst families with urban residence and high income, indicates that contextual factors can have great and variable influence on growth (Doak, Adair, Monteiro, & Popkin, 2000).

From the end of the last century nutritional status has been changing worldwide. There is an increase in obesity in almost every country. Prevalence doubled since 1980 to 35% overweight and 11% obesity in adults (WHO, 2014). Also childhood overweight and obesity is rising, with combined figures ranging from 30-40% in North America to 10-20% in African regions (Wang & Lim, 2012). Although, to date, the highest obesity prevalence is still in the high income countries, accelerated trends in obesity prevalence can be observed in low and middle income countries, especially in urban areas, but at the same time there is relatively less decrease of malnutrition (Popkin, 2002; Wang & Lim, 2012; Ziraba, Fotso, & Ochako, 2009).

The nutrition transition is one of the underlying factors influencing the change in nutritional status. Nutrition transition comprises the change of dietary and physical activity pattern (Popkin, 2002). The complete spectrum of nutrition transition contains roughly 5 different stages, see textbox. But with the term “nutrition transition” is mainly referred to the transition from stage 3, with reduced hunger and an increased diet variety, to stage 4, with diet increasingly consisting of refined products, high sugar and fat consumption and reduced physical activity. It is associated with socioeconomic development of a country. It is, however, not restricted to this or to one defined time interval only. It can also characterize certain socio-economic or geographic sub-populations, for example urban inhabitants (Popkin, 2002). Accelerated transition is noticed in low- and middle income countries. The adaptation to western lifestyle is at an earlier stage in socioeconomic development and occurring much more rapidly compared to this change in high income countries decennia ago. It is enhanced by socioeconomic change through urbanization, emergence of mass media, economic changes (increased income and income inequalities) and food purchasing behaviour (the change over time of the kind and amount of food bought for one dollar) (Popkin, 2002).

Stages of nutrition transition (Popkin, 2002)

- Pattern 1 Collecting food

This diet of a hunter-gatherer population contains high levels of carbohydrates and fiber and low levels of (saturated) fat. Activity levels are high and prevalence of obesity is low.

- Pattern 2 Famine

This diet has reduced variety and food security is lower. The nutrition stress probably has substantial impact on health status and growth and causes more pronounced social stratification.

- Pattern 3 Receding famine

Hunger is reduced and diet variety increases with consumption of fruit, vegetables and animal-source food. Activity levels change and people have more leisure time.

- Pattern 4 Nutrition-related non-communicable diseases

This diet contains high levels of (saturated) fat, cholesterol and refined carbohydrates, like sugar. Together with an increasing sedentary life, this represents the western lifestyle. It is most common in high income countries and nowadays also in large parts of the population in low and middle income countries. Increasing prevalence of obesity and degenerative diseases accompanies this lifestyle.

- Pattern 5 Behavioural change

In the westernized world a lifestyle is advised which could prevent or postpone degenerative diseases. By changing diet and physical activity an attempt is made to prolong healthy life.

Since context and the stage of nutrition transition can have influence on nutritional status and growth this research aims to investigate to what extent context factors are assessed and taken into account in the process of child growth monitoring. Therefore, on the academic level, this research is the first attempt in analyzing growth monitoring practices in countries that are in different stages of nutrition to understand better the influence of the contextual factors on children's growth. In this thesis I assess the growth monitoring practice of three countries, all in a different stage of nutrition transition, in comparison to growth monitoring practice as advised by WHO. First a description will be given of the growth assessment in terms of anthropometric measurements and their interpretation according WHO, followed by the different countries. Then the general advices regarding child nutrition and child care according WHO will be described, followed by the advices according the protocols of the different countries. Finally a description will be given of the contextual factors assessed according the WHO growth monitoring guidelines and according the protocols of the different countries. In this way I would like gain insight if and how the different countries applied growth monitoring practices to the local situation regarding nutritional status and underlying contextual factors.

This thesis has 3 research questions:

1. How do countries at different points in nutrition transition monitor and interpret growth of children?
2. What are the standard advices, with regards to feeding and care, given to the mother in countries at different points in nutrition transition?
3. How is the physical, social and economic environment of a child taken into consideration in growth monitoring in countries at different points in nutrition transition?

2. Background of included countries

2.1 The Netherlands

2.1.1 Demography

The Netherlands is a small and densely populated country of 33,730 km², situated in the northwest of Europe (The World Bank, 2014). The Dutch economy is highly developed, in which trade in services and industry are the main source of income and agriculture only has a share of 2% (The World Bank, 2014). In 2013 The Netherlands was fourth in the United Nations' Human Development Index (United Nations Development Programme, 2013).

The Netherlands has an ageing population. In 2012 the vast majority of all deaths was caused by non-communicable diseases (The World Bank, 2014). Malnutrition has almost disappeared in The Netherlands. Overweight on the other hand is increasing. Overweight has a strong negative correlation with educational level, incidence of overweight is 4 times higher amongst people with only primary education compared to the highest educational level (Centraal Bureau voor de Statistiek, 2013). Table 1 shows all demographic details.

2.1.2 Growth monitoring in the Dutch Health Care System

In The Netherlands growth monitoring is embedded within “de jeugdgezondheidszorg”, meaning Youth Health in English. It is a preventive health care system for youth including different preventive health care and screening programs for children such as vaccination, vision and hearing screening, sports programs. This Youth Health is organized into regional services through delegated responsibility to different institutes like community health services and homecare organisations. The so-called “consultatiebureaus” within the Youth Health are the institutes which measure and assess child growth and development. In these well-baby clinics doctors, nurses and assistants work who are specially trained in youth health care (Ministerie van Volksgezondheid, Welzijn en Sport, 2002).

2.2 India

2.2.1 Demography

India is a large country of 2,973,190 km² in Southeast Asia (The World Bank, 2014). In 2012 it had a population over 1.2 billion people. India is categorized by the World Bank as a lower middle income country. Its economy is growing fast. Industry and service trades are already the main source of income but unlike The Netherlands agriculture still contributes 17.3% to GDP. India has 135th position in the Human Development Index (United Nations Development Programme, 2013).

India has a fairly young population distribution. In 2012 already more than half of all deaths were due to non-communicable diseases. On the other hand communicable diseases and maternal, perinatal and nutritional conditions still accounted for more than a quarter of all deaths (The World Bank, 2014). The National Family Health Service in 2006 showed poor nutritional status of under-fives. The child nutritional status has a strong negative correlation with maternal education and wealth index, 4 to 5 times more children whose mothers hasn't any education are underweight compared to a mother with high educational level. Whereas for overweight and obesity it is exactly the opposite. Malnutrition is still a problem all around

India but urban areas are doing slightly better than rural (International Institute for Population Sciences (IIPS) and Macro International, 2007). Table 1 shows all demographic details.

2.2.2 Growth monitoring in India's Health Care System

Growth monitoring in India is performed within a large childhood programme, Integrated Child Development Service (ICDS). Established in 1975 with help of UNICEF; the aim is to improve health, nutrition and development of children. The central and state-level governments are primarily responsible for implementation and financing of the program. Organisational responsibility for the services lies at district, block and village levels. Programme activities take place in the so-called "Anganwadis" that are embedded in the public health system. Every village has an Anganwadi Centre (AWC) that provides the basic services to children under 6 years old and pregnant and lactating mothers. Each AWC is run by an Anganwadi Worker (AWW), assisted by an Anganwadi Helper (AWH) and are supervised by the ICDS Supervisor. AWW are women chosen from the local community and she receives 4 months of training in health, nutrition and child-care. AWW's are responsible for health and nutrition education including growth monitoring and supplementary feeding. Because AWC are part of the public health system medical problems identified by an AWW can be referred to the primary health care services (Ministry of Women and Child Development, 2009).

Growth monitoring is also performed in private under-fives clinics by paediatricians, using their own national reference charts (Khadilkar, et al., 2007) with currently new national charts under development (Indian Academic of Pediatrics, 2013). Since the focus of this thesis is on public health services we did not include these practices, but the existence of two different practices can potentially affect growth monitoring.

2.3 Tanzania

2.3.1 Demography

Tanzania is a country of 885,800 km² in eastern Africa (The World Bank, 2014). Tanzania is one the poorest countries in the world and ranked 159 in de UNDP's Human Development Index Tanzania (United Nations Development Programme, 2013). Its GNP per capita is 570 US dollar. Agriculture is still the main source of income (The World Bank, 2014).

Typical for low income countries, the population distribution is a pyramid shape. In 2012, almost two third of all deaths were caused by communicable diseases, maternal, perinatal and nutritional conditions (The World Bank, 2014). According the demographic and health survey malnutrition is still a major problem. Child stunting and wasting have an inverse correlation with educational level of the mother and household wealth. Overweight is positively related to mother's weight. A child is two times more likely to be overweight if his mother has a BMI>25 compared to a mother with a BMI<18.5 (Tanzania National Bureau of Statistics (NBS) and ICF Macro, 2011). Table 1 shows all demographic details.

2.3.2 Growth monitoring in Tanzanian Health Care System

Growth monitoring falls under Maternal and Child Health (MCH) services. These services comprise also antenatal and postnatal care, vitamin A supplementation and vaccination for children. MCH clinics provide these services and are embedded within the primary health

care system. The Ministry of Health and Social Welfare is responsible for the provision of preventive services (Ministry of Health and Social Welfare, 2014) (Leach & Kilama, 2009).

Table 1: Background information of the three countries

	The Netherlands	India	Tanzania
Demography			
Inhabitants (millions)	16,77	1,200	47,8
Population growth (% annually)	0.4	1.2	3
Urban population (%)	83	32	27
<14 years (%)	17	29.4	44.9
15-64 years (%)	66	66	52
>65 years (%)	17	5	3
GNI (per capita, US dollar)	47,970	1580	570
UN human development index	4	135	159
Health			
Life expectancy (years)	81.2	66	60
Fertility rate (births per woman)	1.7	2.5	5.4
<5 years mortality (per 1,000 live births)	4.1	56.3	81
Non-communicable diseases (% of all deaths)	89.3	59,8	30,6
Communicable diseases (% of all deaths)	6.4	27,9	57,9
DTP immunization (% at 2 years)	97	72	90
Underweight (% of population)	2.3	36	unknown
Overweight (% of population)	41.5	13	unknown
Underweight (% of children)	4.9 (4-20 years old)	43.5 (0-5yrs)	16.2 (0-5yrs)
Stunting (% of children)	-	47.9 (0-5yrs)	42.5 (0-5yrs)
Wasting (% of children)	-	20 (0-5yrs)	4.9 (0-5yrs)
Overweight (% of children)	13.2 (4-20 years old)	1.9 (0-5yrs)	5.5 (0-5yrs)

References: (Centraal Bureau voor de Statistiek, 2013) (International Institute for Population Sciences (IIPS) and Macro International, 2007) (Tanzania National Bureau of Statistics (NBS) and ICF Macro, 2011) (The World Bank, 2014) (United Nations Development Programme, 2013)

3. Conceptual Framework and Methods

3.1 Theory and Conceptual Framework

WHO's approach in child growth monitoring among the health care providers contains information how growth should be measured (growth measurements), interpreted (interpretation of growth indicators) and what should be considered and advised when growth deviates on the charts (counselling on growth) (WHO, 2008). This approach (guideline) is used as the basis for the factors that are universally accepted to have influence on child growth. All different factors are extracted from the WHO guideline and put together in a list. This list is used to assess the protocols of the different countries.

In 1974 the Canadian minister of Health commissioned the Report about Population Health (Ministry of National Health and Welfare, 1974). The significance of this report is that it introduces a framework to analyse population's health. In this framework, health care services are only one factor influencing the health status of a population. The others are lifestyle, human biology and environment. This framework is often referred to as "The Lalonde Model" (see figure 1). This model is fundamental within public health sciences and also applied in this research in order to examine the research questions and analyse the findings.

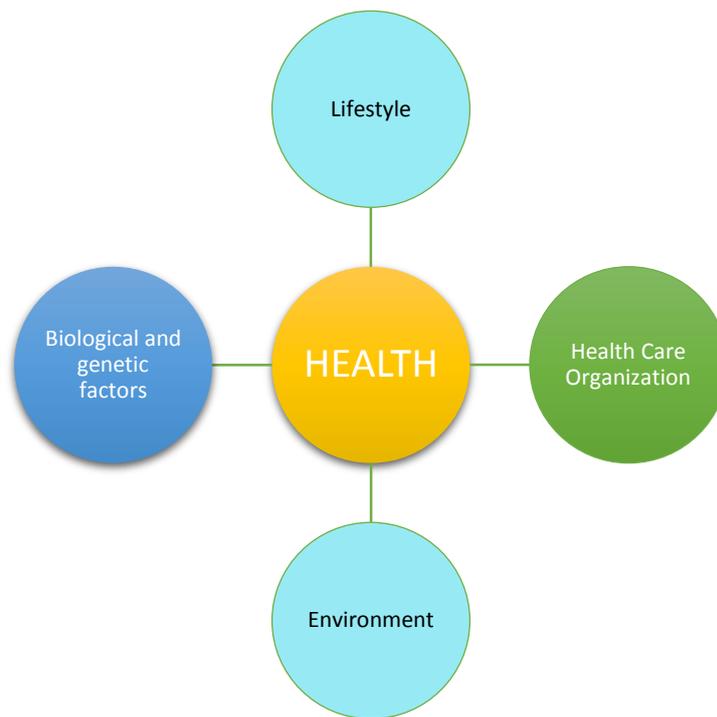


Figure 1 Determinants of Health: Lalonde Model (Ministry of National Health and Welfare, 1974)

Since a child's growth is usually a direct indicator of the child's health, the same approach could be used for child growth and influencing factors on growth could also be subdivided into the same 4 categories. Using the Lalonde Model would suggest that other determinants aside from nutrition can influence growth and should be considered in growth monitoring. Therefore, this research applies the Lalonde Model of determinants of health as conceptual framework. To be able to apply the Lalonde Model to the process of growth monitoring I adjusted it into my own conceptual framework, shown in figure 2. It demonstrates the influence of the determinants of health and the different level of influence, direct or indirect. Biological and genetic factors can have direct effect on growth, health care organization can have an indirect effect on growth and lifestyle and environment can have both direct and indirect effect on growth. The influencing factors for growth considered in the different growth monitoring protocols were identified and categorized according to the four determinants of health of the Lalonde Model.

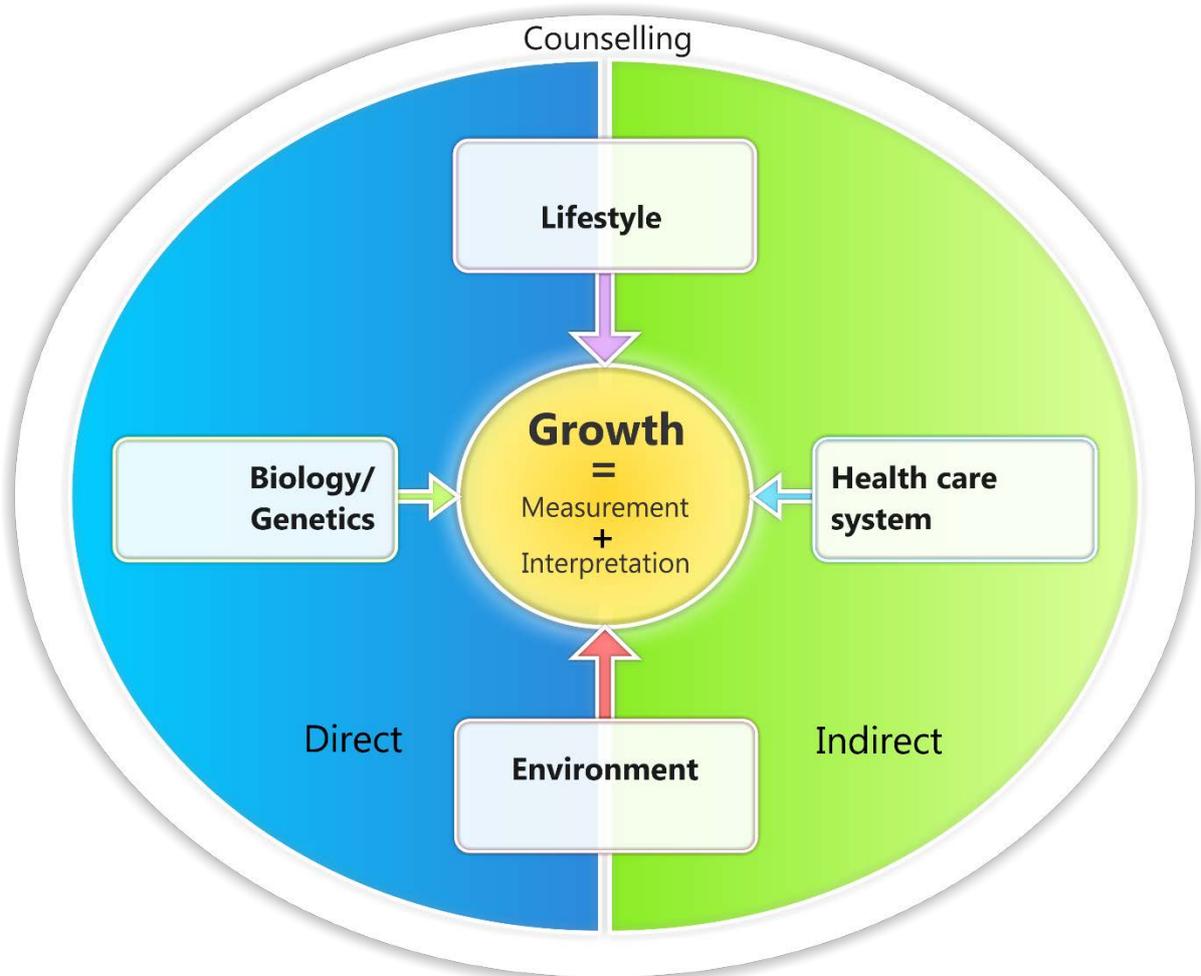


Figure 2: Conceptual Framework[®]: Assessment of growth monitoring

3.2 Methodology

The WHO approach is applied to answer the first two research questions. I used the determinants of health of the Lalonde Model as the framework to address my third research question.

Coding criteria for assessment of healthy growth and growth problems was done on the basis of the WHO approach for child growth assessment. The analytical terms I looked for were:

- measurements (e.g. which measurements of a child are taken and how)
- interpretation (e.g. which type of growth charts and which classifications are used)
- counselling (e.g. what is considered if growth deviates and what kind of action is undertaken)

The national protocols analysis for these initial data was complemented with additional growth monitoring aspects used in each of different national protocols (see table 2, 3, 4, 5, 6 and 7).

Coding for contextual determinants, considered in the counselling part, was done on the basis of the four determinants of health of the Lalonde Model. The content analysis focused on the following terms:

- health care organisation (e.g. health care provider, additional programs)
- biological and genetic factors (e.g. family medical history, pregnancy factors)
- lifestyle (e.g. food/feeding, physical activity)
- environment (e.g. income family, educational level parents)

These analytical terms were identified as either descriptive (e.g. description given how nutrition can influence growth) or prescriptive (e.g. feeding advice given in case of underweight) (see table 7).

Documents were analysed manually, using the computer to store the data excerpts for writing the research. No other software was used.

The growth monitoring practice and criteria of the three countries were compared to the practice described by WHO and then between the three country subjects.

Subsequently the different national protocols were compared for contextual growth assessment using the Lalonde model. Each national growth monitoring protocol was analysed to identify: if and how different contextual factors were reflected, descriptive or prescriptive.

3.3 Selection of countries

Three study countries have been purposively selected based on difference in stage of nutrition transition according to the nutrition transition model of Popkin (Popkin, 2002). Since this study is embedded in a larger study, investigating biological, sociological and anthropological dimensions of child growth (VIDI grant No W01.70.300.002, "Normative indicators of child health and nutrition: one size fits all?" H. Haisma), the same countries have been chosen, Tanzania as a country in stage 3 of the nutrition transition, India as a country currently undergoing the nutrition transition (from stage 3 to 4), and the Netherlands as a country in stage 4. Countries in different stages are expected to have the widest range in nutritional status and contextual difference.

3.4 Data collection

The documents used for the content analysis are growth monitoring protocols and growth monitoring cards of the selected study countries. There is a broad variety of manuals, guidelines and protocols concerning child health and different files and cards to keep record of child health. I limited the selection to the protocols, manuals or guidelines and files or cards which are strictly only concerning or used in the daily practice of child growth monitoring in public health sector in the selected countries at this moment. Guidelines and card used in private paediatric clinics have not been included.

The WHO training courses on child growth assessment, with corresponding Growth Record were derived from the WHO website (WHO, 2008; WHO, 2008).

For the Netherlands the two existing interpretation protocols regarding growth monitoring from the Dutch Centre for Youth Health were used, “Guideline for Overweight” (Nederlands Centrum Jeugdgezondheid, 2012) and “Guideline for Short Stature” (Rijksinstituut voor Volksgezondheid en Milieu, Centrum Jeugdgezondheid, 2010), together with “The Guideline Contact moments in Youth Health Care 0-19 years” from the Ministry of Public Health, Welfare and Sports (Nederlands Centrum Jeugdgezondheid, 2003), “The Manual: Growth Charts 2010” (Talma, Schonbeck, Bakker, HiraSing, & van Buuren, 2011) and “The Growth Guide 0-4 years” (GGD Amsterdam, 2013).

For India “The Growth Monitoring Manual” from National Institute of Public Cooperation and Child Development (National Institute of Public Cooperation and Child Development, 2010) was used together with “The Mother-Child Protection Card” (MCPC) from the Ministry of Women and Child Development and the corresponding “Guide for the use of the Mother-Child Protection Card” (Ministry of Women and Child Development, 2009; Ministry of Women and Child Development, 2009).

For Tanzania the person in Ministry of Health and Social Welfare responsible for national protocols provided us with the “Child Health Handbook” and “Guidelines for monitoring Health and Development of the Child” from the Ministry (Ministry of Health and Social Welfare, 2011; Division of Reproductive and Child Health , 2011). The Tanzanian documents were written in Swahili. They have been translated to English by a translator.

Before and after the first data analysis, the relevance of the source data for the daily practice of growth monitoring has been cross-checked with local experts. Interpretation of growth monitoring protocols and terminology have been validated by growth monitoring experts.

4. Results

4.1 Growth monitoring practice

Table 2 summarizes the findings and highlights the differences/similarities within the national protocols compared to WHO. The table presents growth monitoring aspects. As the table indicates, weight is the key indicator that is shared between the selected countries and WHO. This could be due to the fact that it is the easiest to measure. India is the only country which doesn’t include length. Tanzania includes MUAC to assess wasting in case no length board is available. The Netherlands is the only country that uses BMI and head circumference in its growth monitoring. Similarly, only the Netherlands measures blood pressure (in case of overweight). This is all probably due to the fact that overweight (and its consequences) is more a problem than underweight.

Table 2: Overview Growth Monitoring Aspects

<u>Monitoring Aspects</u>	<u>WHO</u>	<u>Netherlands</u>	<u>India</u>	<u>Tanzania</u>
Measurements				
Weight	Yes	Yes	Yes	Yes
Length	Yes	Yes	No	Yes
BMI	Yes	Yes	No	No
MUAC	No	No	No	Yes
Head circumference	No	Yes	No	No
Blood pressure	No	Yes, if >5 years with overweight	No	No
Temperature	No	No	No	Yes
Observations	Kwashiorkor, marasmus, oedema. Wasted, lean, normal, heavy, overweight, obese	Clinical look: body figure, fat distribution, ethnicity, puberty. Dysmorphic features and disproportion.	Kwashiorkor, marasmus, oedema, micronutrient deficiencies.	Kwashiorkor, marasmus, oedema.
Development	Development milestones	Development milestones	Development milestones	Development milestones
Interpretation				
Chart	Weight/age Length/age Weight/length BMI/age	Weight/age Length/age Weight/length BMI/age HC/age	Weight/age	Weight/age Length/age Weight/length
Reference population	International population from WHO-MGRS	National population 1980 (weight/age, weight/length) National population 2010 (length/age) International population from IOTF (BMI/age)	International population from WHO-MGRS	International population from WHO-MGRS
Frequency of measuring	Not specified	First half year every month Second half year every 2-3 months After 1 year once yearly until 4years old	First month weekly Then monthly until 3 years old and quarterly until 5 years old	Monthly until 2 years Quarterly until 5 years
Growth criteria	Table 3	Table 4	Table 5	Table 6

WHO gives a complete overview about growth and growth problems. They use weight, length and BMI, with corresponding charts and criteria. Table 3, presents the key growth indicators that are used and promoted by WHO, and provides the cut-off points highlighting WHO's definitions of normal vs abnormal growth. As indicated in the table, there are specific cut-offs to categorize children as stunted, normal or tall.

Table 3: WHO Growth Criteria (WHO, 2008)

Z-score	Growth indicator			
	Length/height-for age	Weight-for-age	Weight-for-length/height	BMI-for-age
Above +3	Tallness	May have growth problem	Obese	Obese
Above +2	Normal		Overweight	Overweight
Above +1	Normal		Possible risk of overweight	Possible risk of overweight
0 (median)	Normal	Normal	Normal	Normal
Below -1	Normal	Normal	Normal	Normal
Below -2	Stunted	Underweight	Wasted	Wasted
Below -3	Severely stunted	Severely underweight	Severely wasted	Severely wasted

Growth monitoring in the Netherlands is very extensive. Next to weight, length and BMI also head circumference is used. National growth charts and national growth criteria have been developed. Comparison of table 3 and 4 provides us with interesting findings. For instance, in the Dutch practice, Z-scores of +1 and +2 weight-for-length are directly translated to overweight and obese (Table 4). WHO guideline presents those scores as areas which need further investigations as they may have growth problems. Additionally, the Netherlands national guideline does not indicate any specific score for Z-scores equal or below zero (table 4). Also criteria for length growth is strikingly different (figure 3). The Netherlands developed an extensive flow diagram to assess length growth in order not to miss any case of lagging growth. But despite all these criteria the "clinical look" of the health worker is still very important. Anthropometry should always be interpreted together with the "clinical look".

Table 4: The Netherlands overweight criteria (Nederlands Centrum Jeugdgezondheid, 2012)

Z-score	Growth Indicator	
	Weight-for-length/height (0-2years)	BMI-for-age (>2years)
Above +3	Not mentioned	According IOTF growth criteria as indicated in growth chart
Above +2	Obese	
Above +1	Overweight	
0 (median)	Not mentioned	
Below -1	Not mentioned	
Below -2	Not mentioned	
Below -3	Not mentioned	

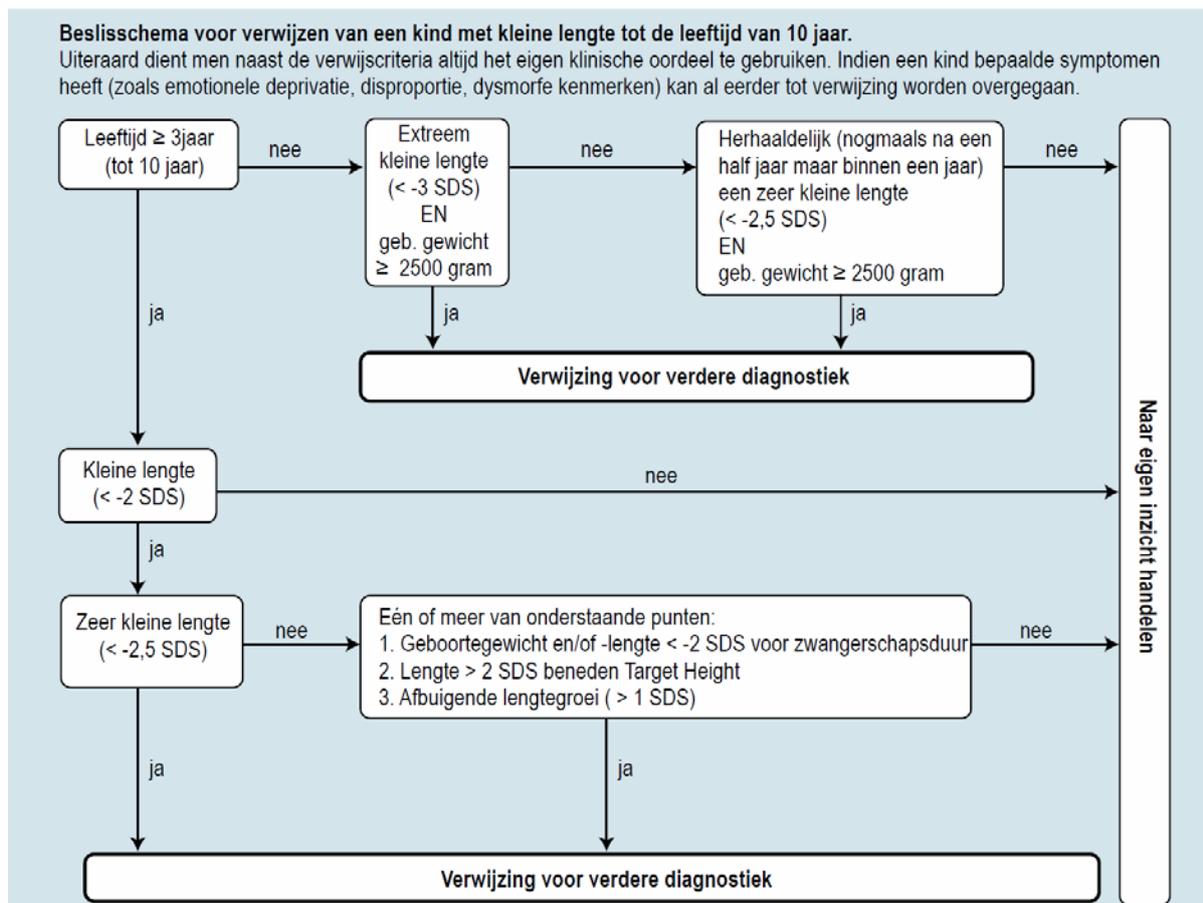


Figure 3: The Netherlands Length Growth Criteria (Rijksinstituut voor Volksgezondheid en Milieu, Centrum Jeugdgezondheid, 2010)

The growth monitoring protocol of India only uses weight. Only one growth chart is used, which is a simplified version of the WHO-CGS for underweight. The review of growth criteria in India and its comparison with WHO's guideline, presents similar scoring (table 5).

Table 5: India Growth Criteria (National Institute of Public Cooperation and Child Development, 2010)

Z-score	Growth Indicator
Above +3	Growth problem
Above +2	Growth problem
Above +1	Growth problem
0 (median)	Normal
Below -1	Normal
Below -2	Moderately underweight
Below -3	Severely underweight

The Tanzanian protocol is almost an exact copy of the WHO approach, using both weight and length. Identification of both malnutrition and overweight is described. Middle Upper Arm Circumference (MUAC) and temperature are added to the indicators. The charts are based on WHO-CGS with the same criteria but by putting all charts for different ages together difficult to interpret. Tanzania's growth criteria presents two key differences with WHO. Weight-for-age criteria, while Z-scores above +1 are indications of possible growth

problems in WHO's assessment, in Tanzania's national criteria a Z-score of +1 is still considered normal and no higher criteria are mentioned. Similarly, WHO considers a Z-score of +1 in weight-for-length as a possible risk of overweight, while in Tanzania a Z-score of +1 is still considered normal (table 6).

Table 6: Tanzania Growth Criteria (Division of Reproductive and Child Health , 2011)

Z-score	Growth Indicator		
	Length/height-for age	Weight-for-age	Weight-for-length/height
Above +3	Not mentioned	Not mentioned	Obese
Above +2	Not mentioned	Not mentioned	Overweight
Above +1	Normal	Normal	Normal
0 (median)	Normal	Normal	Normal
Below -1	Normal	Normal	Normal
Below -2	Stunted	Underweight	Wasted
Below -3	Severely stunted	Severely underweight	Severely wasted

Overall, in the assessment of growth all protocols include both anthropometry and evaluation of development milestones. Differences mainly concern focus and approach of growth monitoring. The WHO protocols are complete and describe both malnutrition and overweight. The main focus is identification of growth problems and providing a corresponding strategy. The Dutch protocols are even more problem-oriented. With lower and very complex growth criteria there is a strong focus on early recognition of lagging length growth or overweight and identifying underlying pathology. The focus of the Indian growth monitoring is mainly on identifying and treating underweight and keeping the protocol as simple as possible. The way in which growth monitoring is performed it is more accompanying healthy growth and giving practical advices. In Tanzania the growth monitoring protocol is almost an exact copy of the WHO protocol. It aims to be complete regarding measuring growth indicators and general advices but lacks background information and assistance in interpretation. Growth monitoring is taken as an opportunity to identify current illnesses, especially infectious diseases. Frequency of measuring is strikingly different with very frequent measuring in Tanzania and India and a lower frequency in the Netherlands. But in view of the high rates of malnutrition and child mortality this would be expected. Further detailed explanations about the different growth monitoring practices are elaborated in Appendix 4.1.

4.2 Contextual determinants of growth

The following 4 sections reflect the analysis of the protocols according the 4 contextual determinants of growth of the Lalonde model:

1. Health care system
2. Lifestyle
3. Biological factors
4. Environment

Table 7, page 19, summarizes the outcomes of the data analysis. The appendices of each section provide a detailed explanation.

4.2.1 Health care organization

In the introduction the growth monitoring the health care system of each country has already briefly been described. In the following section the aspects regarding the health care organization highlighted in the protocols of each country will be discussed.

WHO's approach of growth monitoring is mainly to support both the health care provider and the parents with extensive information in the Growth Record and corresponding growth monitoring manuals. Emphasis is made on the importance additional programs for child health to support growth monitoring in order to achieve child health improvement.

In the Netherlands growth monitoring is supported by several regulations, institutes and programmes at different levels and in different sectors. To address overweight the protocol suggests a community-based and family-oriented preventive approach, including both national and local government but also schools, sports clubs, business and different health care providers. Special emphasis is made also to involve migrant organizations and community key figures to reach out for ethnic minorities. Parents are supported by basic information and advices in the Growth guide and through some laws and regulations regarding child care. Extensive growth monitoring protocols provide information for the health worker.

The Indian growth monitoring protocol strongly supports a community-based approach by awareness raising in the community, collaboration with other health care workers in the community, like traditional birth attendant (TBA) or medical staff of the health centre, and involvement of women's Self Help Groups (SHG) Mahila Mandal. This is enhanced by selecting the AWWs from the community and home-visits. Prevention and treatment of underweight is supported by a supplementary nutrition program (SNP) and locally adjusted child growth and care advices in MCPC.

The growth monitoring protocol in Tanzania provides mainly practical information about how and where measuring should be done. But limited information is provided to the health worker about interpretation of growth criteria and counselling of the parents. Basic child growth and care information for both parent and health care provider in the Child Health Handbook. Growth monitoring is integrated in the medical sector.

Overall, comparing the protocols the design of growth monitoring and integration within the health care system is significantly different. WHO only mentions it briefly since it is country dependent, but recognizes the importance of supportive health programs. In the Netherlands programs and regulations are present at national, regional and individual level and different sectors are involved. Emphasis is made on a proactive and preventive approach through different channels to improve care and support for both child and parents. In India programs supporting growth and growth monitoring are mostly targeting the community and individual. Growth monitoring practice aims for prevention through awareness raising, community involvement and supplementary feeding. Although the protocol instructs to counsel all mothers on healthy growth, the focus is on the ones with an underweight child. In Tanzania the approach of growth monitoring is mainly practical and reactive. Integration of growth monitoring in the health care system is mainly on individual level through advices

or referral possibilities. Appendix 4.2.1 provides further detailed information regarding health care organization in growth monitoring practices in the different protocols.

4.2.2 Lifestyle

WHO provides general food and feeding advices in the Child's Growth Record. To investigate a growth problem there are two interview guides for the health care worker, for both under- and overweight. These guides mainly focus on food and feeding and give some specific advices for intervention in case of a growth problem.

The Dutch Growth Guide provides general food and feeding advices. These are in accordance with the WHO advices but can sometimes be very detailed. Extensive information for the health care provider is given regarding overweight prevention and intervention (risk factors, prevention and treatment advices) mainly focussing on food, feeding and physical activity, supported with a specially developed program, "Bridging Plan".

General food and feeding advices in the Indian manual are in accordance with WHO advices and applied to the local nutritional status and local available food. More information is given to investigate underweight and advices for intervention, all focussing on food and feeding. This supported by a supplementary nutrition programme. There is no information or advices regarding prevention.

In Tanzania the Child Health Handbook provides general food and feeding advices in accordance to the WHO advices with one additional page for children born to a HIV+ mother. Two interview guides are provided to investigate underweight or overweight, accompanied with advices. Both guides are identical to the WHO interview guides and mainly focus on nutrition and few physical activity advices. There is no information or advices regarding prevention.

Concluding, food and feeding information and advices are the most extensively addressed determinant of growth in all countries. All countries give food and feeding information for healthy growth in accordance with WHO. In India and the Netherlands information is adjusted to the local situation and habits. Tanzania uses a copy of WHO advices. Intervention in case of growth problems focusses on food and feeding practice in all countries, only the Netherlands also emphasizes on physical activity. The Netherlands addresses prevention of overweight through lifestyle advices. Whereas in India and Tanzania advices mainly focus on intervention. In appendix 4.2.2 information about lifestyle in the different protocols is further elaborated.

4.2.3 Biological and genetic factors

WHO indicates that sex and illnesses influence growth. Growth charts are adjusted for sex. Information is given how to consider illness in anthropometry interpretation with corresponding advices. Other genetic influence is briefly described.

Biological and genetic influence on growth is quite prominent in the Dutch protocols. Besides sex also ethnicity, parental height, birth weight, small for gestational age and twin pregnancy are taken into account for interpretation of length growth. National curves are used and even these curves are adapted for specific ethnic minorities. Also for overweight prevention the protocol advises to focus on those with genetic and biological risk factors, like ethnicity, >0,67 SDS weight increase in first year, early puberty, depression, smoking during pregnancy and genetic predisposition.

In India only sex and illness are considered in interpretation of anthropometry. Sex-specific charts are used and advices are given in case of illness.

Also Tanzania considers sex as influencing genetic factor and provides sex-specific charts. Recurrent illnesses and mother having HIV are indicated to influence growth and corresponding advices given.

Overall, all countries consider sex as influencing genetic factor for growth and provide sex-specific charts. Illnesses are an important biological influencing factor in the different national protocols and should be considered in the management of growth problems in India and Tanzania. In the Netherlands early identification of hereditary causes or chronic diseases is even the aim of the protocol for short stature. Although it recognizes that in most cases growth faltering is not the first symptom. Genetic predisposition (e.g. parental height and weight, fat distribution, physique) and other biological factors should be considered in growth assessment. Appendix 4.2.3 gives detailed information about biological factors and genetics considered in the different protocol.

4.2.4 Environment

Good child care is considered important for healthy growth in the WHO approach. General pedagogical information and advices are given per age group to create a safe and stimulating environment. Environmental risk factors for growth problems are described and some advices are given, mainly focussing on hygiene, food availability and neglect. In case of neglect advices are to look for support.

In the Dutch protocols general information regarding creating a favourable environment for healthy growth concern psychosocial environment and pedagogical advices are given. Risk factors for overweight are described extensively including physical, economic, social and political environment (e.g. low SES, pedagogical style, unsafe environment, parents' perception of overweight and awareness about the risks of overweight). Information is given and preventive programs should target the low SES population. Neglect should be considered in case of short stature. In case of pedagogical problems support is offered.

In India most general advices given regarding creating a favourable environment for healthy growth concern hygiene and pedagogical care. In case of underweight other environmental factor, like food availability, knowledge of the mother, neglect, awareness and customs/beliefs should be checked. Practical advices are provided to address hygiene, adverse customs and beliefs, knowledge about nutritional needs and neglect. SES is considered as influencing factor. It is, however, is not explained how it could influence growth.

Creating a physically and socially safe environment is considered important for growth in the Tanzanian protocol. General pedagogical and hygiene advices are given. In case of underweight neglect should be considered. The health worker should check for risk factors, e.g. family size, assistance of father and food availability, no further advices given.

Concluding, the general advices in all countries aim, like WHO, for creating a safe and stimulating physical and social environment for the child. Each protocol focusses on the biggest risks of its country, like poor sanitation, child abuse or traffic. In analysing growth problems the influence of environment on growth is considered in different ways. WHO advises to consider mainly the physical and social environment, like hygiene, food availability and family factors. In the Netherlands mainly social and economic environment are

considered. Preventive programs should focus on the high risk groups. In India physical environment is the most important but also social and cultural are considered with respect to malnutrition and advices given. In Tanzania physical environment is the most important factor to consider with regards to growth and practical hygiene advices are given. Influence of social environment is described in case of in growth faltering, but no clear advices or support provided. In appendix 4.2.4 information about environment in the different protocols is further elaborated.

Table 7: Overview Assessment of Context in Growth Monitoring Protocols according determinants of health

<u>Determinants of health</u>	<u>WHO</u>	<u>Netherlands</u>	<u>India</u>	<u>Tanzania</u>
Counselling				
Health System Organization				
Health care service	Not described	Well baby clinic (consultatiebureau) separate	Well baby clinic (anganwadi centre) separate	Clinic for reproductive and child health in health post
Material	Growth Record with growth, development and feeding information for parents Extensive growth monitoring manual for health worker	Growth guide with growth, development and feeding information for parents Growth monitoring protocols for health worker with extensive information about growth	MCPC with pregnancy, growth, development and feeding information for parents, also used for referral Growth manual for health worker with description of tasks	Child Health Handbook with growth, development and feeding information for parents, also used for referral Manual with limited information for health worker
Health care provider	Not described	Assistant, nurse and doctor all trained for child health	Anganwadi worker appointed from the community, assistant and supervisor	Not described
Integration in health care system	Advice for additional programmes	National: guidelines and policies for growth monitoring Regional: community based prevention programmes, referral system for medical care	National: nutrition programmes, child care policies Community: village nutrition and health days, Mahila Mandal, referral system for medical care	Referral system for medical care
Lifestyle				
Feeding	General age-specific feeding information and advices Specific feeding information and advices for both under- and	General age-specific feeding information and advices, locally adjusted Specific feeding information and advices for overweight	General age-specific feeding information and advices, locally adjusted Specific feeding information and advices for	General age-specific feeding information and advices Specific feeding information and advices for both under- and

<u>Determinants of health</u>	<u>WHO</u>	<u>Netherlands</u>	<u>India</u>	<u>Tanzania</u>
	overweight intervention	prevention and intervention in a specially developed program (Bridging Plan)	underweight intervention, nutrition programme as preventive and intervention strategy for underweight	overweight intervention
Physical activity	Information and advices for physical activity to intervene in case of overweight	Information and advices for physical activity to prevent and intervene in case of overweight	Not described	Advices for physical activity to intervene in case of overweight, no information given
<i>Biological/Genetic factors</i>				
Sex	Assessment adjusted for sex	Assessment adjusted for sex	Assessment adjusted for sex	Assessment adjusted for sex
Ethnicity	Not explicitly described	Information about ethnical influence, separate charts and advices for assessment	Ethnic influence is minor to feeding and environment	Not described
Illness	Information about chronic or recurrent illnesses that influence growth, care advices to prevent/treat illness or referral	Disorders can result in short stature, advices for treatment and referral in case of short stature	Information about chronic or recurrent illnesses that influence growth, care advices to prevent/treat illness or referral	Information about chronic or recurrent illnesses that influence growth, care advices to prevent/treat illness or referral, HIV explicitly explained
Length parents	Information about influence of parents length	Information about influence of parents length and advices for assessment	Not described	Not described
Medical history of family	Increased risk for overweight if parents have high BMI	Increased risk for overweight if parents have high BMI, consideration of hereditary diseases affecting growth	Not described	Mother's health has influence on child health
Birth weight	Not described	Information and advices for assessment in case of small for gestational age	Not described	Not described
Twins	Not described	Length standard deviation needs to be adjusted combined with gestational age	Not described	Not described

<u>Determinants of health</u>	<u>WHO</u>	<u>Netherlands</u>	<u>India</u>	<u>Tanzania</u>
Pregnancy factors	Not described	Prematurity or breech delivery can influence growth	Not described	Not described
<i>Environmental factors</i>				
Income	Food availability and possibilities for support should be checked	Information about influence of low SES on growth	Information about negative influence of lack of money on growth Food availability should be checked	Food availability and possibilities for support should be checked
Education parents	Not described	Information about influence of low SES on growth	Information about negative influence of lack of nutritional understanding	Not described
Hygiene	Information and advices regarding hygiene	Some hygienic advices	Information and advices regarding hygiene	Information and advices regarding hygiene
Family size and composition	Information how family size can affect growth through neglect and undernutrition. Discuss how to improve	Not described	Information how family size can affect growth through neglect and undernutrition, advices given	Family size can affect growth through neglect and undernutrition
Mother working	Information how absence of parent/busy work schedule can affect growth. Advices to express breast milk	Advice to create a stable situation for the child when mother starts working	Information how busy work schedule can affect growth. Advices how to combine household and care or ask for assistance	Advices to express breast milk
Social/emotional interaction	General information and advices about social / emotional interaction	General information and advices about social / emotional interaction	General information and advices about social / emotional interaction	General information and advices about social / emotional interaction
Pedagogical style/capability	Pedagogical advices to stimulate healthy growth and prevent overweight	Information how pedagogical style influences growth, pedagogical advices to prevent overweight, influence of neglect, support in case of pedagogical problems	Pedagogical advices to improve eating	Pedagogical advices to stimulate healthy growth and prevent overweight
Behaviour population	Beliefs and customs can affect growth	Behaviour of population influences growth.	Beliefs and customs can lead to underweight	

<u>Determinants of health</u>	<u>WHO</u>	<u>Netherlands</u>	<u>India</u>	<u>Tanzania</u>
		Identify risk groups Cultural acceptance of advices are important		
Awareness in community about growth monitoring	Not described	Not described	Awareness in community is important for compliance, advice to correct adverse perceptions	Not described
Perception of overweight of parents	Advice to inquire perception of parent about weight of child	Perception of overweight is important in treatment	Not described	Not described

5. Discussion

Answering the first research question we can conclude that growth monitoring practice is different between the three countries. Different growth indicators, with different growth charts and different reference population, are used (see tables 2, 3, 4, 5 & 6). The Netherlands have developed very elaborated protocols, using most different growth parameters and charts, which are all nationally developed. They have the lowest frequency of monitoring. The main focus is on overweight and growth disorder. India has its own applied protocol, which only focusses on underweight. Tanzania uses a short and more directive protocol. It is almost an exact copy of the WHO, which addresses both under- and overweight, but the manual for health workers lacks background information on growth. Regarding the prevalence of underweight and overweight and the stage of socio-economic development of the countries different protocols with a focus on different growth problems could be expected.

On the other hand the standard advices given regarding feeding and care are quite similar compared for these three countries (see table 7 feeding and social/emotional interaction). We, however, don't know whether the advices suggested in these protocols are also what is said or done in practice or how this is done.

The third objective was to gain insight if and how the context in which a child is growing up is taking into consideration in interpretation of growth and advices given in the different countries and WHO. For this we used the Lalonde model. Context is assessed differently in the three countries (see table 7). Comparing context in growth monitoring the following themes emerged from the results, representing the most striking differences between the countries which seem to be associated with the stage of nutrition transition. These themes are goal, approach, application and integration.

In different stages of nutrition transition the *goal* of growth monitoring, although not clearly mentioned in most protocols, seems to be different. As already said by Panpanich et al, for evaluation of effectivity of growth monitoring a clear overall goal is essential (Panpanich & Garner, 2009). In Tanzania, the prevailing purpose of growth monitoring is to complement the curative health care and assess the child's current health status (see table 7, integration in health care system). The focus is mostly to determine and treat malnutrition. Regarding

its stage of nutrition transition this would be expected. In India the aim of growth monitoring is to reduce underweight. It has the strongest focus on intervention in case of underweight (see table 7, feeding). However, you would expect more attention for overweight regarding the increasing prevalence of overweight and obesity with its stage in nutrition transition. Research from the last decade shows that the driving forces of changing epidemiology might even be more complex regarding the risk of coexisting underweight and overweight in one family or even through treatment of one growth problem fuelling the other problem (Doak, Adair, Monteiro, & Popkin, 2000). By focussing only on underweight and ignoring this trend, more problems in future can be expected. Navarro et al showed that a combined intervention program, that besides prevention of malnutrition also focusses on prevention of overweight, could be favourable especially for countries in nutrition transition (Navarro, Sigulem, Ferraro, Polanco, & Barros, 2013). In the Netherlands the aim of growth monitoring has shifted from monitoring healthy growth to screening for underlying pathology, especially in case of length growth. This is expected regarding the stage of nutrition transition in which malnutrition almost disappeared. The protocol itself, however, indicates the high chance of false positives (children meeting the criteria for a growth problem but in fact is physiologic) and the absence of evidence for improved quality of life with growth hormone treatment (Rijksinstituut voor Volksgezondheid en Milieu, Centrum Jeugdgezondheid, 2010). One could question if using growth monitoring as screening tool for this indication is an appropriate strategy. It might label a lot of children as abnormal and increase medicalization. Research from Sachs et al showed that parents can even get fixated to the growth curve of their child. They prefer and do anything to achieve the fiftieth centile (=z-score 0) rather than healthy growth and development (Sachs, Dykes, & Carter, 2006). In this way growth monitoring could even lead to increased parents' anxiety or raise guilty feeling which could do more harm than good.

Also the *approach* of growth monitoring is different in all three countries. This is getting clear from how the different influencing factors are considered in the different protocols (see table 7). Tanzania uses a directive approach focussing on the growth monitoring process. The manual describes how growth monitoring should be carried out but scarce information is shared about interpretation and advices in case of growth problems. Some risk factors for underweight or overweight are given, but no explanation how these could affect growth or what should be done. There are no additional programs to support growth monitoring. India uses a more guiding approach with a simplified chart. More attention is paid to interpretation and for the most common problems interventions are explicitly mentioned. Although prevention is recognized to be important and mothers should be counselled and informed in case of good growth as well, intervention for underweight is more prominent. The Dutch approach is more preventive and informative. For both the health worker and the parents comprehensive explanation is given how growth can be affected and what can be done to prevent problems. At the same time the protocols and criteria to diagnose growth problems leave a lot of space for own interpretation of the health worker, especially by including the "clinical look" and using extensive growth criteria (see table 2 and figure 3), which could also complicate the decision making process. Insecurity about interpretation of the growth curve can even negatively affect the health worker's but also the parents' feeling about the child's growth and health. As shown by Ben-Joseph et al understanding of growth charts varies largely from 1 to 85% of the parents. Even many health workers have difficulties (Ben-Joseph, Dowshen, & Izenberg, 2007). They underscore the importance for parents to understand a growth chart in order to be effective. Misinterpretation of a growth chart could

even induce anxiety for the mothers and negatively influence feeding (Sachs, Dykes, & Carter, 2006).

Advices given to mothers on the basis of growth monitoring are not always well *applied to the local circumstances*. In Tanzania, the advices given strongly reflect the WHO guidelines which are not necessarily adjusted or applicable to the local situation. Literature indicates that advices can discourage mothers when these are not applicable to their actual situation or can't put the advices into practice e.g. if it is not supported by decision-making family members (Charlton, Kawana, & Hendricks, 2009 & George, Latham, Frongillo, Abel, & Ethirajan, 1993). In India cultural acceptance is very important as can be seen from the questions about awareness and local customs and beliefs (see table 7). AWWs being selected from the local community and cooperation with local Mahila Mandal should improve connection with the community. Despite these efforts the literature still indicates that compliance of mothers is unsatisfactory. The effect of the supplementary feeding programme, for example, is minimal. Food is shared with the entire family (National Institute of Public Cooperation and Child Development, 2010). Or acceptance and quality of the food is not satisfactory and thus not eaten (Gurukartick, Ghorpade, Thamizharasi, & Dongre, 2013). Also family members and food allocation within the family can be important. Doak et al showed that in countries in transition almost half of the families with one underweight family member could be identified as an under/over family (a family with one underweight and one overweight member) (Doak, Adair, Monteiro, & Popkin, 2000). Food allocation within these families and different susceptibility of the family members for changing physical activity or diet accompanying the experienced nutrition transition could play a role in this phenomenon. These factors are subject to local customs and beliefs and thus very important to consider. The Netherlands advise to address cultural acceptance. Local cuisine and physical activity are recognized to be cultural dependent. Even pedagogical style, which is related to overweight, might be influenced by culture. It is essential to consider these factors in lifestyle advices. To reach for ethnic minorities in health prevention programs key figures for the community are advised to be included.

Integration of growth monitoring within the health care system but also in other sectors, as emphasized by WHO, is very important, especially to support parents at different levels. It is different between the three countries (see table 7). Integration seems to increase with stage of nutrition transition. In Tanzania integration is predominantly with the curative health care sector e.g. referral can be done in case of acute or chronic disease. Support for parents is only through general feeding and care advices. In India growth monitoring is mainly integrated on community-level through community self-help groups, like Mahila Mandal, cooperation with local TBA and other health care workers, awareness raising in the community and home visits. On national level there is integration with the child health care programs, ICDS and SNP. These programs and institutions support parents through advices, but also by providing food and schooling to the children. In the Netherlands prevention and treatment of overweight aims for integrated approach including e.g. schools, sports clubs and business. Also at national level integration with other sectors, like the economic or welfare sector, is attempted through laws and regulations. By providing information but also trying to improve the families' living circumstances parents are supported.

Consideration of the SES in either approach, application or integration of growth monitoring is different between the countries (see table 7 environmental factors). In Tanzania SES is not mentioned at all. Some factors derived from a family's SES, like food availability, are

mentioned. In India SES is recognized to be associated with growth but it is not explained what effect SES can have on growth. Some factors which determine SES, like income, are mentioned but only in relation to overweight. In the Dutch protocol low SES is identified as an important risk factor for overweight. Preventive lifestyle programs are advised to target this group. In day-to-day practice of growth monitoring this influence is only considered through ethnicity, since ethnicity and SES are correlated (Nederlands Centrum Jeugdgezondheid, 2012). According the current literature consideration of SES of the family and within the socioeconomic situation of the country seems to be very important. It appears to be one of the most important incentives for lifestyle (Due, et al., 2009; Wang & Lim, 2012). It influences availability, accessibility and affordability of “westernized food”. The effect of SES on nutritional status, as shown by Doak et al, can also be influenced by other environmental factors, for example urban residence (Doak, Adair, Monteiro, & Popkin, 2000). These factors might thus be essential to consider with respect to growth.

Limitations

This study has several limitations. The countries included are each considered to be in different stages of nutrition transition. Differences found between these three countries are not necessarily the same in other countries in transition. Also other country characteristics, like political situation, can influence the growth monitoring practice. This study gives an indication how nutrition transition can influence growth monitoring.

Also the descriptive character limits this study. It only reflects observations which are confined to the documents used. Factors which are not described in these documents are not considered. It is possible and expected that more factors influence the practice of growth monitoring, like for example availability of health workers and their educational level. These are, however, expected to amplify the observed differences.

This study only assesses the practice of growth monitoring of the public health sector, described in government protocols, since this research only focussed on the perception of growth monitoring by the national governments and which aspects are considered to be important. The private health sector can be largely involved in growth monitoring in some countries, for example India. This could influence growth monitoring practice by attracting a different population.

The fact that the author is Dutch and by profession more informed about the Dutch situation might have influenced this study, e.g. selection and interpretation of the documents. To minimize this influence we cross-checked the selection of documents and interpretation with local experts.

This study only looks at protocols, e.g. how growth monitoring should be performed as prescribed by the government. We are aware that in practice however, it can be very different, for example in Tanzania also often other child health cards are used. We also don't know if and how all information in the protocols is shared with the health workers and the parents. To know the day-by-day growth monitoring practice of each country, qualitative research through observations should be carried out.

6. Conclusions and recommendations

Looking at growth monitoring in the different stages of nutrition transition it seems to develop from a merely reactive strategy to growth problems, with little emphasis on

prevention of growth problems in either direction, to a more preventive strategy or even a screening tool for pathology. In the earlier stages of nutrition transition there is little emphasis on contextual determinants in growth monitoring, the direct determinants for the individual as well as the indirect general context. Due to the lack of consideration of contextual determinants, there are only a few or none context-specific preventive or intervention strategies for growth problems in the earlier stages in nutrition transition. Whereas in the highest stage of nutrition transition maybe too many different influencing factors are described and should be considered in growth monitoring which also could complicate effective strategies.

On the academic level this is the first research to look at the practice of growth monitoring and related it to the stage of nutrition transition of the country. It contributed to the understanding what is considered important in child growth monitoring in the different countries. But since the study is only based on documents, we only know how growth monitoring should be done and what is the emphasis of the different countries. But we still don't know how growth monitoring is performed in reality. To assess the day-to-day growth monitoring practice I would recommend for further qualitative research, e.g. observations, interviews with health professionals and focus groups discussions with mothers. This would also enable us to find out which interventions and approaches have effect and which don't and why.

For governments, policy-makers and national programmes I have two major recommendations to make:

First I would recommend to set clear goals for each growth monitoring practice and evaluate whether these goals are achieved or if there are any adverse outcomes from growth monitoring. This would enable us to say whether growth monitoring is an effective tool for each indication. These goals should be developed with an anticipatory scope on growth trends observed in the world. Especially for countries undergoing the nutrition transition, which could expect that the nutrition status of the country will change in the coming decennia, it is essential to anticipate for this change, find out the driving forces and set their goals accordingly. Growth monitoring protocols should include evaluation of the social, cultural and economic context at both macro- as micro level. Availability, accessibility, affordability and acceptability of healthy lifestyle should be assessed in each setting and corresponding advices should be given.

Secondly I would advise to shift the approach of growth monitoring from intervention to prevention and promotion. From this research we can see that prevention and growth promotion is underrepresented. Especially additional growth promotion programmes and integration within different sectors are minimal or missing in the lower stages of nutrition transition. In my opinion a joint venture between different disciplines in providing information about and opportunities to live a healthy life is the only way forward. For this it is necessary to strengthen the public health care system with additional growth programmes and integrate growth monitoring and healthy growth in different sectors to improve health, for example in economic, social and environmental policies. The aim should be to make people more aware of healthy behaviour and lifestyle but on the other hand also to create a healthy environment which allows them to put this healthy lifestyle into practice.

7. Acknowledgements

I would like to thank the people from the Department of Demography in Groningen, working on child growth monitoring. Zaina Mchome and Shirish Darak helped me to collect the current growth monitoring protocols in Tanzania and India and provided information about the national health care system and practices. Sepideh Yousefzadeh I would like to thank in special for her inspiring and encouraging comments. Our discussions were always refreshing and motivating! Hopefully we will be able to collaborate in future projects.

I would also like to thank the people of the Department of Family Medicine from Leiden University for accepting this Master thesis as part of my specialization as general practitioner. Especially I would like to thank Matty Crone, who has assisted me during the research and writing process and assisted in the collection of the current growth monitoring protocols and practices in The Netherlands.

Finally I would like to thank my partner, Hans van 't Woud. Our discussions and his analytical questions challenged and helped me in the research process. And thanks to his help I could give this master thesis this professional lay-out.

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9. Appendices

Appendix 4.1 Growth monitoring practice

WHO

WHO gives a complete overview about growth. Four different growth charts are advised for interpretation of growth, weight-for-age to determine underweight, height-for-age to determine stunting, weight-for-height to determine wasting or overweight/obesity and BMI-for-age for overweight/obesity. These are the normative WHO-CGS charts. Each age group (0-6months, 6months-2years, 2-5years) has separate charts. For growth criteria see table 3. Also communicational, emotional and gross motor milestones are described for parents in Child Growth Record (WHO, 2008). The main focus of the WHO documents is identifying and analysing growth problems. They emphasize the importance to consider all charts for one age group and all measurements over time for assessment of trends and early recognition of a growth problem (WHO, 2008). No clear advice is given for monitoring frequency.

"If a trend towards stunting or overweight is noticed in time, it may be possible to intervene in good time to prevent a problem." (WHO, 2008)

Clinical observations described mainly concern severe malnutrition, e.g. marasmus, kwashiorkor and marasmic kwashiorkor, with an explanation how to recognize it. Other observations about the child's appearance are mentioned, although not elaborated how to use this (WHO, 2008).

- *"Wasted* (too thin)*
- *Lean (fleshed out, no noticeable fat)*
- *Normal (rounded contours, no noticeable excess fat)*
- *Heavy (sturdy, mostly muscular, not lean or thin)*
- *Overweight* (noticeable fat)*
- *Obese* (excess fat)"*

(WHO, 2008)

The Netherlands

Growth monitoring in the Netherlands is very extensive and adjusted to the local situation. Five different charts are used, weight-for-age, length-for-age, weight-for-length, BMI-for-age and head circumference-for-age. The interval for growth assessment in the first half year is every month, then every 2-3 months, followed by once yearly until the age of four (Nederlands Centrum Jeugdgezondheid, 2012; Rijksinstituut voor Volksgezondheid en Milieu, Centrum Jeugdgezondheid, 2010; Nederlands Centrum Jeugdgezondheid, 2003). Weight-for-age and weight-for-length charts are normative, based on the healthy Dutch norm population from the Third National Growth Study in 1980 before the increase of obesity (Talma, Schonbeck, Bakker, HiraSing, & van Buuren, 2011). The BMI-for-age

corresponds with the normative metric proposed by International Obesity Task Force (IOTF), which is based on an international reference population including the Dutch population from the Third National Growth Study (Cole, Bellizzi, Flegal, & Dietz, 2000). Charts for length and head circumference are descriptive based on the current population (Talma, Schonbeck, Bakker, HiraSing, & van Buuren, 2011). The z-scores of the weight-for-length and cut-off points for BMI-for-age charts are overall lower than the z-scores in WHO charts. Z-scores of length-for-age chart are higher than in the WHO chart (Talma, Schonbeck, Bakker, HiraSing, & van Buuren, 2011). In the Netherlands the main focus of growth monitoring is identifying a growth problem or underlying pathology rather than assessing nutritional status. Head circumference is not taken for general growth assessment but to diagnose early closure of cranial sutures or space occupying lesions (Talma, Schonbeck, Bakker, HiraSing, & van Buuren, 2011). For identification of length growth faltering a complex diagnostic flow diagram is used, in order not to miss one case (see figure 3). Subsequently the possibility for growth hormone treatment for this lagging length growth is assessed, although there is too little evidence of improved quality of life with growth hormone treatment (Rijksinstituut voor Volksgezondheid en Milieu, Centrum Jeugdgezondheid, 2010).

“It should also be taken into consideration that, especially in cases of treatment beyond indication area, there is no evidence of improved quality of life.” (Rijksinstituut voor Volksgezondheid en Milieu, Centrum Jeugdgezondheid, 2010)

There is also a strong focus on early recognition of (the risk of) overweight. Criteria for overweight are more strict. For children <2 years criterion for overweight is >+1 SDS weight-for-length whereas WHO uses >+2 SDS weight-for-length or BMI-for-age. The obesity criterion is >+2 SDS in contrast to WHO's criterion >+3 SDS. For children >2 years diagnosis overweight or obesity is made according the IOTF reference which are overall lower than WHO criteria (see table 4) (Nederlands Centrum Jeugdgezondheid, 2012).

But despite these strict and complex criteria for growth deviations in both guidelines the so-called 'clinical look' always needs to be taken into account in interpretation of the charts. Although it is noticed that vast discrepancy can exist between what youth health care providers observe and the actual weight (Nederlands Centrum Jeugdgezondheid, 2012).

“In order to minimize the number of false negatives and false positives based on BMI, in the signalling protocol for overweight within the youth health care in the Netherlands clinical look has been added for children with a BMI at the boundary between normal weight and overweight”. (Nederlands Centrum Jeugdgezondheid, 2012)

Besides anthropometry ample information about communicational, emotional and gross motor development of the child is shared with the parent in the Growth Guide (GGD Amsterdam, 2013).

“Crying is normal behaviour in the development of children and for children a way of communicating. In the second week babies cry one hour a day on average. Then crying increases until he is 6 weeks old.” (GGD Amsterdam, 2013)

India

Whereas WHO advises to use all charts for growth assessment, growth monitoring in public health sector in India only uses weight (National Institute of Public Cooperation and Child Development, 2010). The first month weekly measuring weight is recommended, followed by monthly consultation until the age of 3 and quarterly until 5 years (National Institute of

Public Cooperation and Child Development, 2010; Ministry of Women and Child Development, 2009). Length is not measured or taken into account.

“The most sensitive and accurate way to measure growth is by weight gain”. (National Institute of Public Cooperation and Child Development, 2010)

The protocol is focussed on identification of underweight and keeping growth monitoring as simple as possible in order to keep it understandable. Only a weight-for-age chart for children aged 0 to 5 years old is used. It is a normative chart, based on a combination of the three WHO-CGS charts for connecting age groups, simplified by using three coloured bands according to z-scores (National Institute of Public Cooperation and Child Development, 2010). It doesn't contain z-score lines above median. Overweight is mentioned but not further elaborated.

“The 1st top curve line on the growth chart i.e. upper border of green band is the median which is, generally speaking, the average...Weight of all normal and healthy children, when plotted on the growth chart, fall above 2nd curve (green band); weight of moderately underweight children fall below the 2nd to 3rd curve (yellow band); and weight of severely underweight children fall below the 3rd curve (orange band).” (National Institute of Public Cooperation and Child Development, 2010)

“If plotted weight of a child falls much above the 1st curve, the child has a growth problem, which can be overweight or obesity. This is better assessed from other indicators. Refer the child to the health centre”. (National Institute of Public Cooperation and Child Development, 2010)

Interpretation of the growth chart is done based on the direction of the curve. A flat or downwards curve indicates a problem and needs attention (National Institute of Public Cooperation and Child Development, 2010).

“If the child's growth curve is flat or downwards, explain the growth curve to the mother and point out to mother that the child's GROWTH is a source of concern and ask her what has happened to the child in the last month.” (National Institute of Public Cooperation and Child Development, 2010)

Clinical observations mainly concern severe malnutrition. Description and pictures of marasmus, kwashiorkor, marasmic kwashiorkor and different micronutrient deficiencies are shown (National Institute of Public Cooperation and Child Development, 2010).

Information about pregnancy and child development is provided to the parents in the MCPC. Communicational, emotional and gross motor milestones are in accordance with WHO. Progress in development is also used to assess growth (Ministry of Women and Child Development, 2009; Ministry of Women and Child Development, 2009).

“Once the child is eighteen months old s/he starts imitating the happenings in his surroundings. The child imitate household work, feed the doll and pretend to take care of it. This way the child in play will imitate the way adults are for the child.” (Ministry of Women and Child Development, 2009)

“If the child seems slow, increase feeding, talking and playing. If the child is still slow, take the child to a doctor.” (Ministry of Women and Child Development, 2009)

Tanzania

The Tanzanian protocol is almost an exact copy of the WHO protocol. An attempt is made to adjust the protocol to the local situation and simplify it but thereby miss information about

interpretation and examples. Three different charts are advised to be used, weight-for-age, length-for-age and weight-for-length. All charts are for the age groups 0-5years old, based on WHO-CGS charts combined for age. Monthly measuring weight is recommended until 2 years of age, then quarterly until 5 years. Length should be taken quarterly. Other indicators mentioned are Mid Upper Arm Circumference (MUAC) and head circumference. The purpose, technique or interpretation of these measurements are not further elaborated (Ministry of Health and Social Welfare, 2011; Division of Reproductive and Child Health , 2011).

“Measure the arm circumference (MUAC) when examining underweight where measuring board is not available”. (Division of Reproductive and Child Health , 2011)

Criteria for growth problems and problematic trends are almost similar to WHO criteria (table 6) but lack information about interpretation. Moreover, by combining the charts for all ages z-score lines are very close together in the first months/years and are difficult to distinguish (Ministry of Health and Social Welfare, 2011; Division of Reproductive and Child Health , 2011).

“When interpreting growth patterns, be careful with the following conditions that may indicate a presence of a problem or imply risks, particularly when:

- *A child growth line crosses the z-score line.*
- *A child growth line has a sudden rise or drop.*
- *A child growth line stagnates, no increase in weight or length.”*

(Division of Reproductive and Child Health , 2011)

Child Health Handbook, almost an exact copy of WHO’s Child Growth Record, contains basic information for parents about emotional, communicational and gross motor development. Parents are encouraged to be alert for growth or development problems.

“This is an important age for a child to start to learn recognising words.” (Ministry of Health and Social Welfare, 2011)

“If you have any doubts about the growth and development of your child, please see a health advisor.” (Ministry of Health and Social Welfare, 2011)

Besides assessing growth and development growth monitoring is an opportunity to assess presence of infectious diseases.

“Write down the identification of the child’s problem according to the guidelines for the treatment of children, for example when a child coughing, has accelerated breathing, is identified as PNEUMONIA.” (Ministry of Health and Social Welfare, 2011)

Appendix 4.2.1 Health care organization

WHO

Involvement of the health care system in growth monitoring is only mentioned briefly since this is country dependent. The setup of growth monitoring is mainly to support both the health care provider and the parents through the provision of the Child Growth Record, with all growth measurements together with basic information and advices for healthy growth and two interview guides to investigate underweight and overweight. They also emphasize the importance for additional programs for child health to support growth monitoring in order to achieve child health improvement (WHO, 2008).

The Netherlands

Growth monitoring is supported by several regulations, institutes and programmes at different levels and in different sectors. All tasks of the youth health care, including growth monitoring, have been defined in the “Basic Tasks Package” and a guideline for consultation frequency exists to carry out these tasks (Nederlands Centrum Jeugdgezondheid, 2003). Growth indicators are taken and assessed by the well-baby clinic assistant, nurse or youth doctor. The doctor is responsible to set indication for intervention or referral (Talma, Schonbeck, Bakker, HiraSing, & van Buuren, 2011). For referral and treatment in case of overweight or short stature the protocol emphasizes on close collaboration regarding growth monitoring between the public health sector and primary health care or second line health care (e.g. dietician, family practitioner or paediatrician) (Nederlands Centrum Jeugdgezondheid, 2012; Rijksinstituut voor Volksgezondheid en Milieu, Centrum Jeugdgezondheid, 2010). For prevention of overweight growth monitoring should have a community-based and family-oriented approach, including both national and local government but also schools, sports clubs, business and different health care providers. Special emphasis is made also to involve migrant organizations and community key figures to reach out for ethnic minorities. This is put into practice through national and regional prevention initiatives (Nederlands Centrum Jeugdgezondheid, 2012).

“In the Netherlands this approach is translated to the JOGG-method (Jongeren Op Gezond Gewicht). JOGG is, like EPODE [Ensemble Prévenons l’Obésité des Enfants, the successful French program to reduce overweight], characterized by introduction of different activities in the community, at school and/or for families.” (Nederlands Centrum Jeugdgezondheid, 2012)

Parents are supported by the provision of the Growth Guide, containing basic information and advices regarding growth and development (GGD Amsterdam, 2013). They are also supported by the government during the first period of childhood through some laws and regulations (GGD Amsterdam, 2013).

“Until the child is eight years old, both parents have the right to take a period of parental leave. More information about this you can read on www.rijksoverheid.nl at the Ministry of Social Affairs and Employment.” (GGD Amsterdam, 2013)

India

Most prominent regulations regarding growth monitoring appearing from the protocol are the job descriptions of the AWW and the supervisor. The AWW is responsible for organizing weighing sessions, calling the mothers whose children need to be weighed and taking subsequent actions if needed. Awareness raising about growth monitoring is also an important part of role of AWW. ICDS supervisors have monthly meetings with the AWW. Their responsibilities include guiding and training of AWWs, stock supplies (eg supplementary nutrition, materials and medicines), home visits of severely underweight children and children ‘at risk’. Although the protocol instructs that *all* mothers should receive information regarding growth of their child, underweight children should be prioritized (National Institute of Public Cooperation and Child Development, 2010). The approach of growth monitoring is community-based and should include awareness raising in the community, collaboration with other health care workers in the community, like traditional birth attendant (TBA) or medical staff of the health centre, and involvement of women’s Self Help Groups (SHG) Mahila Mandal (Ministry of Women and Child Development, 2009; National Institute of Public Cooperation and Child Development, 2010).

“The first step towards accomplishing this tasks is to make the community, especially the mothers aware of the real reasons and objectives of growth monitoring. They must not perceive the activity as a task which the AWW has to do to complete her records for submission at the end of the month” (National Institute of Public Cooperation and Child Development, 2010)

Monthly Village Nutrition and Health Days are mentioned on which health officials take special measurements for rehabilitation and management of severely underweight children. It is not further elaborated how this is done (National Institute of Public Cooperation and Child Development, 2010).

For prevention and treatment of malnutrition growth monitoring is supported by the Supplementary Nutrition Programme (SNP). This programme provides food to all children. Malnourished children receive food with extra caloric value and extra proteins. The protocol recognizes, however, that the aimed effect of SNP is not always achieved since the food is often consumed by the whole family (National Institute of Public Cooperation and Child Development, 2010).

Communication between health care provider and parents is enhanced through the MCPC, with basic information and advices about child growth. It can also be used as a referral tool.

Tanzania

Growth monitoring in Tanzania is designed as part of the curative health care system. This sector should provide basic facilities and utensils for growth monitoring. The approach is very practical.

“Child growth and development monitoring service is done at the clinic for reproductive and child health often located within a health post. This location should have a big enough space, with chairs or benches for children, parents/carers. A solid table capable of holding a board for measuring child length is required. Monitoring of the child growth can be done through outreach missions in communities. Community leaders should be involved in order to create a suitable environment including the availability of suitable tables.” (Division of Reproductive and Child Health , 2011)

Growth measurements are recorded in the Child Health Handbook. It should support parents with basic information and advices for healthy growth. It can also enhance communication between health professionals in case of referral for illness, growth deviation or Prevention of Mother-to-Child Transmission (PMTCT) Service in case of (risk of) human immunodeficiency virus (HIV) infection (Division of Reproductive and Child Health , 2011).

“Reports on HIV MTCT status should be reviewed for every visit because more data will be added as the child continues growing up.” (Division of Reproductive and Child Health , 2011)

Appendix 4.2.2 Lifestyle

WHO

To achieve healthy growth WHO gives lifestyle advices in the Child’s Growth Record. The advices describe basic kind and quantities of food per age group. Also some pedagogical advices are given how to stimulate your child to eat and some hygienic advices to guarantee safe food preparation (WHO, 2008).

“Staple food give your child energy. These foods include cereals (rice, wheat, maize, millet, quinoa), roots (cassava, yam, potato), and starchy fruits (plantain, breadfruit).” (WHO, 2008)

“Boil water vigorously for a few seconds. Cover and let it cool down on its own without adding ice. This water is safe for the baby to drink.” (WHO, 2008)

“Patiently help your baby eat. Talk to her lovingly, look into her eyes and actively encourage her to eat, but do not force her.” (WHO, 2008)

For assessment of growth problems WHO developed two interview guides. The main focus of these guides is on lifestyle. Food and feeding advices are given and in case of both underweight and overweight. Physical activity advices only concern overweight (WHO, 2008).

“Encourage using legumes and animal-source foods in the family’s meals, to improve nutrient quality of the diet. This is especially important for the stunted child to promote growth in height without excess weight gain.” (WHO, 2008)

“Limit time spent watching television or playing video games.” (WHO, 2008)

The Netherlands

In the Growth Guide age-specific food and feeding advices are given. Generally the advices are in accordance with the WHO advices. They are applied to the local available food and nutritional status and can be very detailed (GGD Amsterdam, 2013). For extra information and examples is referred to the website of the national Nutrition Centre (Nederlands Centrum Jeugdgezondheid, 2012).

“When your child is 6 months or older, you can also give him bread.” (GGD Amsterdam, 2013)

“Don’t give the child porridge made of cow’s milk, until the age of one year, ” (GGD Amsterdam, 2013)

Basic pedagogical information and advices regarding feeding and eating are given for confidence building of the parents (GGD Amsterdam, 2013).

“It is an average. One day (or even month) a child eats more than the other. That’s no problem!” (GGD Amsterdam, 2013)

“Parents are the ones who lead the family. They decide when they eat. Children still need to learn. Eat together at the table. You eat, does eat.” (GGD Amsterdam, 2013)

For both overweight prevention and intervention the main focus is on lifestyle. Risk factors and protective factors for overweight are discussed. Based on the existing literature the protocol concludes that fast food and low physical activity level are evident risk factors for overweight, breastfeeding has a protective effect. Other lifestyle factors show inconsistent effect on overweight in literature. Short sleeping duration is correlated with overweight, although causal relation has not yet been established (Nederlands Centrum Jeugdgezondheid, 2012). The Growth Guide provides lifestyle information for parents. Explanations are given how feeding and lack of physical activity can contribute to development of overweight (GGD Amsterdam, 2013). Advices to prevent overweight include discouragement of sweetened drinks for babies and toddlers and stimulation to let children exercise moderately intensive for one hour daily and twice a week training to improve or maintain physical condition, the Dutch Norm for Healthy Activity (Nederlands Centrum Jeugdgezondheid, 2012).

“Children sometimes gain too much weight because their physical activity level is too low. It is good for a young child to get used to walking from childhood. Don’t put him in the stroller, but go walking together for groceries.” (GGD Amsterdam, 2013)

Intervention in case of overweight starts with sensitisation of parents through keeping a diary for diet and physical activity and extra consultation regarding overweight risk factors and awareness. According the protocol there is too little existing evidence whether intervention in case of overweight in children <2 years is necessary and which intervention is appropriate. Nevertheless monitoring and adjusting daily intake is advised when a child is growing extremely fast in order to prevent the baby gets used to (too) large intake. Also advices regarding physical activity should be given (Nederlands Centrum Jeugdgezondheid, 2012). For children >2 years with obesity lifestyle programs, with combined treatment focussing on three or more different components of lifestyle (nutrition, physical activity and behaviour) might be effective according the protocol. Intervention is advised with an integrated approach to change lifestyle, the ‘Bridging Plan’, through which the so-called BOFT-behaviours are stimulated (stimulating breastfeeding, physical activity and having breakfast and to reduce (sweetened) soda’s, fast food, watching television/gaming and (energy rich) snacks) (Nederlands Centrum Jeugdgezondheid, 2012).

India

General food and feeding advices for healthy growing children are in accordance with WHO advices and applied to the local nutritional status and local available food (Ministry of Women and Child Development, 2009). The MCPC contains advices per age group, which are more extensively described for professionals in the Guide for use of the MCPC (Ministry of Women and Child Development, 2009).

“Offer a variety of food as after 6 months of age, breast milk alone is not enough to meet the nutritional needs of the child for growth and development. Some examples include: Thin gruels made from roasted whole wheat flour, or flour of other cereals, or sooji and milk. Mashed potatoes, soft fruits like banana, mango and papaya. Soft cooked and mashed rice and dals.” (Ministry of Women and Child Development, 2009)

“Child should also be given foods rich in Vitamin A. Vitamin A is essential for normal growth and good health. It is needed for keeping the eye healthy. It also protects the children from getting many diseases. Child should be given Vitamin A rich foods every day. These include spinach, deep yellow and orange vegetables e.g. carrots, pumpkin, yellow and orange fruits e.g. mango, papaya, milk, butter, egg and liver.” (Ministry of Women and Child Development, 2009)

Also hygienic advices are given to ensure safe food preparation and some basic pedagogical advices to stimulate your child to eat. Some basic feeding advices are given in case the child is ill. All these advices are accompanied by pictures (Ministry of Women and Child Development, 2009) (Ministry of Women and Child Development, 2009).

“Child may refuse to take a new food or make fuss in eating. Be patient and persistent. Soon the child will get accustomed to eating it.” (National Institute of Public Cooperation and Child Development, 2010)

Food and feeding is the main focus for intervention in case of underweight. Advices are given for the key feeding problems (National Institute of Public Cooperation and Child Development, 2010) (Ministry of Women and Child Development, 2009). No specific information or advices are given regarding prevention of either malnutrition or overweight.

“The supervisor should find out from the mother about food habits of the child...”

- *Delayed introduction of additional foods resulting in child not accepting any food other than milk.*
- *Sudden discontinuation of breast milk without introduction of supplementary foods, due to conception of the next child or sickness of the mother.” (National Institute of Public Cooperation and Child Development, 2010)*

“Small amount of oil or ghee should be added to child’s food to provide for extra energy” (Ministry of Women and Child Development, 2009)

Tanzania

In the Child Health Handbook general food and feeding advices are given, accompanied with examples, for each age group or when the child is ill. Hygienic advices are given for safe food preparation. All are generally the same as the WHO advices. One page is added with feeding advices for children born to a HIV+ mother (Ministry of Health and Social Welfare, 2011).

“Age between 6-9 months, start giving the child 2-3 table spoons of heavy porridge or mashed foods 2 or 3 times a day. Slowly increase the amount to ½ a cup. Add a one table spoon for every meal. Use iodized salt. If a child is not being breastfed, give her 1-2 cups of milk per day and 2 additional meals per day.” (Ministry of Health and Social Welfare, 2011)*

Food and feeding are the most prominent lifestyle factors for intervention in case of growth problems. Separate interview guides are provided in case of underweight or overweight to identify the cause, accompanied with advices. Both guides are identical to the WHO interview guides, with a main focus on nutrition and few physical activity advices.

“Listen carefully to the mother’s answers in order to understand the reasons for malnutrition such as infrequent breastfeeding, feeding skills, too early introduction of additional food, giving other kinds of milk or food with poor nutrients.” (Division of Reproductive and Child Health , 2011)

“Advise the mother to add nutritious legumes, meat and dairy products to the diet. This is important for stunted children that they can grow without putting on extra weight.” (Division of Reproductive and Child Health , 2011)

“Limit eating fried foods.” (Division of Reproductive and Child Health , 2011)

“Limit the time a child spends watching TV or playing computer games.” (Division of Reproductive and Child Health , 2011)

Appendix 4.2.3 Biological and genetic factors

WHO

Biological and genetic factors are not extensively addressed in growth monitoring in the WHO approach. Sex-specific charts are used for growth assessment. Illnesses should be considered in growth assessment and corresponding advices are given. Influence of parental height and weight is described but interpretation is not extensively elaborated (WHO, 2008).

The Netherlands

Biological and genetic influence on growth is quite prominent in the Dutch protocols. For the interpretation of growth separate charts should be used for different sex and ethnic minorities (Talma, Schonbeck, Bakker, HiraSing, & van Buuren, 2011). If length growth falters using the routinely used Dutch chart, it is advised to use the ethnicity-specific chart (Talma,

Schonbeck, Bakker, HiraSing, & van Buuren, 2011; Rijksinstituut voor Volksgezondheid en Milieu, Centrum Jeugdgezondheid, 2010). In referral criteria for length growth biological and genetic factors are incorporated like length of the parents, birth weight, small for gestational age and twins (Rijksinstituut voor Volksgezondheid en Milieu, Centrum Jeugdgezondheid, 2010). The aim of the protocol for short stature is early identification of hereditary causes or chronic diseases. Although it recognizes that in most cases growth faltering is not the first symptom. Biological or genetic causes and risk factors for reduced length growth which should be checked for are pregnancy related factors, e.g. prematurity and breech delivery, hereditary factors, e.g. bone disorders, short stature, consanguinity, puberty development or chronic diseases, e.g. cystic fibrosis, renal dysfunction etcetera (Rijksinstituut voor Volksgezondheid en Milieu, Centrum Jeugdgezondheid, 2010).

“Also applies for most mentioned disorders that these will give complaints before growth falters.” (Rijksinstituut voor Volksgezondheid en Milieu, Centrum Jeugdgezondheid, 2010)

Ethnicity in the Netherlands is considered a risk factor for overweight. It is not yet clear whether this is an independent risk factor or that it is mediated by socio-economic status, dietary practices and pedagogical style (Nederlands Centrum Jeugdgezondheid, 2012). The same normative weight-for-length and BMI-for-age chart are used for overweight assessment (Talma, Schonbeck, Bakker, HiraSing, & van Buuren, 2011) but ethnicity should be considered through the “clinical look”. Other criteria used in “clinical look” are puberty, physique and fat distribution (Nederlands Centrum Jeugdgezondheid, 2012).

“Different physique than the Dutch may bias BMI, despite the fact that the international criteria for overweight in children are based on measurements of children of different ethnical groups.” (Nederlands Centrum Jeugdgezondheid, 2012)

Overweight prevention should focus on children with risk factors. Biological or genetic risk factors mentioned are overweighted or obese parents, Turkish or Moroccan origin, high or low birth weight, >0,67 SDS weight increase in first year, early puberty, depression, smoking during pregnancy and genetic predisposition (Nederlands Centrum Jeugdgezondheid, 2012).

India

In India sex is the only genetic factor considered in growth assessment by using sex-specific charts (Ministry of Women and Child Development, 2009). Other factors, like low birth weight and illnesses, should be considered in the management and prevention of underweight, with corresponding advices or referral (National Institute of Public Cooperation and Child Development, 2010; Ministry of Women and Child Development, 2009).

Tanzania

Sex is the only genetic factor taken into account in assessment of growth. Separate Child Health Handbooks are available for boys and girls with sex-specific charts. Chronic or recurrent illnesses, low birth weight, twins or children with birth problems should receive special treatment, which is not further elaborated. Also mother’s health, like HIV, should be considered with corresponding treatment (Division of Reproductive and Child Health , 2011; Ministry of Health and Social Welfare, 2011).

Appendix 4.2.4 Environment

WHO

For healthy growth and development the Child Growth Record provides basic advices per age group to create a safe and stimulating environment (WHO, 2008).

“The love and time you give him, your interest in what he is doing, and your support for his curiosity will help his self-confidence.” (WHO, 2008)

In case of growth problem physical and psycho-social environment needs to be considered. Information and advices mainly target safety and hygiene to prevent diseases, food availability and risk factors for neglect which could lead to either underweight or overweight. Factors mentioned are one-parent-family or >3 children under 5 years of age. The advice is to refer these parents to a source of assistance, although it is recognized that some of these factors cannot be resolved or there is no assistance available (WHO, 2008).

The Netherlands

Most advices in the Growth Guide regarding creating a favourable environment for growth concern stimulation of development and pedagogical advices. Few advices for a safe physical and social environment are given. In case of one-parent family or if mother restarts work it is advised to have support and create a stabile situation for the child (GGD Amsterdam, 2013).

“During this period [first years] you build an emotional connection with your child. It is very important to take your time for this; look at your child, talk to him, touch him and hold him.” (GGD Amsterdam, 2013)

“Most children enjoy playing a game on a tablet or smartphone every now and then. Small children are surprisingly handy with ‘swiping’. Especially for them there are fun and educational apps available.” (GGD Amsterdam, 2013)

In case of growth retardation emotional deprivation needs to be considered. If neglect is suspected this should be investigated according the JGZ-guideline Secondary Prevention of Child Abuse (Rijksinstituut voor Volksgezondheid en Milieu, Centrum Jeugdgezondheid, 2010).

Extensive information is provided how environment can influence development of overweight, both on macro- and micro level (e.g. food supply at schools or parental authority) and through different aspects of environment, physically, economically, socially or politically (e.g. availability of places to play, bulk discount, socially accepted behaviour or legislation). Environmental risk factors mentioned are low SES and pedagogical style. Preventive measures should be targeted to low SES groups. Providing a safe environment would have a preventive effect on overweight (Nederlands Centrum Jeugdgezondheid, 2012).

“Also in Dutch research a relation has been established between BMI of children and educational level of the parents, family size, having a dole and working outside of the mother (Boere-Boonekamp et al. 2008).” (Nederlands Centrum Jeugdgezondheid, 2012)

In overweight intervention parents’ awareness about risks of overweight and their perception of weight of their child is addressed and the need for pedagogical support should

be checked. Also cultural acceptance of physical activity advices should be considered (Nederlands Centrum Jeugdgezondheid, 2012).

India

Most advices given regarding creating a favourable environment for child growth concern hygiene and pedagogical care.

“As you smile and encourage the child, the first words, like mama/papa, take meaning and delight the family” (Ministry of Women and Child Development, 2009)

In case of growth faltering also socio-economic environment should be considered. Understanding of nutritional needs, family size, income, work and support for the mother are influencing factors (National Institute of Public Cooperation and Child Development, 2010). Practical advices for these problems are given. Also customs and beliefs of individuals and populations as well as awareness regarding growth monitoring need to be addressed (Ministry of Women and Child Development, 2009).

“Supervisor should find out from the AWW the problems of her area and attitude and perceptions of mothers about getting their children weighed. She should then work towards correcting the wrong concepts and reinforcing the right ones.” (National Institute of Public Cooperation and Child Development, 2010)

“Mother does not have enough time to provide care for development.

- *Combine care for development with other care for the child and household chores (feeding, bathing, dressing or cleaning the house).*
- *Ask other family members to help provide care for development or help her with other tasks.” (Ministry of Women and Child Development, 2009)*

Tanzania

Creating a physically and socially safe environment is considered important in child care. Some basic pedagogical and hygiene advices are given (Ministry of Health and Social Welfare, 2011).

“Important things to consider when caring for a child...Child abuse: Lack of time to play, child labour, being raped, mutilation of the uvula, genital mutilation teeth removal, heavy duty, being refused an access to an education and learning, being punished, being refused food for long periods or going without food for long periods, denied treatment and access to mediation, and lack of shelter.” (Ministry of Health and Social Welfare, 2011)

“Children learn faster in stimulating environments through their relationships with their parents/guardians. Mother, father and siblings/relatives can all help contribute to the child’s development through caring and playing with them.” (Ministry of Health and Social Welfare, 2011)

Neglect should be considered in case of growth problems. Family size, assistance from father as well as food availability should be checked and discussed (Division of Reproductive and Child Health , 2011).