An Ontology-based Decision Support System for Obesity Tracking During Childhood and Adolescence

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ABSTRACT

Pediatric obesity patients are required to be continuously tracked by the health experts for providing more efficient treatment. This thesis discusses the design, implementation, and potential use of an ontology based mobile obesity management and consultation system which is a smart consultation and tracking system for children and adolescent patients during their treatments. The system does not only share instant gathered medical data to a physician but also examines the data as a smart medical assistant. The system includes an ontology-based inference engine, is a decision support module, and provides suggestions as supportive treatment steps to gain personalized appropriate dietary habits and physical activities. The applied methodologies and main technical contributions are discussed as three aspects: (1) Obesity Tracking Ontology, (2) Semantic Web Rule Knowledge base and (3) Inference Engine. In this thesis, unlike the other similar studies, ontology and rule based smart medical assistant which have different functionalities from adults' obesity management is considered especially for obesity management of children and adolescents. The system also includes intensive pediatric health care expert involvement. The reported results of the applied case studies are promising in demonstrating the applicability, effectiveness and efficiency of the proposed approach.

Keywords: Pediatric patient, obesity, pediatric patient obesity tracking, knowledge base, expert system, ontology, SQWRL, SWRL rule

ÖZ

Pediatrik obezite hastalarının daha etkili tedavi sağlamak için sağlık uzmanları tarafından sürekli olarak izlenmesi gerekmektedir. Bu tez, çocuklar ve ergen hastalar için tedavileri sırasında akıllı bir istişare ve izleme sistemi olan ontoloji temelli mobil obezite yönetimi ve danışma sisteminin tasarımı, uygulanması ve potansiyel kullanımını tartışmaktadır. Sistem sadece toplanan tıbbi verileri bir uzmanla paylaşmakla kalmaz, aynı zamanda verileri akıllı bir tıbbi asistan olarak inceler. Sistem, ontoloji temelli bir çıkarım motoru içererek, bir karar destek modülü olarak kişiselleştirilmiş uygun beslenme alışkanlıkları ve fiziksel aktiviteler kazanmak için destekleyici tedavi adımları olarak önerilerde bulunur. Uygulanan metodolojiler ve temel teknik katkılar üç açıdan ele alınmaktadır: (1) Obezite İzleme Ontolojisi, (2) Anlamsal Web Kuralı Bilgi tabanı ve (3) Çıkarım Motoru. Bu tezin çıktısı, diğer benzer çalışmaların aksine, yetişkinlerin obezite yönetiminden farklı işlevleri olan ontoloji ve kural tabanlı akıllı tıbbi asistan, özellikle çocuk ve ergenlerin obezite yönetimi için kullanılmaktadır. Sistem aynı zamanda yoğun olarak çocuk sağlığı uzmanı katılımını da içermektedir. Uygulanan vaka çalışmalarının rapor edilen sonuçları, önerilen yaklaşımın uygulanabilirliğini, etkililiğini ve verimliliğini göstermede umut vericidir.

Anahtar Kelimeler: Pediyatrik hasta, obezite, pediyatrik hasta obezite takibi, bilgi tabanı, uzman sistem, ontoloji, SQWRL, SWRL kuralı

ACKNOWLEDGMENT

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LIST OF ABBREVIATIONS

AdM	Administrator(Admin) Module
BMI	Body Mass Index
CF	Code First
CMI	Comprehensive Multidisciplinary Intervention
CSS	Cascading Style Sheets
DA	Decimal Age
DTP	Data Type Property
ECPOP	Expert Committee for Pediatric Obesity Prevention
EF	Entity Framework
FBS	Fasting blood plasma glucose
HC	Head Circumference
HE	Health Expert
HTML	Hyper Text Markup Language
LINQ	Language Integrated Query
LMS	Lambda Mu Sigma
MVC	Model-View-Controller
NDT	Normal Distribution Table
OOP	Object Oriented Programming
ORM	Object Relational Mapper
OTO	Obesity Tracking Ontology
OTP	Object Type Property
OWL	Web Ontology Language
RML	Rule Markup Language

SQL   Structured Query Language

SQWRL   Semantic Query-Enhanced Web Rule Language

SWM   Structured Weight Management

SWRL   Semantic Web Rule Language

UI   User Interface

WC   Waist Circumference

WHO   World Health Organization

Chapter 1

INTRODUCTION

World Health Organization (WHO) defines obesity as abnormal or excessive fat accumulation that presents a risk to health [1]. In recent studies, it is known that various health problems have arisen due to feeding-related disorders especially during childhood and adolescence. One of them being obesity that has recently become a prevalent public health problem. Obesity may promote the risk for diseases such as diabetes, stroke, arthritis, some types of cancer and many more other health problems [2].

To prevent irrevocable consequences, self-monitoring of calorie intake and physical activity are critical and required behavioral changes, especially in childhood and adolescence. Conventionally, pediatric obesity patients are examined on a regular basis, the measurements are compared against pre-defined percentile values and the development of the pediatric patient is examined. The comparisons indicate several suggestions for the pediatric patients, that are proposed by the health expert to the patient as treatment advices. The suggestions are constituted by considering: (1) patient profile information, (2) medical background such as past/available diseases of the patient and the first/second degree relatives, and (3) decimal age, height, head and waist circumference, weight etc. which are presented as key metrics of the pediatric patient.

It can be said that obesity can be pragmatic and may cause irrevocable changes in the long run (i.e. Type 2 diabetes, certain types of cancer, heart diseases, sleep apnea, etc.) if individual-based treatment is not applied properly. Therefore, like all other health problems it is important to detect obesity at childhood and adolescence stage and form individual-based treatments accordingly [3]. In addition, ontology and rule knowledge-based smart medical solutions are very useful for early detection and tracking of obesity. Recently, major number of obesity management consultation systems are being developed for adults in general, are discussed and published in many recent studies. Unfortunately, the number of existing obesity management consultation systems for children and adolescent patients in software product markets is not sufficient. Therefore, the available systems do not include critical functions for pediatric obesity management.

This thesis discusses the design, implementation, and potential use of an ontology based mobile obesity management and consultation system for children and adolescent patients which infers and provides certain supportive dietary habits and physical activity suggestions as treatment steps. Proposed system provides remote consultation and tracking of child and adolescent patients during their treatment. The ontology-based decision support module (its inference engine) deduces a personalized supportive dietary habits and physical activity suggestions as treatment steps and makes the system acts as a smart medical assistant. The ontology knowledge base of the system is created using the following components: (1) ontology classes involving the "is a" relationship to form individuals and inheritance elements (2) object type and data type properties to provide the required key metrics

to calculate necessary inferred metrics for obesity management (3) semantic rules for implementing the inference engine of the proposed system.

In this thesis, the system architecture, working mechanism and user functionalities of the proposed system are discussed. Clearly, three main technical contributions are deliberated in next sections which are: (1) Obesity Tracking Ontology (OTO), (2) Semantic Web Rule Knowledge base, and (3) Inference Engine.

1.1 Problem Definition

1.1.1 Obesity

Abnormal or excessive fat accumulation that presents a risk to health is presented as obesity by the WHO [1]. Obesity may be a result of the calorie intake as well as dissipated energy imbalance. Calorie intake is closely related with obesity as if calorie intake goes beyond the calories burned, the risk of obesity increases considerably. According to WHO, in 2014, 13% of the world's adult population were found to be obese. In addition to this statistical data, it was predicted that 41 million children under the age of five, were declared to be obese. This fact has resulted in more deaths worldwide than those suffering from being underweight [1]. There are guidelines for the management of obesity to determine how obesity can be prevented or treated [4] [5] [6]. These guidelines suggest that obesity management should focus more on body composition improvement. Improving body composition can be achieved by increasing fat-free mass and in contrast reducing fat mass and waist circumference [4] [7]. Waist circumference is an important component for determining more accurate abdominal fat measurements [5]. This approach may be a useful tool in measuring fat free mass before and during obesity treatments [7] [8] [9]. If these guidelines are followed, significant clinical benefits may be achieved.

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These benefits include required amount of weight loss and an improved nutritional diet. In addition to this, increment of physical activity improving general fitness is promoted [10] [11].

A study conducted by certain researchers (Sharma et al., 2017) has shown that though two-thirds of Americans are overweight. The general public's perception of their weight has been preventing them seeking information and advice about obesity [12] [13]. Methods such as Cognitive Behavioral Therapy (CBT) facilitate better obesity management and can help overcome these barriers. CBT addresses behaviors that are required to be changed for successful weight loss and weight loss maintenance [13] [14] [15]. This means that CBT can constitute a long-term treatment and a prevention technique. A review of factors associated with successful chronic disease management showed evidence supporting the effectiveness of interventions to support self-management by patients [16]. These factors included a multidisciplinary program, a collaboration between a highly motivated patient and a committed and experienced team of health professionals [17].

The usage of internet on mobile devices is rapidly increasing each year as 80% of internet users have been cited as owning smartphones [18]. In addition to this, a recent study of 1,604 US smartphone owners conducted by a NYU Langone Medical Center shows that 58% of smartphone users have downloaded health-related applications (apps). The survey also identified that the users mostly likely to use a health app were often young, with a high income, good educational background and had a Body Mass Index (BMI) value in the obese range [19].

Upon further systematic review of research articles it has been determined that, self-management and health expert inclusion are critical components of obesity management. These aspects can allow patients to monitor and control their calorie balance more effectively. Compounding individual based health expert feedback with a better understanding of the patients' condition, allow individuals to maintain an ideal BMI. Individualized feedback to patients was found to be far more effective in behavioral change. These findings support the usefulness and needfulness for development of electronic health systems such as mobile health (m-Health) apps to improve obesity self-management and other chronic health conditions [16].

In addition to the points discussed above, nowadays pediatric obesity is one of the most widespread health challenges [1]. To the best of our knowledge, there are several reasons that can cause obesity. Primarily, the major cause of obesity is inactivity for obese individuals. To be clear, individuals can be candidates for obesity because of their excessive calorie intake and insufficient activity. Secondly, there are many elements that take place in our life with the developing technology. One of these is extensive usage of smart devices. At present, most family members have at least one smart device. Due to the intensive use of smart devices, the physical activities of family members have decreased, resulting in a significant decrease in their quality of life. This situation is an open invitation to obesity problem especially in childhood period which emerges as an important pediatric health problem. Another reason can be hormonal problems which can also cause obesity [20].

1.1.2 Obesity in Pediatric Patients

Childhood obesity is a worldwide challenge in the current century. Cali et al. [21] have stated in their conducted study that about 110 million children in global are overweight or obese. Obesity can be controlled and treated if detected at an early stage preventing irrevocable consequences as mentioned. Tracking the improvements is a crucial component of obesity treatment. Next section reveals more information about the literature review conducted about systems related with obesity tracking and concepts that must be used when considering obesity.

Chapter 2

LITERATURE SURVEY

Some decisive scientific research studies found about obesity management during childhood and adolescence in the literature and several m-health apps in mobile markets are deliberated in this section. The studies and the m-health apps are especially criticized to understand recent developments on obesity management during childhood and adolescence. The acquired outcomes of the analysis have been emerged essential metrics and significant functions of the obesity management during childhood and adolescence. These essential metrics are described as background in the next section. Therefore, in this section, important requirements and functions for obesity control in children and adolescents have been revealed through the comparative analysis based on the decisive research studies investigated, and mobile apps found in mobile markets.

There are some crucial concepts and strategies that are deliberated by some researches (Pagoto et al., 2013) in the study conducted. It is believed that these strategies would be good contribution as evidence-based strategies when included in obesity management solutions [22]. Besides, it is known that behavioral change is required for efficient obesity management, and the evidence-based lifestyle interventions reflect behavioral weight-loss strategies. Table 1 summarizes the categorization of the evidence-based strategies that are to be considered in obesity management solutions [23].

Table 1: Evidence-based strategies [23]

Concepts	Description
Self-Monitoring	Self-monitoring capabilities for weight meals and nutrition
Goal Setting	Goal setting with/without customization
Healthy Eating	Healthy eating support including information, education and skills development
Physical Activity	Physical activity support development
Social Support	Personalized social support
Weight & Health Assessment	Assessment with/without personalization
Motivational Strategies	Strategies including prompts, rewards, or gamified design
Feedback	Personalized feedback

In this thesis, the literature review is conducted based on the above-mentioned concepts and inclusion criteria. Therefore, the obtained results are categorized in three primary research areas.

Table 2 summarizes results of the research about obesity management from the reviewed related articles, research projects, and mobile apps. The first research area (labeled as MS in Table 2) is about recent mobile and Web based system proposals about obesity management in literature. Various research articles are investigated and some of them are discussed to indicate the required information based on obesity management during childhood and adolescence. Furthermore, how such systems effect their users is discussed.

The second research area (labeled as AA in Table 2) is about key and inferred metrics for obesity management which are crucial metrics to assess obesity risk during childhood and adolescence. The aim to examine these research articles is to reveal the basic principles of pediatric obesity control (e.g. percentage, BMI, z-score,

waist circumference, etc.) and obtain a basis for development of the proposed system.

The third research area (labeled as MA in Table 2) is conducted to find out current mobile apps and systems in markets for obesity management. The mobile apps found are analyzed to reveal most critical functions which the ways can be to cope with obesity especially during childhood and adolescence periods. In our research, English language smartphone apps from the Apple and Google Play mobile markets dealing with obesity control are mainly selected. The search terms "weight loss" and "obesity" have been used to find out close apps. The apps are selected which allow their users to track their obesity risk (e.g. BMI tracking, calorie consumption tracker) and/or guide them about obesity control such as giving cooking tips, preserving tip, proper diet plan, health tips etc. Entire features and functionalities of the apps selected have independently assessed by two software engineers for defining requirements to develop advance apps or systems. The outcome of the market research with the "Obesity" term produced 250 hits on the Google Play store. Of the 250 hits, the search identified 34 of the apps as relevant to obesity management, of which 9 met the inclusion criteria (evidence-based strategies). Moreover, out of 9 apps, only one app incorporated all suggestions for patient-focused obesity management from the guidelines provided in this review, including a BMI calculator, body fat percentage calculator, aerobics exercises for weight management, diet plans, and calorie burning charts. Furthermore, the application offers protocols for holistic techniques for weight-loss, as weight is the major catalyst cause of obesity.

The essential metrics in childhood and adolescence obesity management are described as background in next section. After that, important requirements and functions for obesity control in children and adolescents have been revealed through the comparative analysis based on investigated decisive research studies and mobile apps.

Table 2: Results obtained for the first, second, and third research categories

#	Area	Content			Outcome
		Objective	Strategies Used	Results	
[22]	MS	Developing a mobile system to increase physical activities and reduce time spent in front of screens during adolescence.	Self-determination theory (theory of motivation) [22] [24] and social cognitive theory (related to how individuals acquire knowledge by observing others) [22] [25] used as strategies.	Additional strategies are required to increase app usage (The app was not used as expected).	Investigates the effect of MSs on obesity management.
[26]	MS	Developing an ontology-based system for chronic diseases (chronic kidney disease is taken as the domain).	Semantic rules and ontology as knowledge base for providing dietary consultation.	Although there are some restrictions of the ontological knowledge-based systems, a pilot system has been developed.	The system results from the inference and manual dietician calculation and suggestions are the same.
[27]	MA	Evaluates existing apps that are developed for diet/nutrition and anthropometric tracking.	An assessment of top-rated apps found in iTunes App Store is carried out using predetermined inclusion/exclusion criteria.	Half of the examined apps were concluded to be behavioral and the other half as cognitive.	Comparative analysis of existing apps in iTunes store.
[28]	MS	A survey study is performed to indicate the impact of mobile apps on obesity-related anthropometric, psychosocial and behavioral outcomes in adolescents and children.	Examined articles are classified accordance with required criteria that constitute the effect of mobile apps on childhood obesity.	The articles surveyed investigates two obesity groups. One group used mobile apps and the other (control group) does not.	The results indicate comparisons of two groups in terms of anthropometric, psychosocial (related with the knowledge, attitude and motivation), and behavioral outcomes (related with goal setting, diet, physical activity and screen time).

Table 2 (continued)

[29]	MA	Searching available apps including evidence-based strategies (personalized feedback, health care expert involvement, etc.) in mobile markets.	625 apps for 4 operating systems (IOS, Android, Blackberry, Windows) are examined.	Only 393 apps were found suitable and included any of evidence-based strategies.	Comparative results of existing apps in mobile markets.
[30]	MA	Analyzes the content of apps of iPhone/iPad with regards to two critical behaviors for weight loss, healthy eating and physical activity for pediatric patients.	57 apps downloaded, tested with regards to 8 intervention strategies* and 7 behavioral targets** recommended by Expert Committee for Pediatric Obesity Prevention (ECPOP).	61.4% (35 apps) of the reviewed apps do not utilize any of the ECPOP recommendations.	Comparative results of existing apps in iTunes store, overall idea of the criteria and recommendations that should be included in these apps to make them sufficient.
[31]	AA	BMI is a less effective method for early childhood obesity. Waist circumference is a more accurate measure than BMI.	The growth patterns are calculated by age and gender in 0-6-year-old children in quarter year intervals except for 0-28-day newborn period (WHO suggests growth patterns to be documented in intervals shorter than 3 months)	WC together with BMI is a useful clinical tool to detect preschool age children who may be at a higher risk of obesity and cardiovascular diseases.	Detailed information about waist circumference metric that can be used for an accurate personalized treatment and prevention of obesity in children/adolescents.

Table 2 (continued)

[32]	AA	Integrate the existing updated reference standards for the growth of Turkish infants and children, compare these with WHO reference data, data from some European countries and with previous local data.	LMS method [33] was used in analysis and construction of the percentile charts.	Weight and height values in Turkish children were slightly higher and showed higher values for head circumference compared to WHO reference data.	Detailed information about LMS method, percentile and z-score usage for analyzing and comparing different data. Tables of reference values for children/adolescents for different percentiles and z-scores.
[34]	AA	Give detailed information about obesity and recommendations and prevention techniques that should be included treatment.	-	-	Detailed information about obesity and recommendations that should be followed for treatment and prevention techniques.

* The eight intervention strategies recommended by ECPOP are (i) calculate and plot BMI over time, (ii) assess motivation to make changes, (iii) use motivational interviewing(strategies), (iv) tailor strategies to a specific case,(v) set goals/limits, (vi) examine environmental influences, (vii) involve the whole family, (viii) combine multiple behavior changes [30].

** The seven behavioral targets recommended by ECPOP are (i) reduce sugar-sweetened beverages, (ii) consume greater than or equal to nine servings of fruits and vegetables per day, (iii) decrease TV time, (iv) eat breakfast every day, (v) cook at home, (vi) eat together at the table, (vii) do <= 1 hour/day of physical activity [30].

2.1 Background

This section discusses key metrics and Lambda Mu Sigma (LMS) method [33] essential for obesity management during childhood and adolescence. The metrics included in the proposed system are divided into two categories that are *asserted key metrics* and *inferred key metrics*. Instant measurements and information directly taken of the children/adolescents are accepted as asserted key metrics. Inferred metrics are calculated from key metrics by using predefined functions and Normal Distribution Table (NDT) [33]. The equations used to calculate the inferred metrics from the key metrics are given and discussed in the next section.

Beside these, LMS method is a crucial and well-known method for obesity management during childhood and adolescence which is developed by Cole [33]. The researcher used a statistical technique for composing references of auxological parameters in children [33] [35]. L value is calculated using the Box-Cox transformation which obtains the comparative normality. This value is calculated for each age group and the trends for each age group are gathered together and summarized by using a curve. M value is the mean and S value is the coefficient of variation for the specific gender and age group [35]. Z-score is another metric which is calculated by using the L, M, S values corresponding to gender and decimal age values of the child patient. Z-score is then converted to the relevant percentile metric by using NDT [36]. Obesity can be prevented or treated by providing suitable dietary/physical suggestions to the pediatric patient considering the inferred key metrics. Further details about the metrics are given in Sections 6.1 and 6.2.

2.1.1 Asserted Key Metrics

Asserted key metrics are *date of birth, height, weight, head circumference, waist circumference* and *gender* information for obesity management during childhood and adolescence periods [31] [32] [37] [38]. These key metrics are the building blocks of the inferred metrics that are used to determine the growth, nutritional or obesity status of the pediatric patient [36].

- **Date of Birth**: The date of birth is required to calculate the decimal age inferred metric of a child/adolescent patient.

- **Height**: Height is used for monitoring the development of child/adolescent patient. It is measured in centimeters (cm) and used for calculating BMI inferred metric [32].

- **Weight**: Weight is used for monitoring the development of child/adolescent patient. It is also used to determine the fat amount in the body which highly effects obesity management. Weight is measured in kilograms (kg) and used for calculating BMI inferred metric [32].

- **Head Circumference (HC)**: HC corresponds to the development of child/adolescent, it denotes extreme or limited development and it is measured in centimeters. If the HC measurement falls outside the percentiles 99.6 and 0.4, the size and shape is categorized as abnormal [38].

- **Waist Circumference (WC)**: WC is an indicator of health risk associated with excess fat around the waist. WC helps to monitor the proportion of body composition and it can be used as a substitute for abdominal fat [4]. The percentile for WC should be less than 90 to be in the accepted range. Values above the 90th percentile is interpreted as central obesity [31] [37].

- **Gender**: The reference values for L, M, S values differ by gender and decimal age. This fact imposes an additional importance for gathering gender information from pediatric patients [32].

- **Medical Background of Relatives (Health Risk)**: The medical background such as type2 diabetes, obesity, heart disease etc. existence at the first- or second-degree relatives of the pediatric patient, propose a health risk for the patient affecting obesity. Medical background of relatives constitutes a significance for suggestion providing to the patient [3].

2.1.2 Inferred Key Metrics

Inferred metrics are *BMI* [32], *z-score metrics* (*BMI z-score, Height z-score, Weight z-score* [32]*, HC z-score* [32] [38]*, and WC z-score* [31] [37]), and relevant percentile metrics (*BMI percentile, Height percentile, Weight percentile* [32]*, HC percentile* [32] [38]*, and WC percentile* [31] [37]) that are used to determine the obesity risk level of a child/adolescent patient [3]. Obesity can be prevented or treated by providing suitable dietary/physical suggestions to the pediatric patient considering the inferred metrics. Further details about the metrics are given below.

- **Decimal Age (DA):** DA of children/adolescent is calculated as the difference between the birth date and the examination date. The following equation is used to calculate the decimal age. *CurrentDate* denotes the examination date of the pediatric patient. The metric is used to determine the L, M, S values.

$$\text{m} \quad L \gg N \quad :\blacksquare \qquad ; F \; N \quad :\boxtimes \quad D\boxtimes \quad ;?$$

$$E \vdash \frac{R \qquad D:\blacksquare \qquad ; F \; R \quad D:\boxtimes \quad D\boxtimes \quad ;}{st} \vdash$$

$$E \vdash \frac{\boxtimes \quad :\blacksquare \qquad ; F \; \boxtimes \quad :\boxtimes \quad D\boxtimes \quad ;}{u\boxtimes} \vdash \tag{1}$$

- **BMI:** BMI is a person's weight in kilograms divided by the square of the height in meters. A high BMI can be an indicator of high body fat. Generally, for adults older than 20 years: BMI below 18.5 is considered *underweight*. BMI between 18.5 and 24.9 is considered as *healthy weight*. BMI between 25 and 29.9 is considered *overweight* and a BMI of 30 and above is considered *obese*. In children/adolescents BMI percentile less than 5 is denoted as underweight. In addition, BMI percentiles greater than 85 belongs to the overweight and obese categories. The range between the 5th and 85th percentiles corresponds to a healthy weight in children/adolescents [39]. BMI can be calculated by using the following equation [32].

$$\text{nyu} \quad L \; \frac{\textbf{9AEODP}}{\textbf{*AEODP}^6} \tag{2}$$

- **Z-score:** Z-score metrics are *BMI z-score, Height z-score, Weight z-score, HC z-score,* and *WC z-score* [31] [32] [37] [38]. NDT is composed of z-score values and corresponding percentiles. Z-scores allow mapping the key input metrics to the relevant percentile metrics (*BMI percentile, Height percentile, Weight percentile, HC percentile, and WC percentile*) for obesity control [31] [32] [37] [38]. Z-score metrics are calculated using the following equations [32]. L, M, S values correspond to the reference values for each gender and decimal age [39].

$$\check{z} \quad \dagger \; F \; \permil \quad L \; \frac{\overset{9E\;\;\;DP}{>\!\!/}\!\!\mathring{A}?\;F\;s}{5} \tag{3}$$

$$t\check{Z} \quad \dagger \; F \; \permil \quad L \; \frac{\overset{*AEOP}{>\!\!/}\!\!\mathring{A}?\;F\;s}{.5} \tag{4}$$

$$to \quad \dagger \; F \; \permil \quad L \; \frac{\overset{*\%}{>\!\!/}\!\!\mathring{A}?\;F\;s}{.5} \tag{5}$$

$$\oint \quad \dagger \; F \; \permil \quad L \; \frac{\overset{9\%}{>\!\!/}\!\!\mathring{A}?\;F\;s}{.5} \tag{6}$$

$$nyu \quad \dagger \; F \; \permil \quad L \; \frac{\overset{\$+}{>\!\!/}\!\!\mathring{A}?\;F\;s}{.5} \tag{7}$$

- **Percentile:** Percentile metrics are *BMI Percentile, Height Percentile, Weight Percentile, HC Percentile,* and *WC Percentile*. Percentiles are used to determine the children's growth and nutritional status [40] [41]. Percentiles are calculated by using the z-score and the NDT. Percentile value corresponding to the z-score value is retrieved by using the NDT if the z-score value is positive. However, if the z-score value is negative, the corresponding value on NDT is subtracted from 100 to find its percentile [36]. Percentile metrics have several categories based on certain pre-determined ranges. These categories are used to determine the recent growth and nutritional status of a pediatric patient [31] [32] [37] [42].

In the survey conducted by Neyzi et al. the critical percentile values for different age groups of Turkish children/adolescents were determined [32]. Neyzi et al. compared the outcome reference standards with WHO reference data [43] [44], data from some European countries [45] [46] [47] and with past local data [48] [49]. LMS method was used by the researchers in construction of the percentile charts of outcome reference values. The study sample child/adolescent group consisted of 2391 boys

and 2102 girls aged between 15 days and 60 months of age. The measurements of these children (BMI, weight, height, HC, and WC) were taken by trained personnel and compared with other data mentioned previously. The comparison of the gathered data with other relevant data have resulted in the reference values for Turkish children aged between 0-18 [37].

The study conducted have provided the reference LMS values, that are used to perform the necessary calculations in the mobile system proposed in this thesis. Further details will be given in the following sections.

The percentile range boundaries are significant when determining the obesity stage of the pediatric patient and providing necessary suggestions. Table 3 summarizes the percentile ranges corresponding to different stages of obesity in pediatric patients.

Table 3: Percentile stages defined for pediatric patients [50]

Percentile Range Boundary	Description
(<3. p)	Underweight
(3-15. p)	Risk of Underweight
(15-85. p)	Normal Weight
(85-97. p)	Overweight
(>97. p)	Obese

2.1.3 Dietary and Physical Suggestions

The dietary and physical suggestions are significant for obesity treatment of children and adolescents to promote necessary behavioral changes. The nutrition intake suggestions are formed considering calories, protein, fruits, vegetables, grains and dairy amounts appropriate for the age group of the pediatric patient. Every individual needs the same type of nutrients but in different amounts in different ages. Insufficient amounts of any of the nutrients can cause problems such as deficiency of Calcium, Vitamin D, Anemia etc. [50]. The approximate amounts are summarized in suggestions in Appendix A.

The dietary intake suggestions are designed with the professional consultancy of a dietician. Different age groups require different daily portion intakes. Following tables include details of "one portion" defined for each nutrition category. Portions impose a crucial importance in diet and should be followed. The protein category includes food like egg, meat etc.; the diary category include milk, yoghurt etc. Table 4 and Table 5 demonstrate the diary and the portion details [50].

Table 4: Proteins and their single portion amount [50]

Food	Amount
Egg	2 small-sized / 100 g
Meat (cooked)	3-4 grilled meatballs / 2 hamburger meatball / 1 palm sized meat piece / 1 large rib / 80 g
Chicken (cooked)	1 medium sized baguette chicken/ 1 palm sized meat piece / 80 g
Fish (cooked)	1 hand sized thin piece / 1 palm sized thick piece / 150 g
Small fish (cooked)	150 g
Tuna	100 g (water excluded)
Shrimp and other sea food (cooked)	12-15 small pieces / 100 g
Chickpea, beans, kidney bean, broad bean (boiled)	2 small scoops / 8-10 spoons / 130 g
Hazelnut	28-30 / A handful / 30 g
Walnut	4-5 large / 6-7 medium / 10-12 small whole walnuts / A handful / 30 g
Almond	24-26 / A handful / 30 g
Peanut	27-30 / A handful / 30 g
Cashew nuts	18-20 / A handful / 30 g
Sunflower seeds	1 cup / 5 handful / 60 g (crust included)
Pumpkin seeds	½ cups / 2.5 handful / 40 g (crust included)
Pistachio	2 handful / 60 g (crust included)

Table 5: Dairy food and their single portion amount [50]

Food	Amount
Milk	1 cup / 240 mL
Yoghurt	1 cup / 1 small bowl / 240 mL
Yoghurt(home-made)	1 cup / 1 small bowl / 240 mL
Kephir	1 cup / 240 mL
Buttermilk drink	1.5 cups / 1 large glass / 350 mL
White cheese	Size of 3 fingers / 2 match box big / 60 g
Kashar cheese	Size of 2 fingers / 40 g

In addition to the dietary suggestions, the physical suggestions (e.g. reduce daily TV/screen activities to less than 2 hours) are proposed by considering the BMI percentile level of pediatric patients. The suggestions considered are explained in detail in further sections.

2.1.4 Laboratory Results

The blood values and urine values should be examined by HE for providing the best and the most accurate treatment. The tests that should be inspected in pediatric patient obesity are given as [51]:

• Fasting blood plasma glucose (FBS)

• Complete urine analysis

• Fasting serum lipid profile (total cholesterol, HDL-cholesterol, LDL-cholesterol, total cholesterol / HDL cholesterol and triglycerides)

• Serum uric acid measurement

• Liver enzymes (ALT, AST, GGT, ALP)

• TSH level if necessary

2.2 Motivation and Objectives

The number of existing mobile-based obesity tracking systems for children and adolescent patients in mobile markets is not sufficient. Therefore, the available apps in mobile markets do not include critical functions for obesity control during childhood and adolescence. The focus of this thesis study is developing an Ontology Knowledge-based Mobile Medical Expert System for Obesity Management during childhood and adolescence which infers and provides certain supportive dietary habit and physical activity suggestions as treatment steps when necessary. In the thesis, the comparative analysis, system architecture, working mechanism and user functionalities of the system are discussed. Recently, many studies about mobile-based obesity tracking systems mostly for adults have been discussed and published in literature. Three main technical contributions of the developed system: (1) Obesity Tracking Ontology, (2) Semantic Web Rule Knowledge-base and (3) Inference Engine are deliberated.

2.3 Outline of the Thesis

The rest of this thesis is organized as follows: Section 2 discusses the survey results performed based on scientific research studies for obesity in the literature and m-health apps for obesity control in mobile markets. In addition to the survey, it also includes the background information gathered considering pediatric patient obesity tracking. Section 3 presents the methodology in terms of the tools used when developing the thesis system. Section 4 presents the design and implementation of the system in terms of system architecture, working mechanism and user functionalities of the proposed system. In addition, the development of the ontology and rule knowledgebase of the system is also included in Section 4. Section 5 presents the experimental results of the system proposed in this thesis. Section 6 is dedicated to conclusions.

Chapter 3

METHODOLOGY

3.1 Used Tools

3.1.1 MVC Architecture

MVC(Model-View-Controller) is a software design approach which provides the opportunity to separate the business logic and view of the application. Model is the component that is responsible for data domain of the application. It specifies the fields that should be held in each table. Current states of the model objects are held in the database with the help of model component [52]. View component is responsible for the User Interface (UI) handling of the application being developed. The third component, controller interacts with the user input from the View, contains functions that process the necessary model state data and update the Model component members accordingly. The interactions between the components are summarized in Figure 1.

There are several points that make using MVC architecture reasonable. One of them is the fact that, making changes is easy since the input, business logic and UI layers are separated. In other words, for instance when the UI component is needed to be changed, only that component is exposed to changing and the other components may remain unmodified if not needed [53]. In addition to separated layers, MVC architecture supports parallel developing where multiple people can work on

different layer components at the same time. This becomes an advantage on the long view to be able to fasten the application development [54].

The system proposed in this thesis is developed using ASP.NET MVC architecture. 10.6% of all websites with known server-side languages have been constructed using ASP.NET as a server-side language [55]. Considering this fact and the sources available due to the prevalence, ASP.NET is chosen as the server-side programming language for developing the system. In addition to this, ASP.NET is implemented using Object Oriented Programming (OOP) approach and languages suitable for this approach for instance C#. OOP approach is useful as it allows easy problem fixing. This means that, when an object causes an error; the related class can be debugged directly for the error [56]. Basic process of debugging, helps to fasten the development process. Considering the benefits mentioned above, MVC architecture is used to develop the pediatric obesity tracking system in this thesis.
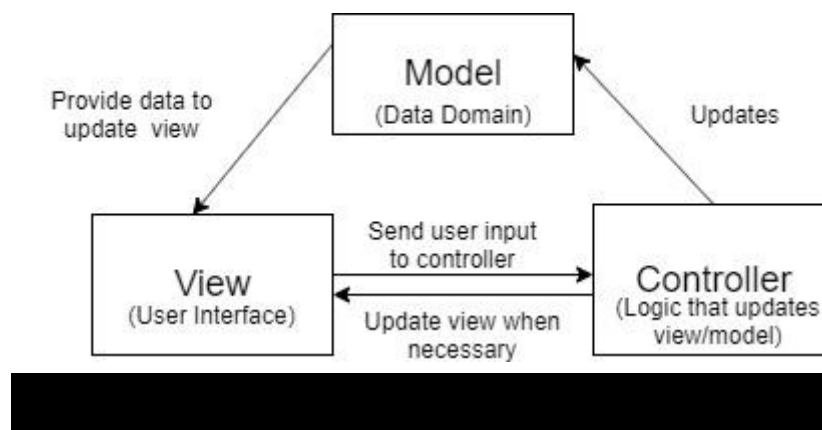
3.1.2 Visual Studio

Visual studio is a development environment produced by Microsoft. VS contains a code editor with code completing property which makes developing an application faster and helps the developer. Moreover, debugging is made easier at Visual Studio and application development becomes easier and faster with this provided property [57]. The given opportunities and user friendly view caused VS to be used when developing the proposed system.

3.1.3 Entity Framework
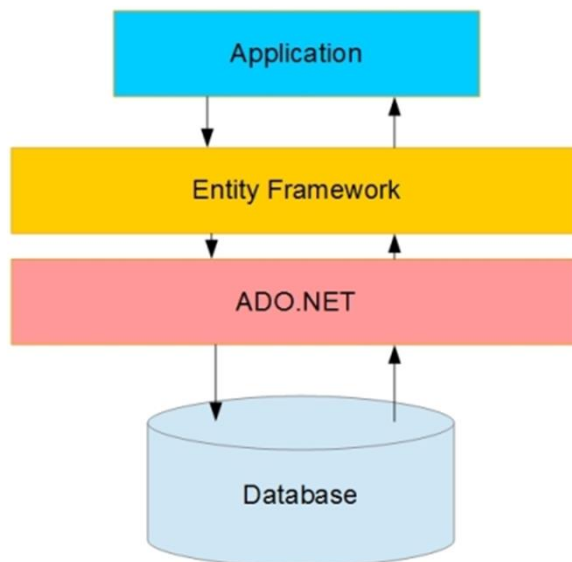
Figure 2: Entity Framework Example [58]

Entity Framework (EF) is an Object Relational Mapper (ORM) that allows the developer to use Code First (CF) approach to map classes to database. In Code First approach the fields are defined in the model classes as properties and automatically converted to database fields by EF. This opportunity decreases the time taken to arrange the fields and related foreign keys of the database, instead the related property classes are added and the database is updated accordingly. In the development process of the system proposed in this thesis, utilizing EF and CF

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approach reduced the effort and time taken significantly. Further, the object oriented approach assimilated by the EF, made defining classes which are then mapped to ontology classes, class properties and tables easier [59] [60]. An instance working architecture for EF is given in Figure 2. Conceptual model is defined as the model of the application objects. EF, is responsible for mapping the conceptual model to the database.

Language Integrated Query (LINQ) queries are used by EF, to query the underlying database. LINQ is a higher level querying language that is integrated to C# or other languages. Unlike Structured Query Language (SQL); LINQ is not expressed as string and it contains code completion property inside the development environment. In addition, it contains type checking at compile time [61]. Developer is given more opportunity to focus on the conceptual model rather than handling database compatible query strings. Additionally, without forming joins cross tables can be queried using LINQ, as a result making querying effortless [62]. Despite the advantages, SQL is needed at some points to handle some database operations like triggers. Therefore, both querying languages are useful for specific operations.

3.1.4 Bootstrap

Bootstrap is the world's most popular library for developing front-end components. It is used to develop responsive systems compatible with all size devices. In addition to being very popular, to develop a user interface, full knowledge of Hyper Text Markup Language(HTML) and Cascading Style Sheets(CSS) is not required as Bootstrap has many open sources and necessary support. Further, for a fully customized development Bootstrap is very suitable as required components can be changed rapidly and easily by the developer [63].

3.1.5 Protégé

Protégé is an open source platform developed by Stanford University, that is used to develop knowledge-based applications using web semantics. It uses Web Ontology Language (OWL) to allow development of ontology-based applications. [64]. The knowledge-based expert systems used for decision making is created using Protégé editor. Further details will be given in the upcoming sections giving detailed information about the ontology-base of the system proposed in this thesis. In addition, Protégé provides a user interface for creating ontologies, making creation clarified and more schematic [64] [65].

Chapter 4

IMPLEMENTATION

4.1 System Architecture

This section introduces the system architecture of the proposed system. Figure 3, demonstrates the system architecture and user interactions of the proposed system. As shown in the figure, the system includes five main modules which are (1) Administrator(Admin) Module (AdM), (2) HE Module (HeM), (3) Parent Module (PaM), (4) Child/Adolescent Module (ChM), and (5) Inference Engine Module (IEM). In addition, three types of interaction are defined and considered in the system: (1) User Interaction (UI) is between the user and system modules. (2) System Interaction (SI) is done among all modules and the system. (3) Component Interaction (CI) is found between the components of the system with each other.
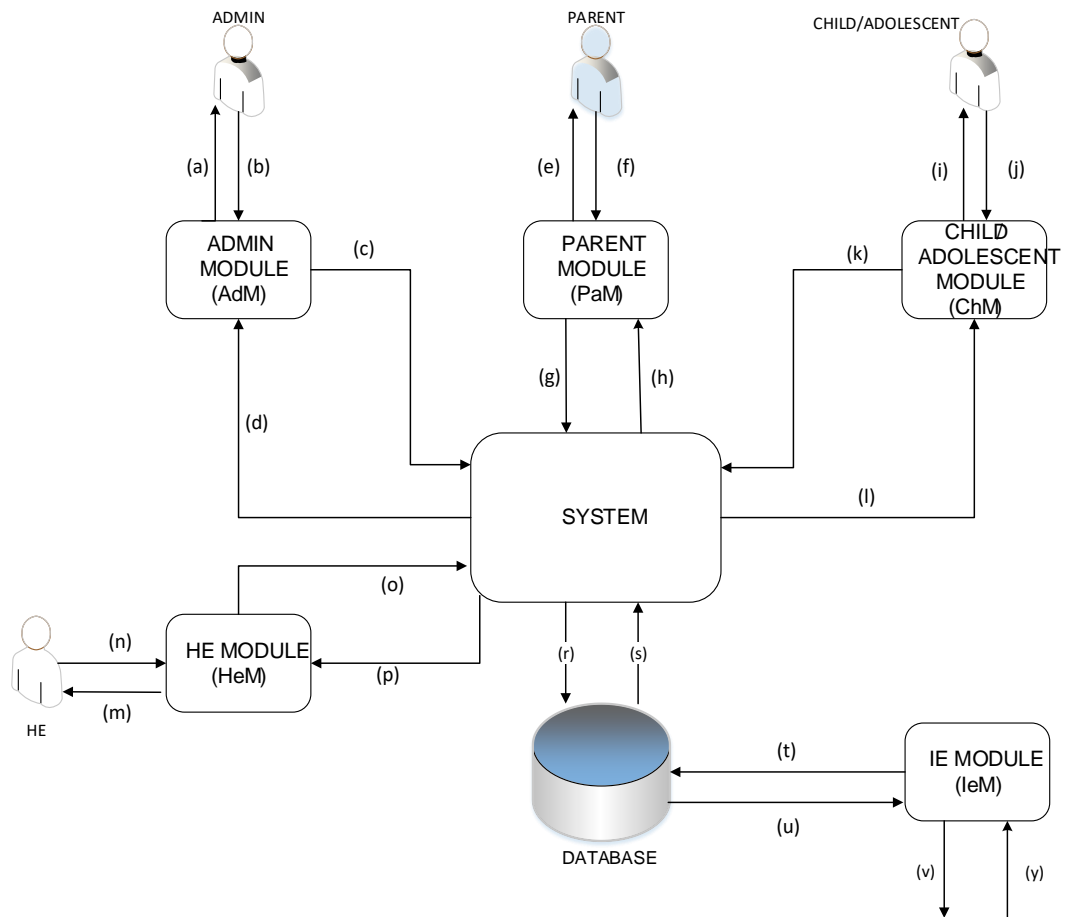
Figure 3: System architecture and user interactions diagram of the proposed system

The module functionalities are explained in detail in Sections 10.5 – 10.9. All interactions performed by the proposed system are shown in Table 6.

The data needed for performing the system's functionalities is explained in this section, which is gathered either by HE during inspection, or by parents at home, or by the adolescent using the mobile module of the system. The use of the proposed system starts when the child / adolescent patient periodically comes for medical examinations. HE is able to enter profile data with the key metrics of the child/adolescent etc. As mentioned earlier, BMI and WC are critical measurements

for child/adolescent patients that should be monitored to determine the development pattern and the risk of pediatric obesity. The time between medical examinations is usually more than two or three months [3] [66]. This fact means that, parents also are responsible and encouraged to enter the relevant measurements of their child/adolescent to the system for performing continuous and efficient obesity tracking. Because, the parents enter these measurements simply and in shorter periods of time to promote continuity. The information entered over the system according to the user types are categorized in three:

(1) Personal data: Personal data such as name, surname, date of birth, gender for all types of users are gathered. Parents can enter the information of their children using "Add Child" card. HEs also can add their patients' with their medical history and personal information by using a "Add Patient" card.

(2) Medical background: The parents can also enter available diseases of their children or medical history of the first/second degree relatives during registration by using the card. This data is needed to be collected since some diseases owned which may be genetic may increase the obesity risk of a child/adolescent patient. For instance; if parents or first/second degree relatives have obesity, fat level anomaly, Type 2 diabetes, hypertension or heart disease, then the risk of child/adolescent obesity becomes considerably higher. In addition, if the parents or any first/second degree relatives have an obesity history, or if the mother suffered from diabetes during pregnancy, then the risk also increases.

(3) Key metrics: The rest of the information requested by the system are key metrics such as date of birth, height, weight, HC, WC, gender, etc. The asserted key metrics are gathered by users to obtain the inferred key metrics which are needed to perform the following system functions as shown in Table 6.

Table 6: Features and functionalities shaped in the proposed system

Definition	Input	Outputs	User
BMI Calculator	Weight (kg), Height (cm)	BMI Value	Parent, Patient, HE
BMI Z-Score Calculator	BMI Value, Gender, Decimal Age	BMI Z-Score Value	HE
BMI Percentile Calculator	BMI Z-Score, NDT	BMI Percentile (%)	HE
Weight Z-Score Calculator	Weight Value, Gender, Decimal Age	Weight Z-Score Value	HE
Weight Percentile Calculator	Weight Z-Score, NDT	Weight Percentile (%)	HE
Height Z-Score Calculator	Height Value, Gender, Decimal Age	Height Z-Score Value	HE
Height Percentile Calculator	Height Z-Score, NDT	Height Percentile (%)	HE
HC Z-Score Calculator	HC Value, Gender, Decimal Age	HC Z-Score Value	HE
HC Percentile Calculator	HC Z-Score, NDT	HC Percentile (%)	HE
WC Z-Score Calculator	WC Value, Gender, Decimal Age	WC Z-Score Value	HE
WC Percentile Calculator	WC Z-Score, NDT	WC Percentile (%)	HE
Weight Tracker	Weight (kg), Date	Weight Development Graph, Table	Parent, Patient, HE
Weight Percentile Tracker	Weight Percentile (%), Decimal Age	Weight Development Graph Including Reference Lines For Boundary Percentiles[31]	HE
Height Tracker	Height (cm), Date	Height Development Graph, Table	Parent, Patient, HE
Height Percentile Tracker	Height Percentile (%), Decimal Age	Height Development Graph Including Reference Lines For Boundary Percentiles[31]	HE

Table 6 (continued)

HC Percentile Tracker	HC Percentile (%), Decimal Age	HC Development Graph Including Reference Lines For Boundary Percentiles[31]	HE
WC Tracker	WC (cm), Date	WC Development Graph, Table	Parent, Patient, HE
WC Percentile Tracker	WC Percentile (%), Decimal Age	WC Development Graph Including Reference Lines For Boundary Percentiles[31]	HE
Dietary Suggestion	BMI Percentile, Gender, Decimal Age	Appropriate Dietary Suggestions	Parent, Patient, HE
Physical Activity Suggestion	BMI Percentile, Gender, Decimal Age	Appropriate Physical Activity Suggestions	Parent, Patient, HE
Consultation Requirement	Pediatric Patient File	Consultation From Other HEs About the Sent Patient	HE
Laboratory Result Tracking	Laboratory Results of Pediatric Patient	Laboratory Result Table	HE
Patient Summary	Pediatric Patient Info.	Weekly, monthly, yearly etc. Summary	HE
Award Assignment	Pediatric Patient Assignments	Awards	HE
Notifications Service	Data from All Modules	Notifications about new suggestion, suggestion reminder, award etc.	All
Display Profile	User Profile Info.	Profile	All
Display Awards	Patient Award Info.	Awards	Parent, Patient, HE
Display Current Suggestions	Patient Suggestion Info.	Suggestions	Parent, Patient, HE
Display Suggestion History	Patient Suggestion History.	Suggestion History	Parent, Patient, HE
User Registration	User Personal Info.	User Account	Admin
User Account Editing	User Account	Edited User Account	Admin

4.2 System Users and Interactions

This section explains user types and their roles in the system. System architecture diagram and user interactions of the system are demonstrated in Figure 3. Table 7 summarizes the interactions found in the system. The system users and their responsibilities are defined as follows:

- **Health Expert (HE):** HEs provide professional support and monitor to the registered child/adolescent patients by observing their development. HEs constitute proper suggestions, awards, motivational strategies and give feedback to their patients in order to increase their motivation based on their achievements and measurements.

- **Parent:** Parents are responsible for monitoring and providing instant information required for the system about their children/adolescents. In the parent module, for continuity, entering of the key metrics of their child/adolescent at shorter intervals (weekly or twice a month) is expected. However, monitoring of HEs require continuous measurement about a patient at longer intervals (quarterly). In addition, the completion of the assigned activities and treatments by HEs are needed to be checked by parent users regularly.

- **Child/Adolescent Patient:** Patients are able to use their pediatric patient module to check their achievements and receive the rewards assigned to them. In addition, the patients can observe next milestones and suggestions proposed by the system, to be a healthier person and reach their planned goal. Patient also marks the physical activities which are assigned by his/her registered HE, as completed or not completed. Monitoring of physical activities, completed suggestions is important for monitoring obesity risk during treatment.

- **Admin:** Admin is responsible for creating and registering the users and configure the system. Also, the other user operations are all handled by admin.

Table 7: Description of user interactions in the system

Interaction	Type	Description
(a)	UI	System user profiles and other user information(info) are sent to the administrator(admin) by the AdM.
(b)	UI	Admin sends requests to the system for user registration, user account editing through the AdM.
(c)	SI	The admin requests about user registration etc. are sent to system using the AdM.
(d)	SI	User accounts and details requested by the admin are sent to the AdM.
(e)	UI	Development graphs, assigned suggestions, achievements, awards(**), necessary measurements etc. of the pediatric patient are sent to the parent via PaM.
(f)	UI	Development graphs, assigned suggestions, achievements, awards, necessary measurements etc. of the requested child/adolescent are requested by parent through PaM.
(g)	SI	Parent requests about info of their child/adolescent(s) are sent to the system through PaM.
(h)	SI	Development graphs, assigned suggestions, achievements, awards, necessary measurements etc. of the requested child/adolescent are sent by the system to parent through PaM.
(i)	UI	Development graphs, assigned suggestions, achievements, awards, necessary measurements etc. are sent by the system to patient through ChM.
(j)	UI	Development graphs, assigned suggestions, achievements, awards, necessary measurements etc. are requested by the child/adolescent through ChM.
(k)	SI	Child/Adolescent requests are sent to the system via the ChM.
(l)	SI	Requested info. are sent to the child/adolescent by the system through ChM.
(m)	UI	Info. requested by HE are sent by the system through the HeM.
(n)	UI	HE requests the necessary obesity tracking info. of all of the pediatric patients registered to the system. Clinical examinations, laboratory results etc. entered by HE are sent to the HeM.
(o)	SI	Requests from HE are transferred to the system by HeM.
(p)	SI	Clinical examinations, laboratory results, development graphs, assigned suggestions, achievements etc. of the registered pediatric patients are sent to HeM by the system.
(r)	SI	Data of all registered patients are sent by the system and saved to the database.

Table 7 (continued)

(s)	SI	System requests all data from the database to be able to allow users display.
(t)	CI	IeM checks the uncalculated clinical examinations regularly.
(u)	CI	Data of uncalculated clinical examinations are sent to IeM by the database for inferring.
(v)	CI	IeM writes the data from uncalculated clinical examinations to OTO for inferring by the rule-based expert system.
(y)	CI	Inferred data and personalized treatment suggestions are read by IeM from OTO.

** There are four types of awards that can be sent by the system which are: (1) Using the system regularly, (2) Attending clinical examinations regularly, (3) Applying dietician suggestions regularly, (4) Applying physical exercise suggestions regularly.

4.3 Obesity Tracking Ontology (OTO)

After analyzing the problem definition, as a first step OTO is implemented. Considering the pediatric patient obesity tracking metrics; classes, properties and rules are designed and OTO is created. The details of each component of OTO are given in the following sections.

4.3.1 Classes & Individuals

The classes are decided considering the requirements for pediatric obesity management. There are 7 important classes in OTO, demonstrated in Figure 4. Patient class is used to represent the pediatric patients registered to the system. In addition, the gender class represents the gender of the pediatric patient. Different type of suggestions are indicated by different classes in OTO. ZScore class stores the constant values that are used for calculating the necessary percentiles [36].
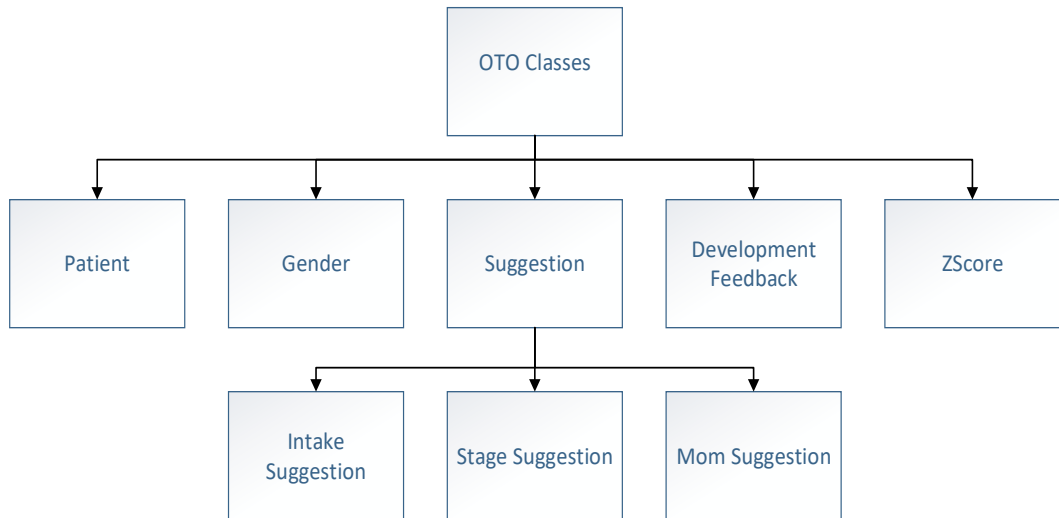
Figure 4: Classes of OTO

4.3.2 Data Type & Object Type Properties

The essential metrics required for obesity management and treatment are mentioned in Section 4.1. As mentioned previously, z-scores and percentiles are important parameters for pediatric patient obesity [23] [24]. Patient class should possess the data-type properties required for calculating percentiles. The data-type and object-type properties are summarized in Table 8.

The DTP's named "*hasDecimalAge*", "*hasHealthRisk*", "*hasWeight*", "*hasHeight*", "*hasWaistCircumference*", "*hasHeadCircumference*" are used to hold personal information of each pediatric patient. In addition to the personal information DTP's, object-type property hasGender also has the personal gender information of each pediatric patient. The personal information DTP's are combined with the properties related with L,M,S values to find the inferred z-scores. L,M,S values depend on the decimal age and gender of the pediatric patient. Neyzi et. al, have found the L,M,S reference values for Turkish children in their study (2015). The references in this study are used to find the relevant values for each registered pediatric patient. In

some cases, the decimal age could not be found at the reference table; in such cases statistical averaging methods are used to find the L,M,S values for the pediatric patient with the absent decimal age.

Table 8: DTPs and OTP s in OTO

Attribute Name	Property Type	Type	Domain	Range
hasDecimalAge	DTP	A (*)	Patient	(Double)
hasHealthRisk	DTP	A	Patient	(Boolean)
hasWeight	DTP	A	Patient	(Double)
hasHeight	DTP	A	Patient	(Double)
hasWaistCircumference	DTP	A	Patient	(Double)
hasHeadCircumference	DTP	A	Patient	(Double)
hasLvalue_W	DTP	A	Patient	(Double)
hasMvalue_W	DTP	A	Patient	(Double)
hasSvalue_W	DTP	A	Patient	(Double)
hasLvalue_H	DTP	A	Patient	(Double)
hasMvalue_H	DTP	A	Patient	(Double)
hasSvalue_H	DTP	A	Patient	(Double)
hasLValue_Waist	DTP	A	Patient	(Double)
hasMValue_Waist	DTP	A	Patient	(Double)
hasSValue_Waist	DTP	A	Patient	(Double)
hasLValue_Head	DTP	A	Patient	(Double)
hasMValue_Head	DTP	A	Patient	(Double)
hasSValue_Head	DTP	A	Patient	(Double)
hasBMI	DTP	I (*)	Patient	(Double)
hasWeightZscore	DTP	I	Patient	(Double)
hasHeightZscore	DTP	I	Patient	(Double)
hasHeadCircZscore	DTP	I	Patient	(Double)
hasWaistCircZscore	DTP	I	Patient	(Double)
hasBMIPercentile	DTP	I	Patient	(Double)
hasWeightPercentile	DTP	I	Patient	(Double)
hasHeightPercentile	DTP	I	Patient	(Double)
hasHeadCircPercentile	DTP	I	Patient	(Double)
hasWaistCircPercentile	DTP	I	Patient	(Double)
hasGender	OTP	A	Patient	Gender
hasDevelopmentFeedback	OTP	I	Patient	Development_ Feedback
hasIntakeSuggestion	OTP	I	Patient	Intake Suggestions

Table 8 (continued)

hasMomSuggestion	OTP	I	Patient	MomSuggestions
hasSuggestion	OTP	I	Patient	Suggestions
hasSuggestionItem	DTP	I	Suggestions, MomSuggestions	(String)
hasDevelopmentFeedbackItem	DTP	I	Development_Feedback	(String)
hasCalorie_IntakeAmount	DTP	I	IntakeSuggestions	(String)
hasGrain_IntakeAmount	DTP	I	IntakeSuggestions	(String)
hasVegetable_IntakeAmount	DTP	I	IntakeSuggestions	(String)
hasFruit_IntakeAmount	DTP	I	IntakeSuggestions	(String)
hasDiary_IntakeAmount	DTP	I	IntakeSuggestions	(String)
hasProtein_IntakeAmount	DTP	I	IntakeSuggestions	(String)
hasLiquid_IntakeAmount	DTP	**I**	IntakeSuggestions	(String)
(*) "A" stands for asserted key metrics (**) "I" stands for inferred key metrics				

The calculated z-scores are the required parameters for percentile calculations. Normal Distribution Table (NDT) are used together with the calculated z-scores to obtain the percentiles. NDT usage has some specific cases that are handled when obtaining the necessary percentiles. These cases are positive z-score values and negative z-score values. Percentiles for positive z-score values are not directly taken from the NDT, the value is subtracted from 100 to find the correct percentile. On the other hand, percentiles for negative z-score values are directly taken from NDT. BMI, percentiles and z-scores are inferred metrics and related properties contain the calculated values.

4.3.3 Suggestions

Decimal age, gender and BMI percentile are used to determine the suggestions that should be assigned to the patient by the system using SQWRL rules. Suggestion assignment parameter for pediatric patients with age 0-2 years is weight-for-length. Furlong et al, have mentioned in the study performed that, the correlation between BMI and weight-for-length is strong (2016). Considering the result of this study, BMI percentile is used to decide on the suggestions that should be assigned to all pediatric patient at all age groups. Barlow et al, have suggested in the Pediatrics journal that obesity treatment can have multiple stages that are determined by considering the improvement of the pediatric patient. The stages are as follows: (1) Stage 0: Prevention Councelling (This category contains development feedbacks and suggestions), (2) Stage 1: Prevention Plus, (3) Stage 2: SWM (Structured Weight Management), (4) Stage 3: CMI (Comprehensive Multidisciplinary Intervention). Stage 0 is the prevention stage where the pediatric patients are given general suggestions to prevent obesity. On the other hand, the other stages are treatment stages where Stage 0 is not sufficient and more strict suggestions are needed. Appendix A demonstrates some instances of suggestions and treatment strategies included in each stage.

Traditionally, patient attends the clinical examination, the necessary measurements are taken by the health expert and improvement of the patient is inspected. Improvement can be given as 0.5 kg per week etc. In this thesis, the suggested system deisignates the appropriate and personalized suggestions to the patient by considering the measurements entered by the parents and/or health experts.

There are five types of system suggestions that can be assigned to the pediatric patient which are:

(1) **Development feedback suggestions (DS):** The development suggestions are suggestions related with the development of the pediatric patient. The development includes cases such as poor, normal, more than expected development etc. Immediate health expert consultancy may be required in some cases emphasizing the importance of the development feedback suggestions [41].

(2) **Intake suggestions (IS):** There are five types of nutrition elements that each child must take everyday with different amounts. These elements are: Protein, fruits, vegetables, grains and diary. In addition, the intake suggestions also include proposed daily intake amount for liquid. The amount of each element vary considering the gender and decimal age of the pediatric patient. The intake suggestions are designed with a dietician for professional consultancy.

(3) **Mom suggestions (MS):** At certain age intervals, the mother also needs to be careful for the food consumed. The mom suggestions are related with the mother consumption warnings.

(4) **Stage Suggestions (SS):** There are certain pediatric patient obesity treatment stages according to Barlow et. al. These stages are given as: Stage 0 (prevention counseling), stage 1 (prevention plus), stage 2 (structured weight management), stage 3 (comprehensive multidisciplinary intervention), stage 4(tertiary care intervention) [33].

(5) **General Suggestions (GS):** The group of suggestions do not belong to any of the treatment stages and they are represented as SG_YY_GEN where YY is the order number of the suggestion. (e.g 01,02,10 etc.)

The suggestions other than the general suggestions are given as SGX_YY_ZZZ_(Q) where SGX part corresponds to the category of techniques mentioned above. YY corresponds to the order number of the suggestion(e.g 01, 02, 10 etc.) and ZZZ corresponds to either EAT, PHY, DEV, INT, or MOM. EAT denotes the nutritional suggestions, PHY denotes the physical activity suggestions,DEV denotes the development feedbacks and INT corresponds to the daily nutritional intake suggestions for the pediatric patients. MOM denotes the suggestions given to the mother of the pediatric patient at a certain age. The component represented by Q is optional and if it does not exist, this means the suggestion is applicable for all genders. If it exists, Q denotes the gender(s) that the suggestion is applicable for. Q can be F or M. M corresponds to male and F corresponds to the female pediatric patients. For instance, SG0_06_INT_F is categorized as the nutritional intake suggestion with order number 6(6th) that belongs to the prevention counselling category for female pediatric patients.

4.3.4 Semantic Web Rule Knowledge Base

SQWRL (Semantic Query-Enhanced Web Rule Language) [67] is a SWRL based expressive query language that can be used to query OWL ontologies. SQWRL is built on the Semantic Web Rule Language (SWRL) [68]. SWRL makes possible to write semantic rules and this provides more powerful deductive reasoning capabilities than OWL alone. SWRL combines OWL DL [69] and OWL Lite [68] sublanguages with sublanguages of the Rule Markup Language (RML) [68] [70]. The rules are used to check specified conditions and if they hold some actions are taken. Main difference between SWRL and SQWRL is that SWRL is an OWL rule language. SQWRL is an OWL query language. However, both of them have an antecedent part, which is known as the body, and a consequent part, which is known

as the head. SQWRL uses SWRL semantics for its left-hand side (in body) but running a SQWRL query does not modify an on ontology in any way. Protégé editor, SWRL and SQWRL are used to define semantic rules of the system which provide user the combination of the problem definition facts and inference of the knowledge base.

SQWRL rules of OTO require the key metrics (e.g. height, weight, HC, WC, and gender) as inputs to calculate the values of the inferred key metrics (e.g. BMI, decimal age, BMI/weight/height z-score metrics, BMI/weight/height percentile metrics) to perceive latest developments about the child patient. In addition, the values of the key metrics are used to infer proper suggestions and activities about the patient and guide his/her HEs through decisions that shoulf be taken on medical treatment(s) for their patient. Totally, 113 different SQWRL rules are created on OTO. In general, the rules take height, weight, HC, WC and gender information as input and finds the inferred key metrics by using NDT and the mathematical formulas mentioned in Section 4.2 [31] [32] [33] [36] [37]. After the values of BMI/weight/height percentile metrics are calculated, the values are used as inputs by the system inference engine to find suitable personalized suggestions through the rules on OTO. Then, the system presents the suggestions to the HE to assign them to his/her patient to as treating or preventing activity. The SWRL rules are modelled and categorized based on the four suggestions categorization which is mentioned in Section 7, plus with inferred key metrics. The rules are implemented on different concepts on OTO such as (1) Inferred Key Metrics Calculation rules, (2) Development Feedback rules, (3) Mom Suggestion rules, (4) Intake Suggestion rules,

and (5) Stage Suggestion rules. Some instances are given below and the complete set of rules are given in Appendix B.

(1) Inferred Key Metrics Calculation rules are created and used to calculate the values of relevant z-score and percentile metrics from the asserted key metrics entered (e.g. weight, height, WC, and HC). To illustrate, some the rules are discussed below. Rules between the 7-9 are given as instances for asserted key metric percentile calculations and the rest of the rules in this category are used to calculate the z-score metrics.

The rules of the "*Inferred Key Metrics Calculation*" category are applicable to all pediatric patients present in the system. For instance, the Rule 1 shows how SWRL with its built-in functions can be used to calculate the value of BMI. The "?p" is a patient, "?h" is height information of the patient, "?w" is weight information of the patient, ?BMI represent the result value of BMI calculation which is evaluated using the "swrlm:eval" function. The function is used to implement the Eq (2) which takes the "?h" and "?w" parameters. Return value of the function is the "?BMI" result value which will be assigned to the "?p" patient. Moreover, the "?p" has the property association, "hasBMI" as DTP, that is result of the rules and indicated after arrow (after the query run). There are 56 SQWRL rules (in 113 rules) created for calculation of the inferred key metrics on OTO.

Rule 1 for Eq (2): Patient(?p) ^ hasHeight(?p, ?h) ^ hasWeight(?p, ?w) ^ swrlm:eval(?BMI, "10000*w/(pow(h, 2))"^, ?w, ?h) -> hasBMI(?p, ?BMI)

Rule 2 for Eq (3): Patient(?p) ^ hasLvalue_W(?p, ?Lw) ^ hasMvalue_W(?p, ?Mw) ^ hasSvalue_W(?p, ?Sw) ^ hasWeight(?p, ?w) ^ swrlm:eval(?WZScore, "(pow(w/Mw, Lw) -1)/(Lw * Sw)"^, ?Lw, ?Mw, ?Sw, ?w) -> hasWeightZscore(?p, ?WZScore)

Rule 3 for Eq (4): Patient(?p) ^ hasHeight(?p, ?h) ^ hasLvalue_H(?p, ?Lh) ^ hasMvalue_H(?p, ?Mh) ^ hasSvalue_H(?p, ?Sh) ^ swrlm:eval(?HZScore, "(pow(h/Mh, Lh) -1)/(Lh * Sh)"^, ?Lh, ?Mh, ?Sh, ?h) -> hasHeightZscore(?p, ?HZScore)

Rule 4 for Eq (5): Patient(?p) ^ hasLValue_Head(?p, ?Lw) ^ hasMValue_Head(?p, ?Mw) ^ hasSValue_Head(?p, ?Sw) ^ hasHeadCircumference(?p, ?w) ^ swrlm:eval(?HCZScore, "(pow(w/Mw, Lw) - 1)/(Lw * Sw)"^, ?Lw, ?Mw, ?Sw, ?w) -> hasHeadCircZScore(?p, ?HCZScore)

Rule 5 for Eq (6): Patient(?p) ^ hasLValue_Waist(?p, ?Lw) ^ hasMValue_Waist(?p, ?Mw) ^ hasSValue_Waist(?p, ?Sw) ^ hasWaistCircumference(?p, ?w) ^ swrlm:eval(?WCZScore, "(pow(w/Mw, Lw) -1)/(Lw * Sw)"^, ?Lw, ?Mw, ?Sw, ?w) -> hasWaistCircZScore(?p, ?WCZScore)

Rule 6 for Eq (7): Patient(?p) ^ hasBMI(?p, ?bmi) ^ hasLvalue_BMI(?p, ?Lbmi) ^ hasMvalue_BMI(?p, ?Mbmi) ^ hasSvalue_BMI(?p, ?Sbmi) ^ swrlm:eval(?BMIZScore, "(pow(bmi/Mbmi, Lbmi) -1)/(Lbmi * Sbmi)"^, ?Lbmi, ?Mbmi, ?Sbmi, ?bmi) -> hasBMIZscore(?p, ?BMIZScore)

Rule 7: Patient(?p) ^ hasWeightZscore(?p, ?wzr) ^ hasWeightR3(?p, ?wzr3) ^ ZScore(?z) ^ hasZScore(?z, ?zs) ^ swrlb:equal(?zs, ?wzr3) ^ hasZSC2Percentile(?z, ?zp) ^ swrlb:greaterThan(?wzr, 0) ^ swrlm:eval(?zpr, "100-zp"^, ?zp) -> hasWeightPercentile(?p, ?zpr)

Rule 8: Patient(?p) ^ hasWaistCircZScore(?p, ?wzr) ^ hasWaistCircR3(?p, ?wzr3) ^ ZScore(?z) ^ hasZScore(?z, ?zs) ^ swrlb:equal(?zs, ?wzr3) ^ hasZSC2Percentile(?z, ?zp) ^ swrlb:greaterThan(?wzr, 0) ^ swrlm:eval(?zpr, "100-zp"^, ?zp) -> hasWaistCircPercentile(?p, ?zpr)

Rule 9: Patient(?p) ^ hasBMIZscore(?p, ?bzr) ^ hasBMIR3(?p, ?bzr3) ^ ZScore(?z) ^ hasZScore(?z, ?zs) ^ swrlb:equal(?zs, ?bzr3) ^ hasZSC2Percentile(?z, ?zp) ^ swrlb:greaterThan(?bzr, 0) ^ swrlm:eval(?zpr, "100-zp"^, ?zp) -> hasBMIPercentile(?p, ?zpr)

(2) Development Feedback rules are used to assign the development feedback type of suggestions to the pediatric patients. These rules are applicable for patients belonging to the age interval 0-11 years. For instance; Rule 10 is developed for pediatric patients with decimal age in interval 0-2 years and BMI percentile equal to 1. To clarify, more rules are given below. There are 6 development feedback rules created on OTO.

Rule 10: Patient(?p) ^ hasDecimalAge(?p, ?a) ^ hasBMIPercentile(?p, ?bp) ^ swrlb:greaterThanOrEqual(?a, 0) ^ swrlb:lessThanOrEqual(?a, 2) ^ swrlb:equal(?bp, 1) -> hasDevelopmentFeedback(?p, SG0_01_DEV)

Rule 11: Patient(?p) ^ hasDecimalAge(?p, ?a) ^ swrlb:greaterThanOrEqual(?a, 0) ^ swrlb:lessThanOrEqual(?a, 2) ^ hasBMIPercentile(?p, ?bp) ^ swrlb:greaterThan(?bp, 1) ^ swrlb:lessThanOrEqual(?bp, 3) -> hasDevelopmentFeedback(?p, SG0_02_DEV)

(3) Mom Suggestion rules are applicable for pediatric patients with decimal age 0-1 years. Several examples are given below. For instance; Rule 13 is for 6-9-month-old patients. There are 2 rules used for assigning mom suggestions to pediatric patients in OTO.

Rule 12: Patient(?p) ^ hasDecimalAge(?p, ?a) ^ swrlb:greaterThanOrEqual(?a, 0) ^ swrlb:lessThanOrEqual(?a, 1) -> hasMomSuggestion(?p, SG0_26_MOM) ^ hasMomSuggestion(?p, SG0_27_MOM)

Rule 13: Patient(?p) ^ hasDecimalAge(?p, ?a) ^ swrlb:greaterThanOrEqual(?a, 0.5) ^ swrlb:lessThanOrEqual(?a, 0.75) -> hasMomSuggestion(?p, SG0_28_MOM) ^ hasMomSuggestion(?p, SG0_29_MOM) ^ hasMomSuggestion(?p, SG0_30_MOM) ^ hasMomSuggestion(?p, SG0_31_MOM) ^ hasMomSuggestion(?p, SG0_32_MOM) ^ hasMomSuggestion(?p, SG0_33_MOM) ^ hasMomSuggestion(?p, SG0_34_MOM)

(4) Intake Suggestion rules are developed for all pediatric patients existing in the system which means patients 0-18 years old. Different rules apply for female and male patients. Several instances are given below to clarify. For instance; Rule 14 is for female patients aged between 6-9 with BMI percentile between 5-94. There are around 50 rules created for intake suggestion assignments.

Rule 14: Patient(?p) ^ hasGender(?p, Girl) ^ hasDecimalAge(?p, ?a) ^ hasBMIPercentile(?p, ?bp) ^ swrlb:greaterThan(?a, 6) ^ swrlb:lessThanOrEqual(?a, 8) ^ swrlb:greaterThanOrEqual(?bp, 5) ^ swrlb:lessThanOrEqual(?bp, 94) -> hasIntakeSuggestion(?p, SG0_21_INT_F)

Rule 15: Patient(?p) ^ hasGender(?p, Boy) ^ hasDecimalAge(?p, ?a) ^ hasBMIPercentile(?p, ?bp) ^ swrlb:greaterThan(?a, 0.92) ^ swrlb:lessThanOrEqual(?a, 1) ^ swrlb:greaterThanOrEqual(?bp, 5) ^ swrlb:lessThanOrEqual(?bp, 94) -> hasIntakeSuggestion(?p, SG0_17_INT_M)

(5) Stage Suggestion rules are the rules that are used to assign an appropriate obesity treatment or prevention stage to the pediatric patient. Different rules apply for different decimal ages and BMI percentiles. For instance, Rule 16 applies for pediatric patients aged 2-18 with BMI percentile in range 5-94.

Rule 16: Patient(?p) ^ hasDecimalAge(?p, ?a) ^ swrlb:greaterThanOrEqual(?a, 2) ^ swrlb:lessThanOrEqual(?a, 18) ^ hasBMIPercentile(?p, ?bmip) ^ swrlb:greaterThanOrEqual(?bmip, 5) ^ swrlb:lessThanOrEqual(?bmip, 94) ^ hasHealthRisk(?p, ?hr) ^ swrlb:equal(?hr, false) àhasSuggestion(?p, SG0_06_EAT) ^ hasSuggestion(?p, SG0_07_EAT) ^ hasSuggestion(?p, SG0_08_EAT) ^ hasSuggestion(?p, SG0_09_EAT) ^ hasSuggestion(?p, SG0_10_EAT) ^ hasSuggestion(?p, SG0_11_EAT) ^ hasSuggestion(?p, SG0_12_EAT) ^ hasSuggestion(?p, SG0_13_EAT) ^ hasSuggestion(?p, SG0_14_PHY) ^ hasSuggestion(?p, SG0_15_PHY)

4.4 Database

Figure 5 and 6 demonstrate the class diagram of the complete proposed system. The classes and relationships between them are demonstrated. Each class corresponds to a table in the database. There are 17 classes in the proposed system corresponding to the important components of the system. To begin with, the "Pediatric Patient" class represents the child/adolescent patients and important features of patients are handled using this class. As the second main class, the "Inspection" class represent the clinical examinations of each pediatric patient. The "Suggestion" class, represents the suggestions, which are one of the main outputs of the proposed system. The classes and their properties are explained in detail in the following sections.

Suggestion

+ID: string
+SuggestionCode: string
+SuggestionType: string
+Stage: int
+MetricType: string
+AgeBoundType: string
+AgeLowerBound: double
+AgeUpperBound: double
+HealthRisk: bool
+BoundType: string
+PercentileLowerBound: double
+PercentileUpperBound: double
+SuggestionDescription: string
+RoleWhoAddedSuggestion: string
+Gender: string

1..*

PatientAssignedSuggestions

+ID: string
+SuggestionSendDate: datetime
+SuggestionCompleteDate: datetime
+PatientSuggestionList:List<Suggestion>
+PatientId: int
+Patient: Patient
+SentBy: string
+SuggestionProgress: string
+RemindedDate: datetime

ExerciseSuggestions

+ID: string
+SuggestionCardSendDate: datetime
+SuggestionCardCompleteDate: datetime
+ExerciseSuggestionDescriptions:List<string>
+PatientId: int
+Patient: Patient
+SentBy: string
+SentTo: string
+RemindedDate: datetime

Notification

+ID: string
+Date: datetime
+SentBy: string
+SentTo: string
+Seen: bool
+Message: string
+NotificationType: int
+PediatricPatient: int
+suggestionReminded: PatientAssignedSuggestions
+exerciseSuggestionReminded:ExerciseSuggestions
+AnswerToSuggestionReminderInt: int
+StarSent: bool
+SendConsultationNotification(string sentUser , string receivedUser, string sMessage, int pediatricPatientId): ActionResult
+GetNotificationRecipients(): JsonResult
+GetNotificationsOfLoggedInUser(string userName): JsonResult
+GetMessagesOfLoggedInUser(string userName): JsonResult
+MarkNotificationAsSeen(int notificationID): ActionResult
+GetExpectedConsultationsOfLoggedInUser(string userName): JsonResult
+GetWaitingConsultationsOfLoggedInUser(string userName): JsonResult

PediatricPatient

+ID: string
+ Name: string
+ Surname: string
+ Gender: string
+ParentMedicalHistory :string
+prenatalHistoryDetails: string
+natalHistoryDetails: string
+postNatalHistoryDetails: string
+Telephone: string
+DecimalAge: double
+Diagnosis: string
+L,M,S Values(for all metrics) : double
+starCount: int
+medalCount: int
+thropyCount: int
+Inspections: ICollection<Inspection>
+HomeInspections: ICollection<HomeInspection>
+SummaryDetails: ICollection<Summary>
+PatientSuggestions: ICollection<PatientAssignedSuggestions>
+SystemSuggestions: ICollection<Suggestion>
+ExerciseSuggestions: ICollection<ExerciseSuggestions>
+PatientHealthRisk: bool
+Parent: Parent
+CalculateDecimalAge(PediatricPatient patient)
+CalculateDecimalAge(PediatricPatient pediatricPatient, DateTime dateToBeUsed)
+GetLMSValue(PediatricPatient pediatricPatient, string metricType,double inspectionDecimalAge=-1.0)
+GenerateSummaryArrays(PediatricPatient patient)
+AssignSuggestionToPatient(string[] chetedSystemSuggestionDescList,string[] systemChectedSystemSuggestionDescList,string[] dieticianSuggestionDescList, string patientId,string userName): ActionResult
+MarkSuggestionAsCompleted(string[] suggestionsToComplete): ActionResult
+AssignExerciseSuggestionToPatient(string[] exerciseSuggestionDescList,string patientId): ActionResult
+GetMedicalHistoryOfPatient(string pediatricPatientId): JsonResult
+CheckSuggestionsAndSendAwards(string username)
+CheckInspectionAttendance(string username)
+GetPatientLaboratoryResults(int laboratoryTest, string patientId, string orderByParameter): JsonResult
+GetStarAwardDetailsOfPediatricPatient(string username): JsonResult

Summary

+ID: string
+Date: datetime
+Weight: double
+Height: double
+HeadCircumference: double
+WaistCircumference: double
+BMI: double
+BMI_Percentile: double
+Weight_Percentile: double
+Height_Percentile: double
+HeadCircumference_Percentile: double
+WaistCircumference_Percentile: double

Home Inspection

+ID: string
+Date: datetime
+Weight: double
+Height: double
+HeadCircumference: double
+WaistCircumference: double
+PatientId: int
+Patient: Patient

Figure 5: Class diagram of the proposed system(1)

Parent
+ID: string
+ Name: string
+ Surname: string
+Address: string
+Telephone: string
+ChildList: ICollection<PediatricPatient>

HeadCirdZScore_Reference
+ID: string
+Age: double
+AgeDesc: string
+Gender: string
+Head_LValue: double
+Head_MValue: double
+Head_SValue: double
+MinusThree_SDS: double
+MinusTwo_SDS: double
+MinusOne_SDS: double
+One_SDS: double
+Two_SDS: double
+Three_SDS: double

PediatricPatient
+ID: string
+ Name: string
+ Surname: string
+ Gender: string
+ParentMedicalHistory :string
+prenatalHistoryDetails: string
+natalHistoryDetails: string
+postNatalHistoryDetails: string
+Telephone: string
+DecimalAge: double
+Diagnosis: string
+L,M,S Values(for all metrics) : double
+starCount: int
+medalCount: int
+thropyCount: int
+Inspections: ICollection<Inspection>
+HomeInspections: ICollection<HomeInspection>
+SummaryDetails: ICollection<Summary>
+PatientSuggestions: ICollection<PatientAssignedSuggestions>
+SystemSuggestions: ICollection<Suggestion>
+ExerciseSuggestions: ICollection<ExerciseSuggestions>
+PatientHealthRisk: bool
+Parent: Parent
+CalculateDecimalAge(PediatricPatient patient)
+CalculateDecimalAge(PediatricPatient pediatricPatient, DateTime dateToBeUsed)
+GetLMSValue(PediatricPatient pediatricPatient, string metricType,double inspectionDecimalAge=-1.0)
+GenerateSummaryArrays(PediatricPatient patient)
+AssignSuggestionToPatient(string[] chetedSystemSuggestionDescList,string[] systemChectedSystemSuggestionDescList,string[] dieticianSuggestionDescList, string patientId,string userName): ActionResult
+MarkSuggestionAsCompleted(string[] suggestionsToComplete): ActionResult
+AssignExerciseSuggestionToPatient(string[] exerciseSuggestionDescList,string patientId): ActionResult
+GetMedicalHistoryOfPatient(string pediatricPatientId): JsonResult
+CheckSuggestionsAndSendAwards(string username)
+CheckInspectionAttendance(string username)
+GetPatientLaboratoryResults(int laboratoryTest, string patientId, string orderByParameter): JsonResult
+GetStarAwardDetailsOfPediatricPatient(string username): JsonResult

HeightZScore_Reference
+ID: string
+Age: double
+AgeDesc: string
+Gender: string
+Height_LValue: double
+Height_MValue: double
+Height_SValue: double
+MinusThree_SDS: double
+MinusTwo_SDS: double
+MinusOne_SDS: double
+One_SDS: double
+Two_SDS: double
+Three_SDS: double

Inspection
+ID: string
+Date: datetime
+IsCalculated: bool
+Weight: double
+Height: double
+HeadCircumference: double
+WaistCircumference: double
+BMI: double
+BMI_Percentile: double
+Weight_Percentile: double
+Height_Percentile: double
+HeadCircumference_Percentile: double
+WaistCircumference_Percentile: double
+BMI_ZScore: double
+Weight_ZScore: double
+Height_ZScore: double
+HeadCircumference_ZScore: double
+WaistCircumference_ZScore: double
+InspectionDescription: string
+PubertyInspectionDescription: string
+Progress: string
+Treatment: string
+Diagnosis: string
+Considerations: string
+DietHistory: string
+PubertyStage: string
+TestisVolumes: string
+L,M,S Values(for all metrics) : double
+PatientDecimalAge: string
+PatientId: int
+Patient: Patient
+LabResult: ICollection<LaboratoryResult>

BMIZScore_Reference
+ID: string
+Age: double
+AgeDesc: string
+Gender: string
+BMI_LValue: double
+BMI_MValue: double
+BMI_SValue: double
+MinusThree_SDS: double
+MinusTwo_SDS: double
+MinusOne_SDS: double
+One_SDS: double
+Two_SDS: double
+Three_SDS: double
-memberName

WaistCircZScore_Reference
+ID: string
+Age: double
+AgeDesc: string
+Gender: string
+Waist_LValue: double
+Waist_MValue: double
+Waist_SValue: double
+MinusThree_SDS: double
+MinusTwo_SDS: double
+MinusOne_SDS: double
+One_SDS: double
+Two_SDS: double
+Three_SDS: double

LabrotaryTestDefinition
+ID: string
+TestName: string
+Unit: string
+ReferenceValues: string
+Type: string

LaboratoryResult
+ID: string
+Date: datetime
+PatientNameSurname:string
+Result: string
+TestType: string
+TestDefinitionID: int
+ReferenceValues: string
+PreviousResults: string
+InspectionId: int
+Inspection: Inspection

WeightZScore_Reference
+ID: string
+Age: double
+AgeDesc: string
+Gender: string
+Weight_LValue: double
+Weight_MValue: double
+Weight_SValue: double
+MinusThree_SDS: double
+MinusTwo_SDS: double
+MinusOne_SDS: double
+One_SDS: double
+Two_SDS: double
+Three_SDS: double

1..*

1   1

Figure 6: Class diagram of the proposed system(2)

4.4.1 Pediatric Patient Class

Pediatric Patient class is the main class all system relies on. Figure 7, represents the pediatric patient class and its attributes. In addition to the attributes, the prototypes functions implemented inside this class are also demonstrated.

PediatricPatient
+ID: string + Name: string + Surname: string + Gender: string +ParentMedicalHistory :string +prenatalHistoryDetails: string +natalHistoryDetails: string +postNatalHistoryDetails: string +Telephone: string +DecimalAge: double +Diagnosis: string +L,M,S Values(for all metrics) : double +starCount: int +medalCount: int +thropyCount: int +Inspections: ICollection<Inspection> +HomeInspections: ICollection<HomeInspection> +SummaryDetails: ICollection<Summary> +PatientSuggestions: ICollection<PatientAssignedSuggestions> +SystemSuggestions: ICollection<Suggestion> +ExerciseSuggestions: ICollection<ExerciseSuggestions> +PatientHealthRisk: bool +Parent: Parent
+CalculateDecimalAge(PediatricPatient patient) +CalculateDecimalAge(PediatricPatient pediatricPatient, DateTime dateToBeUsed) +GetLMSValue(PediatricPatient pediatricPatient, string metricType,double inspectionDecimalAge=-1.0) +GenerateSummaryArrays(PediatricPatient patient) +AssignSuggestionToPatient(string[] chetedSystemSuggestionDescList,string[] systemChectedSystemSuggestionDescList,string[] dieticianSuggestionDescList, string patientId,string userName): ActionResult +MarkSuggestionAsCompleted(string[] suggestionsToComplete): ActionResult +AssignExerciseSuggestionToPatient(string[] exerciseSuggestionDescList,string patientId): ActionResult +GetMedicalHistoryOfPatient(string pediatricPatientId): JsonResult +CheckSuggestionsAndSendAwards(string username) +CheckInspectionAttendance(string username) +GetPatientLaboratoryResults(int laboratoryTest, string patientId, string orderByParameter): JsonResult +GetStarAwardDetailsOfPediatricPatient(string username): JsonResult

Figure 7: Pediatric Patient Class

There are aggregation relationship between the pediatric patient and *Exercise Suggestion*, *PatientAssignedSuggestion*, *Summary*, *HomeInspection*, *Inspection* classes. In addition to the aggregation relationships, pediatric patient has association

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relationship with all other classes in the system. The registered child/adolescent patients are denoted by pediatric patient class. The table linked to this class holds personal information such as name, surname, prenatal history, decimal age etc. In addition to the personal information, awarding details such as star count, medal count and trophy count are stored in the table since these values are specific to each patient.

Each pediatric patient has clinical examinations, suggestions, summary details. Clinical examinations entered by HE are related with pediatric patients using the "*Inspections*" attribute, examinations entered by parents are related using the "*HomeInspections*" attribute. "*SummaryDetails*" attribute links the pediatric patient class with the Summary class to hold the summary details of the patient. Moreover, the suggestions of the pediatric patients are held in attributes "*PatientSuggestions*" and "*ExerciseSuggestions*".

There are 12 methods implemented in pediatric patient class. The method with signature "*CalculateDecimalAge(PediatricPatient patient)*", calculates the current decimal age of the patient considering the current date and updates the related field for the patient given as parameter. The overloaded function with signature "*CalculateDecimalAge(PediatricPatient patient, DateTime dateToBeUsed)*" is implemented to allow calculating decimal age of a patient at a specific date time. This is necessary when calculating the decimal age of the patient at a given clinical examination. "*GetLMS*" method uses the reference tables for metrics, decimal age and gender of the given patient and finds the L,M,S values for the parameter metric. In addition, "*GenerateSummaryArrays*" is used to generate the weekly, monthly etc. summary arrays considering the entered clinical examination dates of the patient. For assigning the suggestions sent to patient by HEs, "*AssignSuggestionToPatient*" and

"*AssignExerciseSuggestionToPatient*" methods are implemented. These methods get the suggestions selected by HEs and send them as to the related pediatric patient for personalized obesity treatment. Sending process also includes sending a notification to the patient regarding the assigned suggestions.

Furthermore, the awards that can be sent to the patients are categorized into 4 categories such as: (1) using the system regularly, (2) attending clinical examinations regularly, (3) applying dietician suggestions regularly, (4) applying physical exercise suggestions regularly. Suggestion reminders are sent to the pediatric patient at regular intervals to ensure that patient is following them. Assigning the awards require checking the dates of clinical examinations or checking the responses given to the suggestion reminders. For this purposes, "*CheckSuggestionAndSendAwards*", "*CheckInspectionAttendance*" methods are implemented. The rest of the methods are for displaying awards, marking the suggestions as completed etc. To sum up, pediatric patient class is related and associated with all of the other classes that exist in the system.

4.4.2 Parent Class

The parent class denotes the parents of pediatric patients. Parent class has association relationship with the *PediatricPatient* class. When a pediatric patient is being registered to the system, parents are also registered and assigned to allow tracking of improvements of their child/adolescent(s). The attributes of the class are the personal information and child list of the parents. The child list attribute corresponds to the foreign keys with the pediatric patient class records. Figure 8, represents the parent class and its attributes.
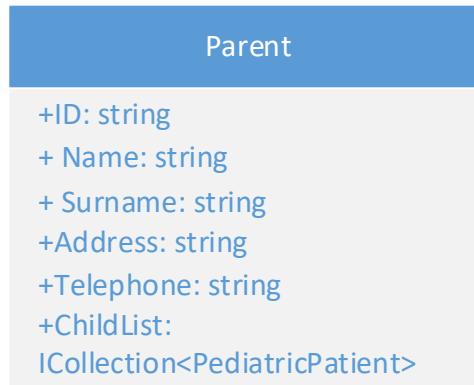
Figure 8: Parent Class

4.4.3 Inspection Class

The inspection class represents the clinical examinations of the pediatric patients.

Figure 9, represents the inspection class and its attributes.
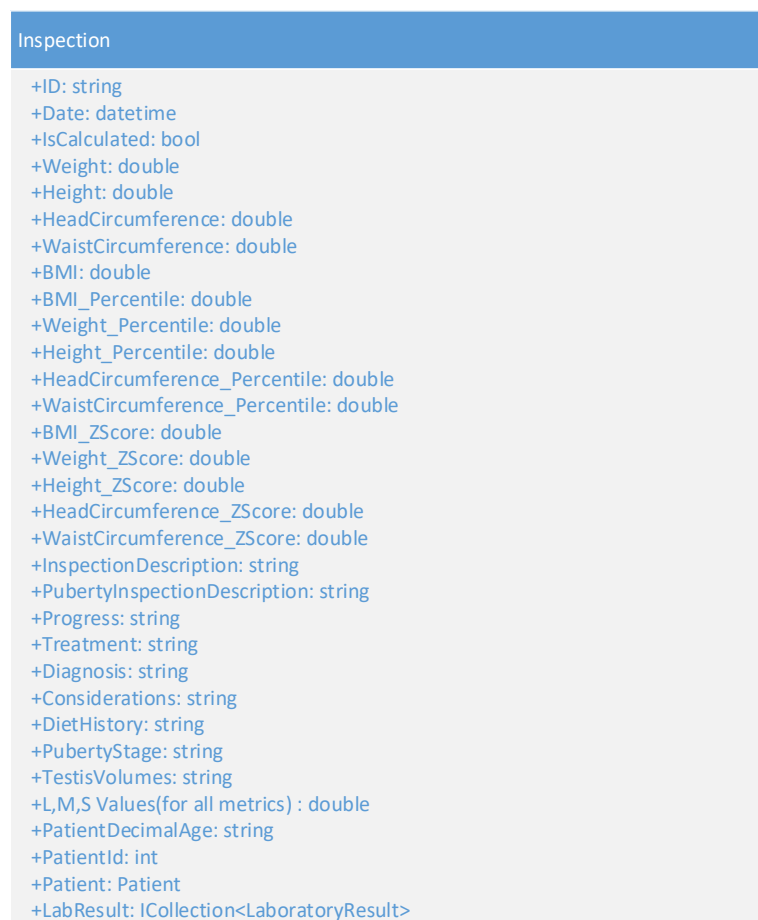
Figure 9: Inspection(Clinical Examination) Class

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The inspection class is linked with the table that holds all of the clinical examinations of all patients. The inspection class has aggregation relationship with *PediatricPatient* and composition relationship between *LabrotaryResult* class. The "PatientId" and "Patient" attributes are used to specify which patient the examination belongs to. These two attributes are the foreign keys with the pediatric patient records. At time of a clinical examination, measurements of the pediatric patient are entered by HEs. These measurements are held in attributes "Weight", "Height", "HeadCircumference", "WaistCircumference". The rest of the information such as treatment, diagnosis etc. are also entered at time of an examination. The patient decimal age at time of the examination is calculated and held in "PatientDecimalAge" attribute. L,M,S values considering the date of clinical examination. The decimal age, L,M,S values and patient gender are transferred to the inference engine for calculating the z-scores and percentiles. The calculated percentiles and z-scores are held in related attributes. In addition, at each clinical examination blood,urine tests of pediatric patient may be required for tracking important blood values. These laboratory results are entered by responsible people and held in "LabResult" attribute.

4.4.4 Home Inspection Class

Home inspection class work as the same manner with the inspection class. Home inspection class has aggregation relationship with *PediatricPatient* class. The only difference is that home inspections correspond to the examinations entered by the parents. The "PatientId" and "Patient" attributes are used to specify which patient the home examination belongs to. These two attributes are the foreign keys with the pediatric patient records. Figure 10, represents the home inspection class and its attributes.

Home Inspection

+ID: string
+Date: datetime
+Weight: double
+Height: double
+HeadCircumference: double
+WaistCircumference: double
+PatientId: int
+Patient: Patient
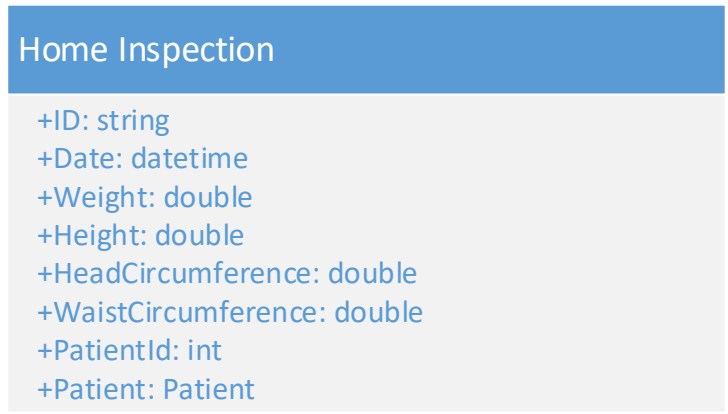
Figure 10: Home Inspection (Examination) Class

4.4.5 Suggestion Related Classes

The classes used for suggestion handling properties are explained in this section and given in Figure 11.

Suggestion

+ID: string
+SuggestionCode: string
+SuggestionType: string
+Stage: int
+MetricType: string
+AgeBoundType: string
+AgeLowerBound: double
+AgeUpperBound: double
+HealthRisk: bool
+BoundType: string
+PercentileLowerBound: double
+PercentileUpperBound: double
+SuggestionDescription: string
+RoleWhoAddedSuggestion: string
+Gender: string

1..*

PatientAssignedSuggestions

+ID: string
+SuggestionSendDate: datetime
+SuggestionCompleteDate: datetime
+PatientSuggestionList:List<Suggestion>
+PatientId: int
+Patient: Patient
+SentBy: string
+SuggestionProgress: string
+RemindedDate: datetime

ExerciseSuggestions

+ID: string
+SuggestionCardSendDate: datetime
+SuggestionCardCompleteDate: datetime
+ExerciseSuggestionDescriptions:List<string>
+PatientId: int
+Patient: Patient
+SentBy: string
+SentTo: string
+RemindedDate: datetime

Figure 11: Pediatric Patient Suggestion Related Classes

The suggestions class is linked to a table containing all defined suggestions present in the system. These suggestions are either suggestions proposed by the system or

added by HEs. The suggestions are defined for a specific age group ("*AgeBoundType*", "*AgeLowerBound*", "*AgeUpperBound*"), a specific metric ("*MetricType*"), and a specific percentile range ("*BoundType*", "*PercentileLowerBound*", "*PercentileUpperBound*"). The suggestion type ("*SuggestionType*") denotes the type of suggestion for instance physical, nutrition etc. Metric type can be height, weight etc. denoting the metric that should be checked when assigning the suggestion. Health risk attribute is used to denote whether the suggestion is suitable for patients with health risk etc.

PatientAssignedSuggestions are the suggestions that are sent to the patient by HE considering the situation, improvement of the patient. The sent suggestions are held in the attribute "*PatientSuggestionList*". "*SuggestionProgress*" is used to determine whether the suggestion is sent new or it is completed etc. The "PatientId" and "Patient" attributes are used to specify which patient the health expert suggestion belongs to. These two attributes are the foreign keys with the pediatric patient records.

Exercise suggestions are the physical activity suggestions entered to the system and sent to the patient by HEs. The suggestions proposed by the inference engine are searched for in the suggestion table and found records assigned to the pediatric patient. The "PatientId" and "Patient" attributes are used to specify which patient the exercise suggestion belongs to. These two attributes are the foreign keys with the pediatric patient records.

4.4.6 Notification Class

The notification class is used for handling the notifications sent to the users of the system. The class and its attributes are demonstrated in Figure 12.

```
┌─────────────────────────────────────────────────────────────┐
│ Notification                                                 │
├─────────────────────────────────────────────────────────────┤
│ +ID: string                                                  │
│ +Date: datetime                                              │
│ +SentBy: string                                              │
│ +SentTo: string                                              │
│ +Seen: bool                                                  │
│ +Message: string                                             │
│ +NotificationType: int                                       │
│ +PediatricPatient: int                                       │
│ +suggestionReminded: PatientAssignedSuggestions             │
│ +exerciseSuggestionReminded:ExerciseSuggestions             │
│ +AnswerToSuggestionReminderInt: int                          │
│ +StarSent: bool                                              │
├─────────────────────────────────────────────────────────────┤
│ +SendConsultationNotification(string sentUser , string       │
│ receivedUser, string sMessage, int pediatricPatientId):      │
│ ActionResult                                                 │
│ +GetNotificationRecipients(): JsonResult                     │
│ +GetNotificationsOfLoggedInUser(string userName): JsonResult │
│ +GetMessagesOfLoggedInUser(string userName): JsonResult      │
│ +MarkNotificationAsSeen(int notificationID): ActionResult    │
│ +GetExpectedConsultationsOfLoggedInUser(string userName):    │
│ JsonResult                                                   │
│ +GetWaitingConsultationsOfLoggedInUser(string userName):     │
│ JsonResult                                                   │
└─────────────────────────────────────────────────────────────┘
```

Figure 12: Notification Class

The *Notification* class has association relationship with *PediatricPatient* class.There are several notification types such as: (1) consultation which are notifications related with consultation requirements of HEs from each other, (2) reminder notifications which are related with dietician and exercise suggestion reminders, (3) new suggestions. These are held in "*NotificationType*" attribute. First 7 attributes are the identity information for each notification. "*PediatricPatient*" is the attribute for the patient which notification sent to.

When a reminder notification is being constructed, the "*suggestionReminded*" or "*exerciseSuggestionReminded*" attributes are filled with the suggestion cards that are

being reminded. "*AnswerToSuggestion Reminded*" corresponds to the answer given by the pediatric patient whether the pediatric patient applies the suggestions or not.

In addition to the attributes, the methods handle the sending, getting and marking the notifications as seen.

4.4.7 Laboratory Result Class

The classes used for entering and examining the laboratory results of the pediatric patient are "*LaboratoryResult*" class and "*LaboratoryTestDefinition*" classes. These classes and their attributes are demonstrated in Figure 13.

```
LaboratoryResult

 +ID: string
 +Date: datetime
 +PatientNameSurname:string
 +Result: string
 +TestType: string
 +TestDefinitionID: int
 +ReferenceValues: string
 +PreviousResults: string
 +InspectionId: int
 +Inspection: Inspection

            1

            1

LaboratoryTestDefinition

 +ID: string
 +TestName: string
 +Unit: string
 +ReferenceValues: string
 +Type: string
```
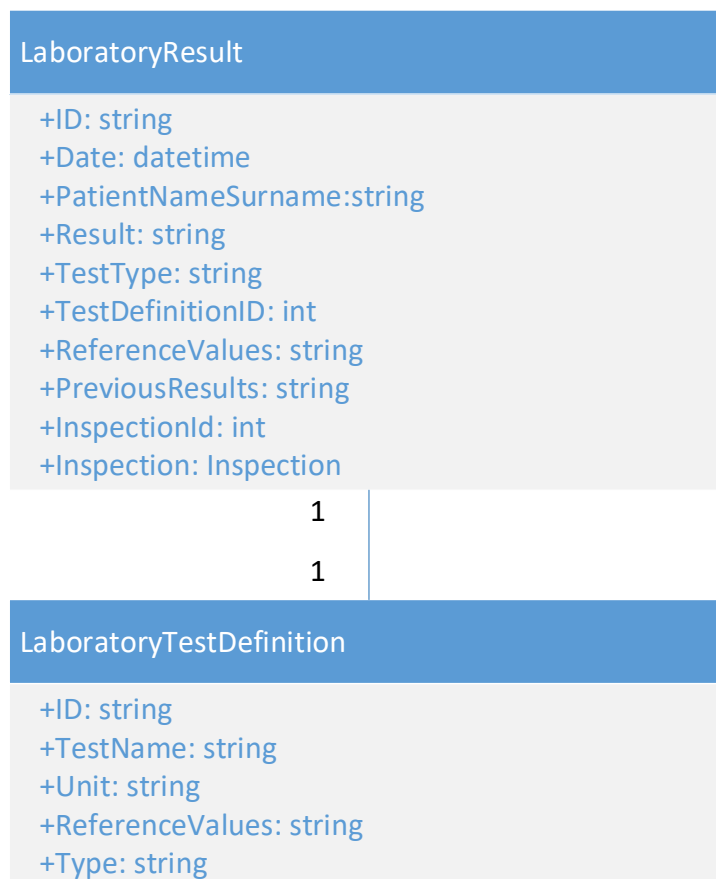
Figure 13: Pediatric Patient Laboratory Result Classes

The table linked to *Laboratory Result* class is used to hold the blood or urine test results of the pediatric patient. The results are important for obesity tracking of the

patient. The laboratory results, date of the results, test type are entered by the responsible people. The test type denotes whether the test is of type immunology, biochemistry etc. The *LaboratoryTestDefinition* class holds the tests that correspond to each test type. For instance, the biochemistry tests such as: glucose, sodium(Na), potassium(K) etc. are saved under the type biochemistry. All of the tests are saved to the table linked to *LaboratoryTestDefinition* class. When the test type is chosen during entrance of a lab result, the tests are filtered and only the tests corresponding to the chosen type are shown.

4.4.8 Summary Class

The pediatric patient measurements and inferred metrics must be examined in regular periods for determining the progress of the patient. In addition to the progress, the treatment strategies proposed are evaluated by examining the measurements and inferred metrics. The periodical grouping of these measurements and metrics are given the term "*Summary*". The summary class and its attributes are demonstrated in Figure 14.

Summary
+ID: string
+Date: datetime
+Weight: double
+Height: double
+HeadCircumference: double
+WaistCircumference: double
+BMI: double
+BMI_Percentile: double
+Weight_Percentile: double
+Height_Percentile: double
+HeadCircumference_Percentile: double
+WaistCircumference_Percentile: double

Figure 14: Summary Class

The inspection data is filtered with the given summary type to form the summary details of the pediatric patient. For instance, if the required summary type is weekly then the inspection data for the last week is saved as weekly summary, if the summary type is 4-month then the inspections within the 4-month from current date are taken as summary. The inspection filtering operations are handled by the summary class. Pediatric patient has list of inspections that form the summary as summary details. This means that, the summary class has an aggregation relationship with the *PediatricPatient* class.

4.4.9 Reference Classes

The reference classes are used for holding the L, M, S reference values for the reference ages determined in study performed by Neyzi et al.[32]. The pediatric patient gender and decimal age at time of the inspection is used to find the L, M, S values for z score calculation of the entered measurements. The L, M, S values are unique for each metric therefore, reference table for each metric exists. Figure 15, represents the classes that are used for saving the reference values for each provided pediatric patient age group.

HeightZScore_Reference
+ID: string
+Age: double
+AgeDesc: string
+Gender: string
+Height_LValue: double
+Height_MValue: double
+Height_SValue: double
+MinusThree_SDS: double
+MinusTwo_SDS: double
+MinusOne_SDS: double
+One_SDS: double
+Two_SDS: double
+Three_SDS: double

BMIZScore_Reference
+ID: string
+Age: double
+AgeDesc: string
+Gender: string
+BMI_LValue: double
+BMI_MValue: double
+BMI_SValue: double
+MinusThree_SDS: double
+MinusTwo_SDS: double
+MinusOne_SDS: double
+One_SDS: double
+Two_SDS: double
+Three_SDS: double

WaistCircZScore_Reference
+ID: string
+Age: double
+AgeDesc: string
+Gender: string
+Waist_LValue: double
+Waist_MValue: double
+Waist_SValue: double
+MinusThree_SDS: double
+MinusTwo_SDS: double
+MinusOne_SDS: double
+One_SDS: double
+Two_SDS: double
+Three_SDS: double

HeadCirdZScore_Reference
+ID: string
+Age: double
+AgeDesc: string
+Gender: string
+Head_LValue: double
+Head_MValue: double
+Head_SValue: double
+MinusThree_SDS: double
+MinusTwo_SDS: double
+MinusOne_SDS: double
+One_SDS: double
+Two_SDS: double
+Three_SDS: double

4.5 Admin Module (AdM)

The AdM is used by the admins of the system for maintaining the user accounts. User registration and user account maintenance can only be done by responsible admins. AdM is the user interaction module that allows admin requests to be sent to the system for performing necessary operations.

4.6 HE Module (HeM)

The HeM module is used by the HEs to register their patients. The personal information of the patients are entered to the system by HEs. Personal information entered include name, surname, date of birth, family medical background and patient prenatal, natal, postnatal history. After registration, at each clinical examination necessary measurements such as weight, height, HC and WC of the patient are entered. In addition to the measurements other information necessary for patient

tracking are also entered. The other information include (1) puberty stage and examination, (2) diagnosis, (3) treatment(if necessary), (4) considerations about the patient, (5) for male patients testis volume, (6) diet history, (7) laboratory results. The information from clinical examinations are used for forming the necessary metric development graphs, summary, auxology monitoring.

HeM allows the HE to perform the following operations : (1) register new pediatric patient, (2) edit personal information of the pediatric patient, (3) display,enter and edit clinical examinations of patient, (4) auxology monitoring, (5) display home examinations of patient, (6) display,enter and edit laboratory results of the patient, (7) display, create personalized dietician and exercise suggestions of the patient, (8) display awards sent by the system to the patient, (9) display treatment summary and (10) display metric summary of the pediatric patient.

Clinical examinations are entered each time the child/adolescent comes to the examination by the HE. The details of clinical examinations are given previously.

Auxology monitoring correspond to the metric versus decimal age graphs including boundary percentiles. Neyzi et al. performed a study that resulted in the boundary percentiles in Turkish children [32]. These percentiles and related growth charts corresponding to these percentiles are used to produce the auxology monitoring graphs. Figure 16, demonstrates an instance weight growth chart for female Turkish child with decimal age 1.44. Certain percentiles such as 3,10,97 etc. are the boundary percentiles determined in the study conducted by Neyzi et al. The range, line followed by pediatric patient determines the development of the pediatric

patient.Home examinations are entered by the parents of the patient. This allow the HE to monitor pediatric patient development and progress at shorter periods of time.

The personalized suggestions are generated by the system considering the current situation of the pediatric patient. HE displays the generated suggestions and chooses the necessary ones suitable and sends to the pediatric patient. At each 15 days, the most recent suggestions are sent as reminder to the pediatric patient to check whether they are being followed or not. Following the suggestions regularly and continuously results in patient earning an award (applying dietician and exercise suggestions regularly). All of the gained awards and treatment summary can be displayed by the HE. Moreover, the weekly, monthly, 3-month, 4-month, 6-month, yearly summary tables of the asserted and inferred key metrics are also demonstrated to the HE. These functionalities provide the necessary operations for pediatric patient obesity tracking.
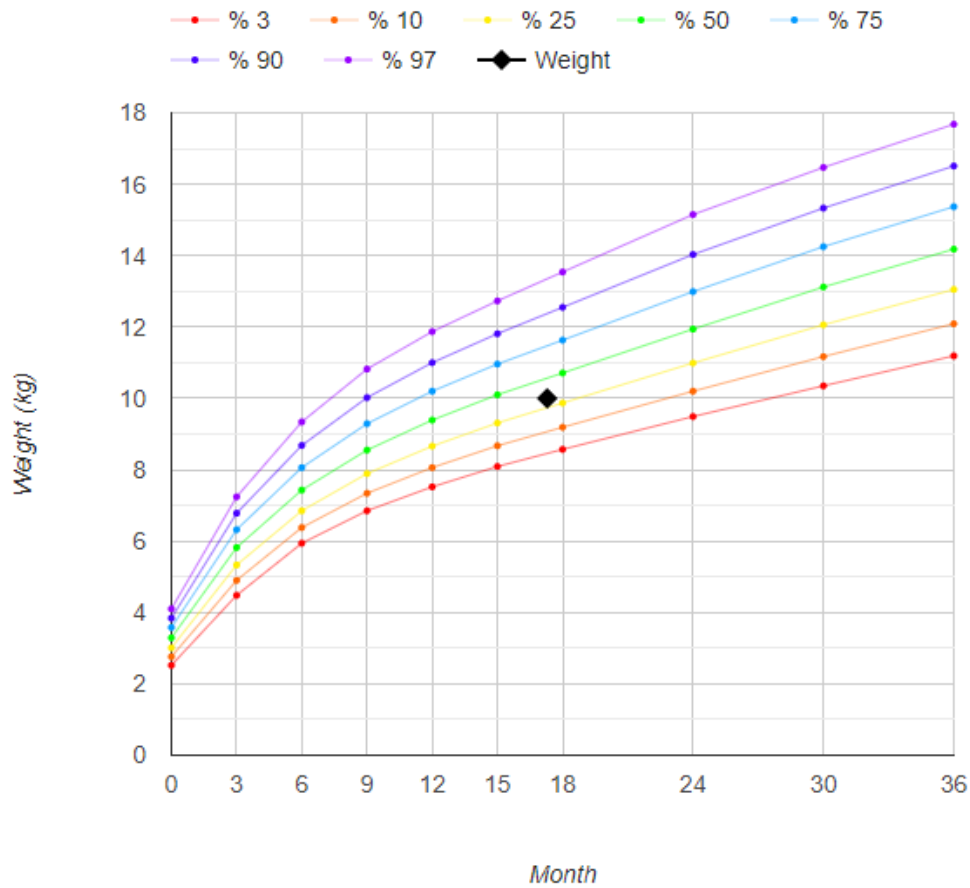
Figure 16: Growth Chart Example [71]

4.7 Parent Module (PaM)

PaM is used by parent users to enter personal information and necessary measurements of their child/adolescent taken weekly/twice a month. The entered data are required to keep track of the development and achievements of the pediatric patient. In addition to the measurements and personal information entrance, parents can also display the graph based analysis of development of their child/adolescent(s) through the development graphs. Moreover, the achievements, gained awards, assigned dietary or exercise suggestions of the child/adolescent(s) are displayed.

4.8 Child/Adolescent Module (ChM)

The ChM is used by child/adolescent patients which shows HE suggestions, awards, personal achievements and development etc. Moreover, ChM gathers information about whether activities assigned by the HE for the child/adolescent patients are performed or not by sending reminder notifications continuously. To sum up, the operations that can be carried out through ChM are (1) display own profile including personal information, (2) display current suggestions and suggestion history, (3) display development graphs, (4) display and receive awards, (5) display and respond to the reminder notifications. Providing the mentioned operations allow the pediatric patient user keep track of the progress and to be included in the treatment process more.

4.9 Inference Engine Module (IeM)

The IeM component is used to constitute the connection between OTO and the database. IeM, writes the necessary data to OTO, run the queries in the rule based expert system and reads the results. The gathered results are the inferred key metrics and the suggestions that should be proposed to the pediatric patient after inferring. IeM, is implemented in Java language since the communication between ontology and Java language is set up easier.

The entered clinical examinations are marked as uncalculated initially and when an edit operation occurs. The examinations are continuously checked by the IeM and the ones that are marked as uncalculated are transferred to the OTO. Instead of sending all clinical examinations only the uncalculated examinations are sent to decrease the complexity and processing time of the operation.

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After the rule base expert running is completed, the inferred data and suggestions are transferred back to the database by IeM. The steps of transferring inferred data from OTO to database are as follows: (1) necessary inferred DTPs of the processed clinical examination are read which include BMI, z-score metrics and percentile metrics etc., (2) necessary inferred OTPs of the processed clinical examination are read which include suggestions, (3) suggestions are OTPs which include the suggestion items as text held in DTPs. The DTPs of suggestions are read to obtain the suggestion items, (4) all read data is saved to the database.

The system then preprocess the database data if necessary and demonstrate to the users. Suggestions proposed by OTO are saved to the database as concatenated strings. Preprocessing step may include converting the concatenated strings to lists for easy demonstration to users.

Figure 17 represents the class diagram of the IeM classes. The get classes such as getClassesOfOTO or getDTPClass etc. are related with reading data from OTO. In addition to the get classes, the remove classes are related with removing data from OTO. The class that is used to run the SQWRL rules and infer the metrics is named as "runSQWRLRulesOfOTO". "OTOCalculationAgent" class is used as the IeM, performing the procedures explained.
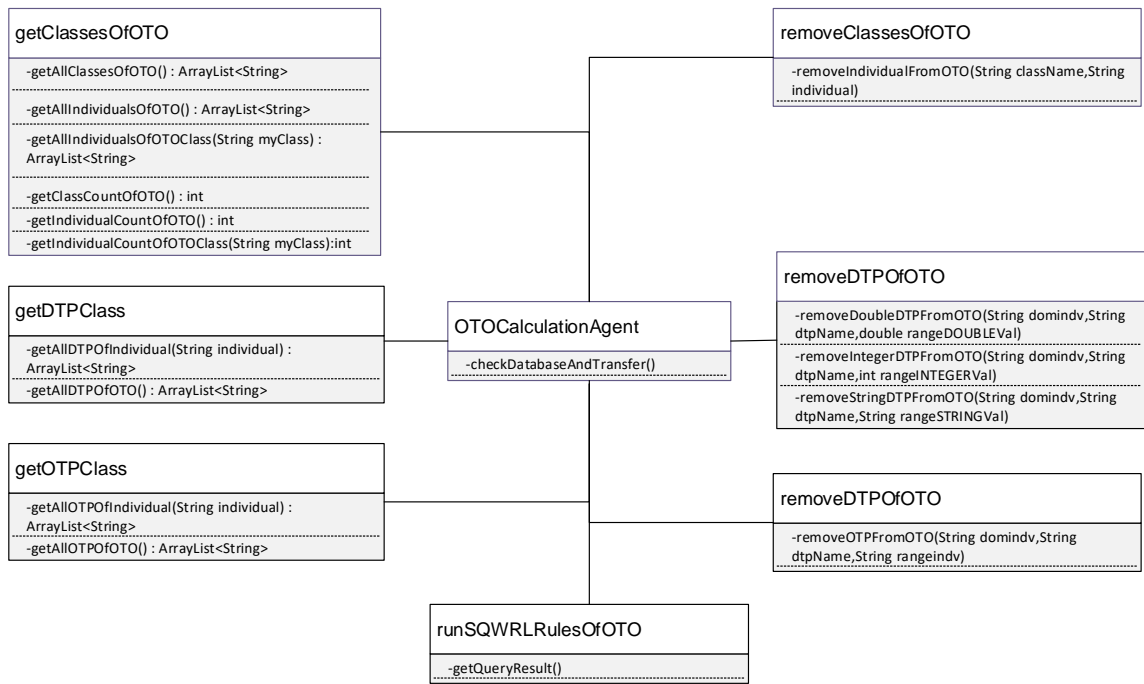
Figure 17: Classes of IeM

4.10 User Application

The user application is designed with an approach where it can be used in multiple platforms without being dependent to a specific platform or machine. This section includes the views of the designed application and detailed information about the views. In addition to the view information, the modules for different user groups are explained.

Each user group can observe different type of information and views. For instance, the admin user group can only see the system users and information about their profile. The rest of the information about patients such as clinical examinations, laboratory results etc. are not visible for admin user group. The child/adolescent user group can see their profile, development graphs, awards and suggestions using their module. Moreover, the parents see the profiles, development graphs, awards and suggestions for their each child/adolescent. The health experts have the most detailed

module to be able to see all necessary details of the pediatric patients needed for obesity treatment. The views of the modules are given below.

Figure 18, demonstrates the card that is used by the admin to register new users. Depending on the roles of the user to be registered, necessary information appears and is gathered by the admin to create the user.
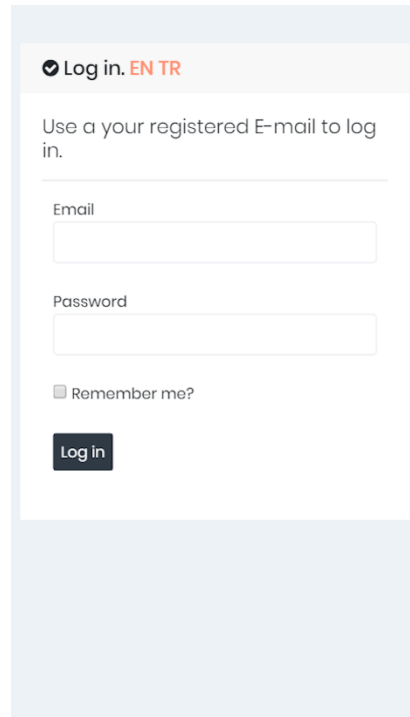
Figure 18: Register User View For Admin

Figure 19, represents the view that is used for logging in to the system. The registered users of the system log in to the system using this view. The users who are not registered, are registered to the system by the Admin.

Figure 19: Login View

After the user account is created by the admin, the user can login with the registered e-mail using the login view provided.

Figure 20 demonstrate the pediatric patient list for the HE module. The list is scrollable towards right to be able to see all the coloumns. The pagination property is implemented for the child list and at ach page only 10 patients are demonstrated. Only 6 of the patient records are demonstrated in Figure 20.

Figure 20: Pediatric Patient List Enlarged View HE Module

Figure 21, demonstrate the view that HEs used to enter and edit the pediatric patient. The pediatric patients can be registered to the system by the HEs, using this view.

Figure 21: Patient Addition View HE Module

The patient addition view include the personal information and other medical background infotmation of the patient necessary for the calculations and inferring

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mechanisms of the proposed system. Figure 22 show the views used by the HE to add the medical background of the family of the child.
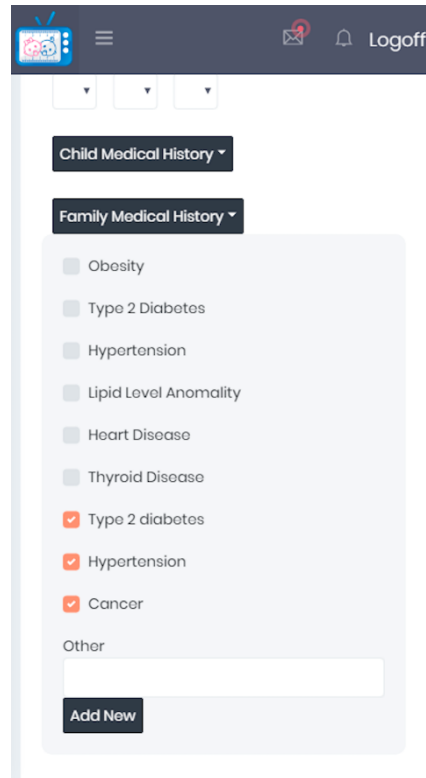
Figure 22: Family Medical Background Addition View HE Module

Figure 23 demonstrates the complete view used by HE for tracking the pediatric patient. In this view, the personal information, most recent puberty stage and testis volumes(for male patients), all of the diagnosis of the patient are displayed.

Figure 23: Patient Details Tracking View

The patient personal information can be edited using the "*Edit Information*" button. Furthermore, the patient file shown in this view can be sent to another HE for consultation using "*Ask For Consultation*" button. The consultation related messages sent by other health experts are displayed using the message icon found at the top right corner. The other notifications, for instance the notifications related with progress or reverse progress of a patient are displated using the bell icon found at the top right corner. Whenever a new message is received or there are unread messages, the pop up "You have new messages!" appears at the top right corner to remind the health expert. The same case applies for the other type of notifications too.

The consultations received from other health experts are viewed using the left menu option "*Consultations Pending Reply*", the ones waiting reply from other health experts are displayed using the option "*Consultations Waiting Reply From*".

All of the modules have the language changing capability. This can be done using the "EN|TR" button where a dropdown appears to choose the desired language. In the current version, only two languages are included as options. Figure 24, demonstrates the view used for editing pediatric patient information.

Figure 24: Edit Information of Pediatric Patient View

Figure 25 demonstrates one of the consultation handling screens for pending consultations. This view is similar to the pediatric patient list except, a new patient cannot be added using the consultation views. Instead, the existing patient files and all of their information can be displayed by clicking on the desired patient row.

Figure 25: Consultations Pending Reply View

The consultations appear in the message box of the HEs. The pop up screen that appears when the message icon is clicked is also demonstrated in Figure 25. The sender of the message, date of sending and some part of the message is displayed at the message list. The messages that are unread are shown with a slightly different background. For instance, the last message at Figure 25 is not read yet. Clicking on a specific message shows the details.

Figure 26, demonstrates the clinical examination list of the pediatric patient when the related menu option is used.

Clinical Examinations

Add Clinical Examination

Examination Date	Age	Puberty Stage	Considerations	
22/7/2019 – 00:00	1	Tanner 5	Dikkat 1	Examination Details
8/11/2019 – 20:50	1.3	Tanner 5		Examination Details
29/1/2020 – 12:29	1.52	Tanner 1	consider	Examination Details

Figure 26: Clinical Examinations Of Pedric Patient

The clinical examinations of the pediatric patient are entered and tracked using the "Clinical Examinations" menu option. The date of examination, decimal age,puberty stage of the patient at the date of examination and considerations can be directly displayed at the initial table. Further details are examined using the "Examination Details" button. Figure 27 and 28 demonstrate the view that is used to add a new or edit an existing clinical examination information.

Clinical Examination
22/7/2019 - 00:00

Weight (kg)

10

Height (cm)

85

Head Circumference
(cm)

25

Waist Circumference
(cm)

34

Examination Details

Puberty Examination

Figure 27: Add/Edit Clinical Examination View (1)

Figure 28: Add/Edit Clinical Examination View (2)

Figure 29 demonstrates the clinical examination details view where all of the calculated values are displayed. In addition to the calculated values, laboratory results can also be displayed and added using the "Laboratory Results" button.

Clinical Examination Information

Edit Examination Information   Laboratory Results   Delete Clinical Examination

Clinical Examination Date	22/7/2019 - 00:00		
Decimal Age	1		
Puberty Stage	Tanner 5		
Testis Volume(ml) (Left)	In inguinal canal	**Testis Volume(ml) (Right)**	In inguinal canal
Weight (kg)	10		
Weight ZScore	-0.156		
Weight Percentile (%)	43.64		
Height (cm)	85		
Height ZScore	2.508		
Height Percentile (%)	99.4		
Head Circumference (cm)	25		
Head Circumference ZScore	-15.136		
Head Circumference Percentile (%)	0		
Waist Circumference (cm)	34		
Waist Circumference ZScore	-3.881		
Waist Circumference Percentile (%)	0		
BMI (kg/m2))	13.84		
BMI ZScore)	-2.506		
BMI Percentile (%))	0.6		

Figure 29: Examination Details

The HEs, enter laboratory result of the patients using the add laboratory result view demonstrated in Figure 30. Result date, test type, test and result are entered for laboratory result tracking.

Figure 30: Add Laboratory Result View

Figure 31 demonstrate all of the menu options available for the HEs in the proposed system for obesity management of the pediatric patients. The menu options to display relevant information are given as "*Clinical Examinations*", "*Auxology Monitoring*", "*Home Examinations*", "*Dietician Suggestions*", "*Exercise Suggestions*", "*Awards*", "*Treatments*", "*Laboratory*" and "*Summary*".
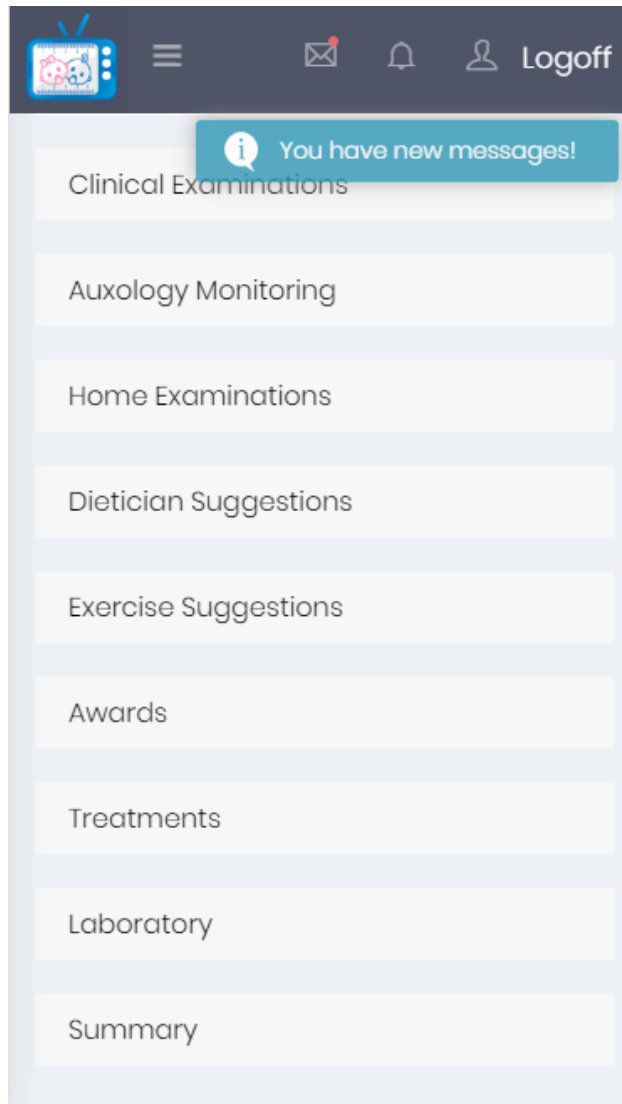
Figure 31: Menu Options For Patient Tracking

The next menu option to be considered is "*Auxology Monitoring*" where the development graphs of the pediatric patient are given with respect to the reference percentile curves which are 3%, 10%, 25%, 50%, 75%, 90%, 97%. The clinical examination measurements of the pediatric patients are plotted with the percentile curves to inspect the development and progress of the patient. The patient curve determines which percentile the patient is closer to.

Figure 32 demontstrates the view used by HE for auxology monitoring graphs of the pediatric patients. The graphs are dynamically created considering the age,gender and measurements of the tracked pediatric patient. The reason for this is that, the percentile curves differ with age and gender. The curves for age 0-2 are different than the curves for 2-18. The auxology monitoring can be inspected using two forms. The values can either be shown as tables (Figure 32) or graphs (Figure 33).

Dec. Age	Pub. Stage	Height	Height Z.	Height(%)	Weight	Weight Z.	Weight(%)	BMI	BMI Z.	BMI(%)	Waist Circ.	Waist Circ. Z.	Waist Circ.(%)	Head Circ.	Head Circ. Z.	Head Circ.(%)
1	Tanner 5	85	2.51	99.40	10	-0.16	43.64	13.84	-2.51	0.60	34	-3.88	0.00	25	-15.14	0.00
1.3	Tanner 5	172	26.56	99.98	63	14.42	99.98	21.30	2.49	99.36	7	-44.68	0.00	10	-25.53	0.00

Figure 32: Auxology Monitoring Table View
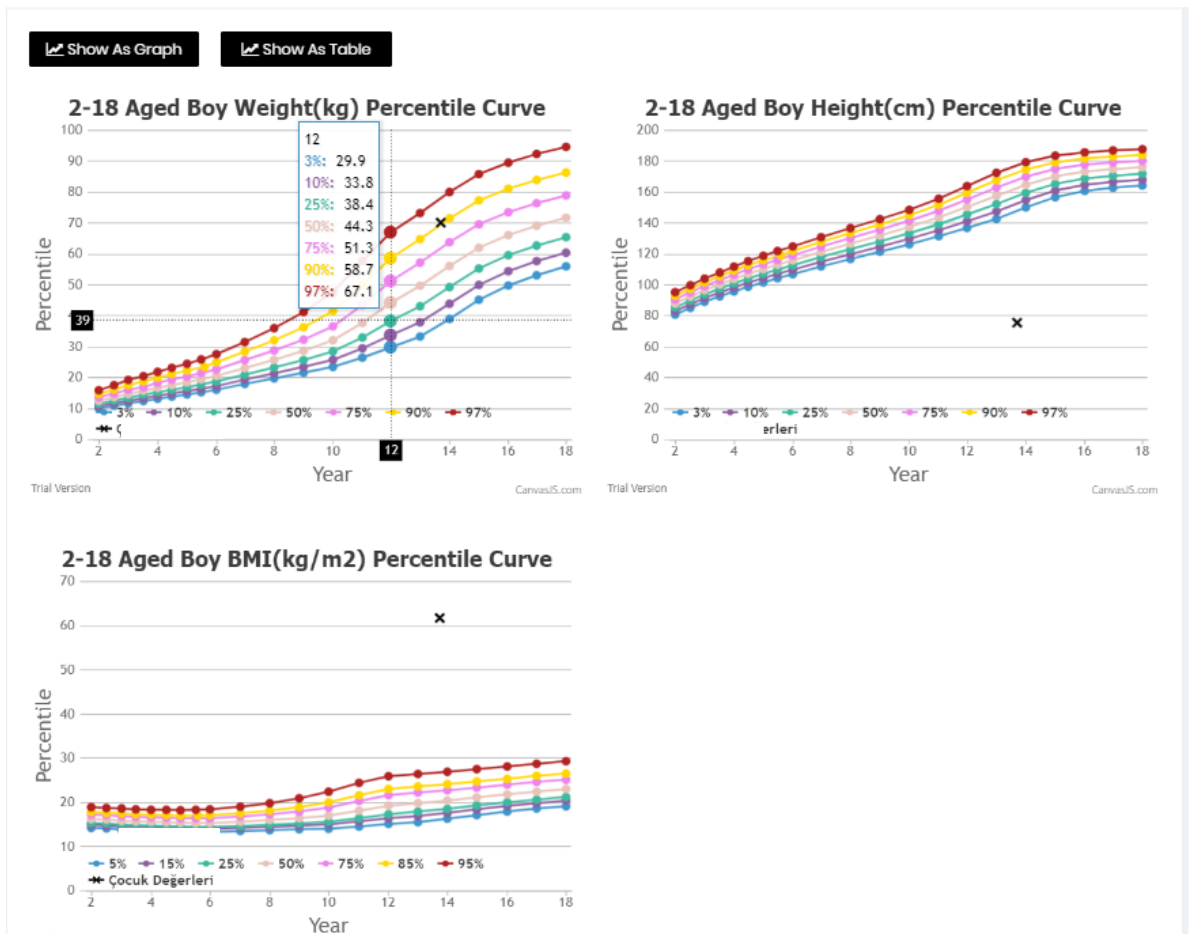
Figure 33: Auxology Monitoring Graph View

Next menu option is "*Home Examinations*". Home examinations correspond to the measurements entered by parents of the registered pediatric patients. The view of home examinations are similar to the clinical examinations view except only weight, height, HC and WC measurements can be entered by the parents.

"*Dietician Suggestions*" menu option is used by the HEs to examine the suggestions proposed by the system for the pediatric patient and decide on the appropriate ones. If required, a completely new suggestion can also be created by the HE. In addition to this, the suggestion history of the pediatric patient can also be viewed using this menu option. Figure 34 demonstrates the dietician suggestions view for a particular patient. The dietician suggestions are proposed by the system using the inferred metrics of the patient.

Dietician Suggestions

↻ Suggestion History

System Suggestions

Suggestions below, are standard suggestions proposed by the system considering the situation of the pediatric patient. (Please choose the appropriate suggestion(s) for the pediatric patient)

☐ Choose All

☐ Daily approx. 1.5 portion protein, 265 – 350 g fruits, 365 – 640g vegetables, 140 – 255g grains, 3 portion diary, 2100 ml liquid

☐ Reduce amount of oil put in food

☑ Eat healthy snacks at predetermined intervals between meals

☑ Eat three meals every day

☐ Consume water instead of juice

☑ Consume more vegetables/fruits per day (2 cups for 2 years old 4.5 cups for 17-18 years old)

☐ Watch TV / use computer max 2 hours a day

☐ Decrease carbohydrate consumption(1 slice of bread each meal)

☐ Decrease consuming sweetened food like chocolate, soda,cola

☐ Decrease number of consuming food from outside(max. once in two weeks)

☐ Be active 60 minutes a day

⊕ Add Suggestion   ⋯ All Suggestions   ✔ Choose

The HE, decides on and selects the suggestions to be sent to the patient. The selected

suggestions are then listed for the HE, for confirmation, using the dietician

suggestion view shown in Figure 35.
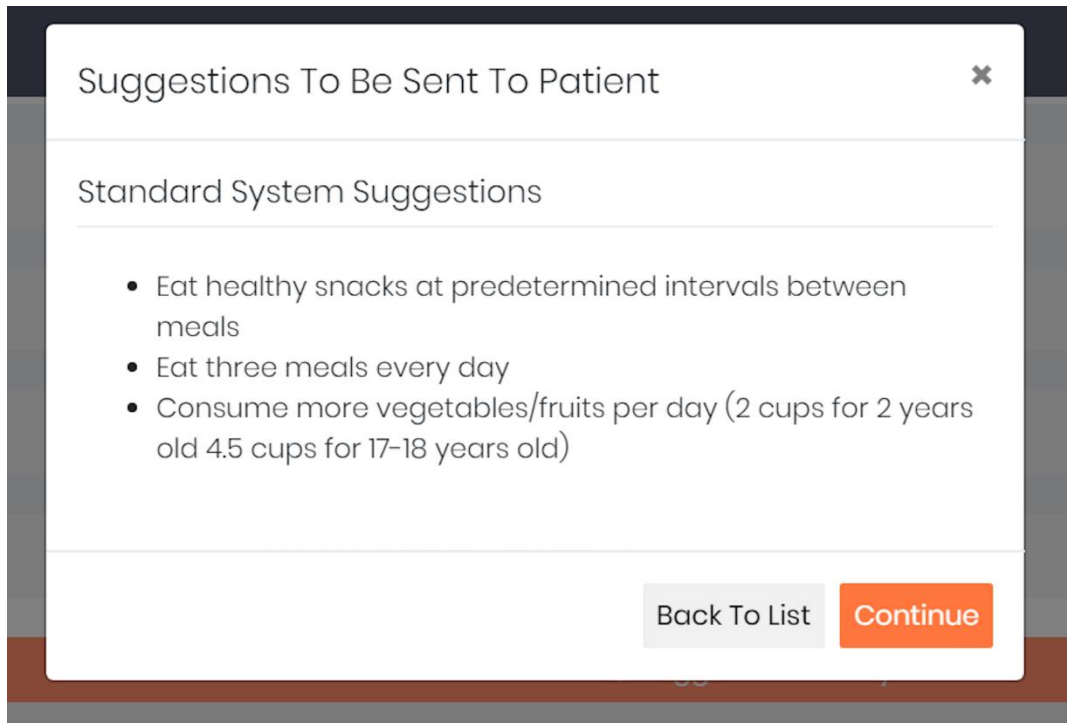
Figure 35: Send Dietician Suggestion View

If another suggestions are added by HE and are also selected, these will also appear below the standart system suggestions. The HE, then either confirms the demonstrated list or checks the suggestion list again for adding further suggestions to be sent. Exercise suggestions are also added and sent to the patient using the same approach.

Figure 36 demonstrates the view for adding and assigning exercise suggestions for the related patient. The exercise suggestion is entered to the "Exercise Suggestion" text box and the "Add" button is clicked to move the exercise suggestion to the sending list.
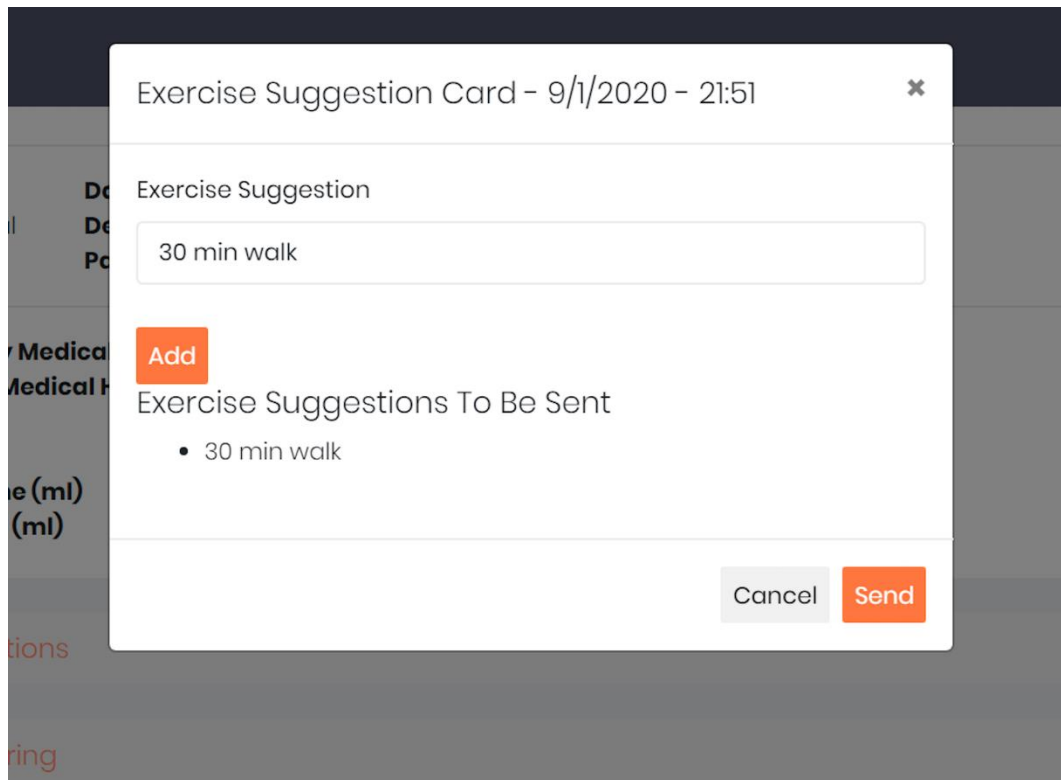
Figure 36: Send Exercise Suggestions View

The menu options "*Awards*" , "*Treatments*", "*Laboratory*" and "*Summary*" are used to track the information entered previously. This means that, no new information is being entered using these menu options. The entered information are displayed by HE. "*Awards*" option is used to display four types of awards gained by the pediatric patients. These awards are assigned to the patient automatically by the system considering the entered information. Figure 37, shows the awards view.

Figure 37: Awards View

"*Treatments*" are entered by the HE, during the clinical examinations. These are summarized in this menu option. Figure 38, represents the treatment summary view listed for HE, when the related menu option is chosen.

Figure 38: Treatments View

Figure 39 demonstrates the "*Laboratory*" menu option view. The tests that have been entered in the clinical examinations of the patient are summarized here. Even though a test may be carried out multiple times, unique names are taken.

Figure 39: Laboratory View

The results and the result dates are either displayed as table using the table icon or graph using the graph icon. Figure 40 demonstrates a sample graph for a sample test for a patient. The graph is produced monthly because the test was carried out each month, however in the table exact dates and values are given. Graphs are only used to see the overall flow of test values.

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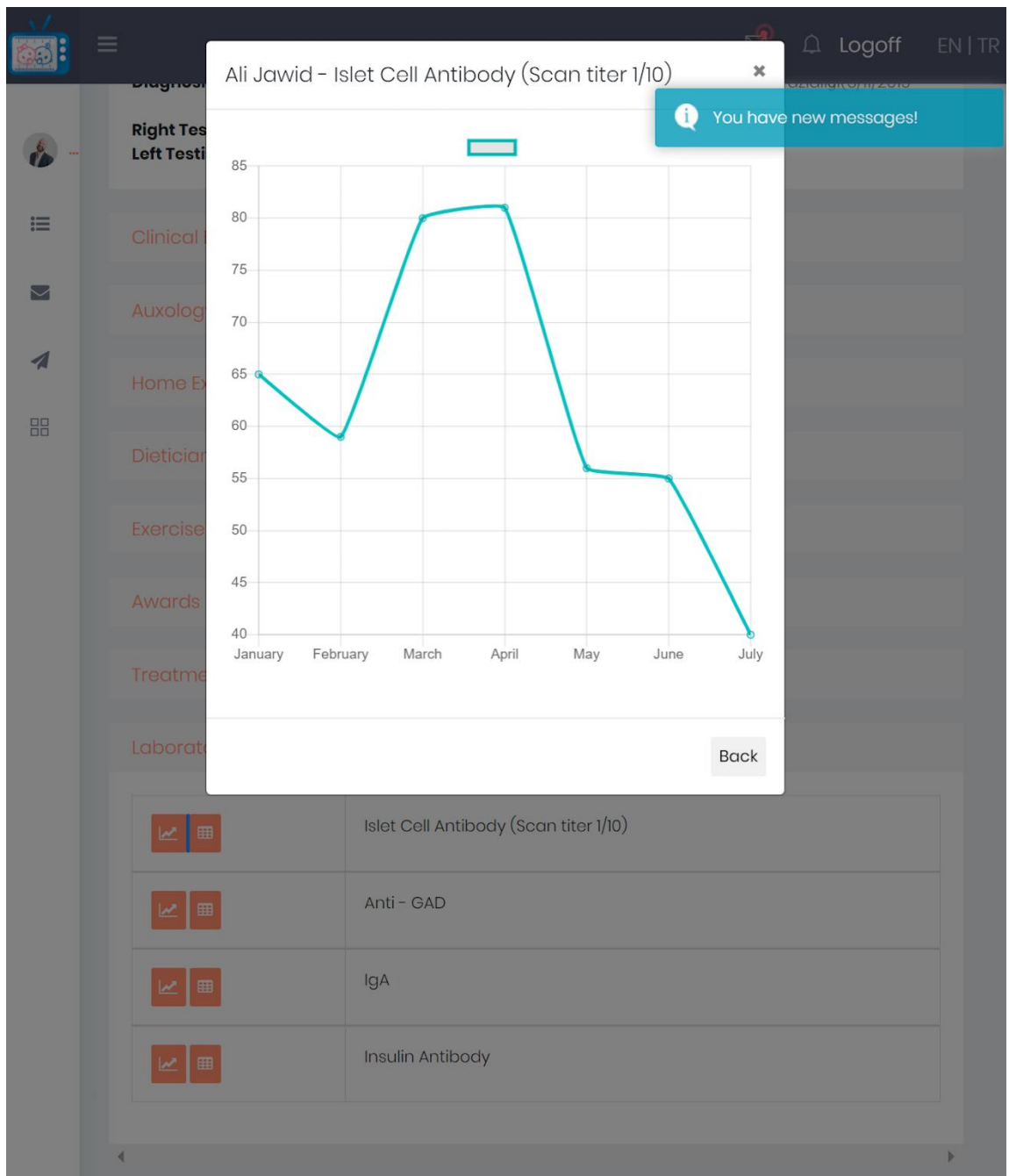
Figure 40: Laboratory Result Graph View

The "*Summary*" option view is demonstrated in Figure 41. The summary interval is selected from the options weekly, monthly, 3 mont, 4 month, 6 month and yearly. The clinical examination dates are considered and the ones that fall into the chosen interval are brought as summary. Summary can be viewed as table or each metric values can be viewed as graphs.

Summary

| 4 Month ▼ | Show As Graph | Show As Table |

Date	Height	Weight	Head Circ.	Waist Circ.	BMI	Height(%)	Weight(%)	Head Circ.(%)	Waist Circ.(%)	BMI(%)
06/11/2019 00:28:28	0	0	0	0	0	0	0	0	0	0
06/11/2019 10:19:48	172	20.2	50	50	6.83	99.98	99.98	91.62	0	0.01
08/11/2019 20:50:50	172	63	10	7	21.3	99.98	99.98	0	0	99.36
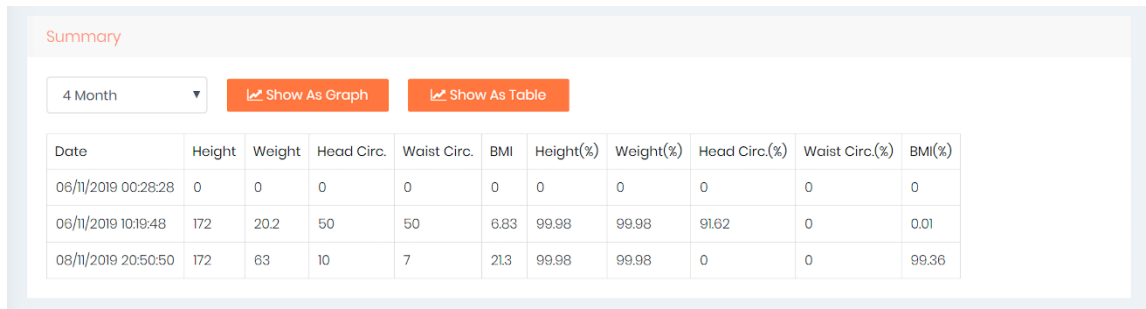
Figure 41: Summary View

Chapter 5

EXPERIMENTAL RESULTS

The proposed system is exposed to 80 pediatric patients where data were retrospectively collected by scanning the patient files with the pediatrics experts. The data gathered were entered to the system and the system is tested and evaluated in terms of the calculations performed and suggestions provided. The calculation results are checked against the results provided in CeddCozum website created by Turkish Pediatric Endocrinology and Diabetes Society [71] and the calculation results provided by the pediatrics expert. In addition to the calculation results, the suggestions provided by the system are checked if they are logical and in line with the suggestions that would be provided by the health expert.

5.1 CeddCozum Calculation Comparisons

The calculation comparisons are summarized in Appendix C. The pediatric patient personal information and measurements necessary for the calculations are given at the "*Pediatric Patient Info*" column. The results either provided by the CeddCozum or pediatric experts are given in the column named "*CeddCozum Result*" and the calculation results provided by the system are given in the column named "*System Result*". The metric values calculated by both systems are compared correct to 2 decimal places.

Graphs are produced by considering the results obtained from the system and the results obtained from CeddCozum. The line graph with cross marker (X) demonstrate the results obtained from the proposed system. The line graph with

diamond marker demonstrate the results obtained from CeddCozum. As it can clearly be seen, nearly all of the values are aligned and equal meaning that the system accuracy is high. Several statistical techniques are used to compare these values and determine the reliability of the proposed system. Each point in the line graphs corresponds to a pediatric patient. Figure 42 to 48 represent the line graphs for value comparisons for the inferred metrics.
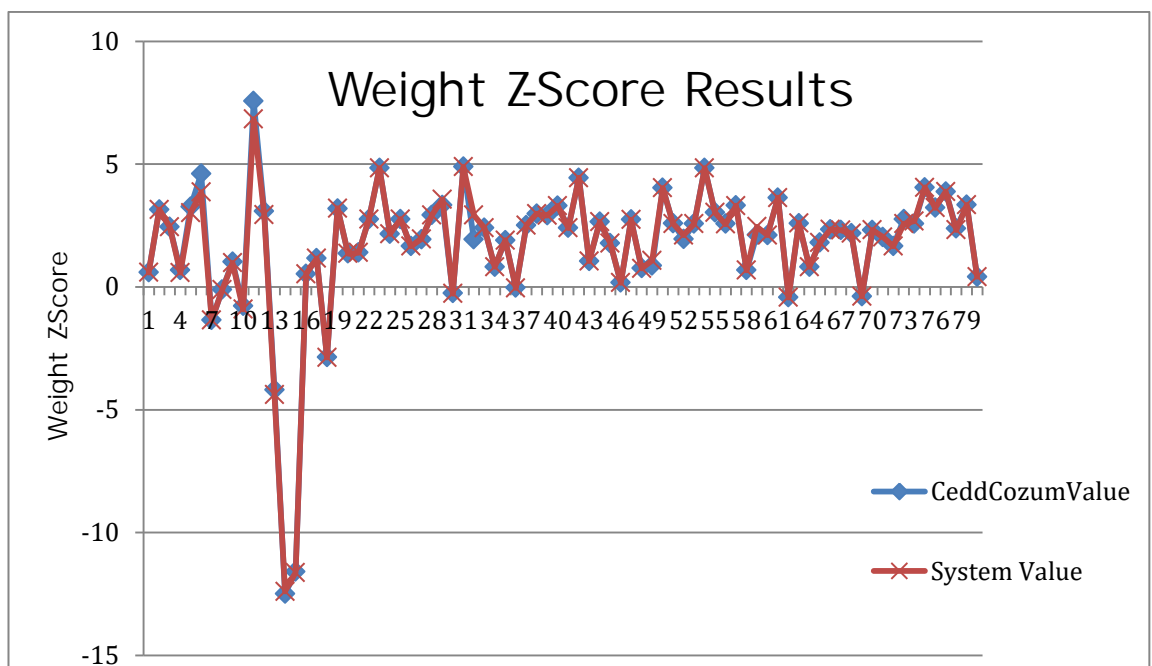
Figure 42: Weight Z-Score Comparison
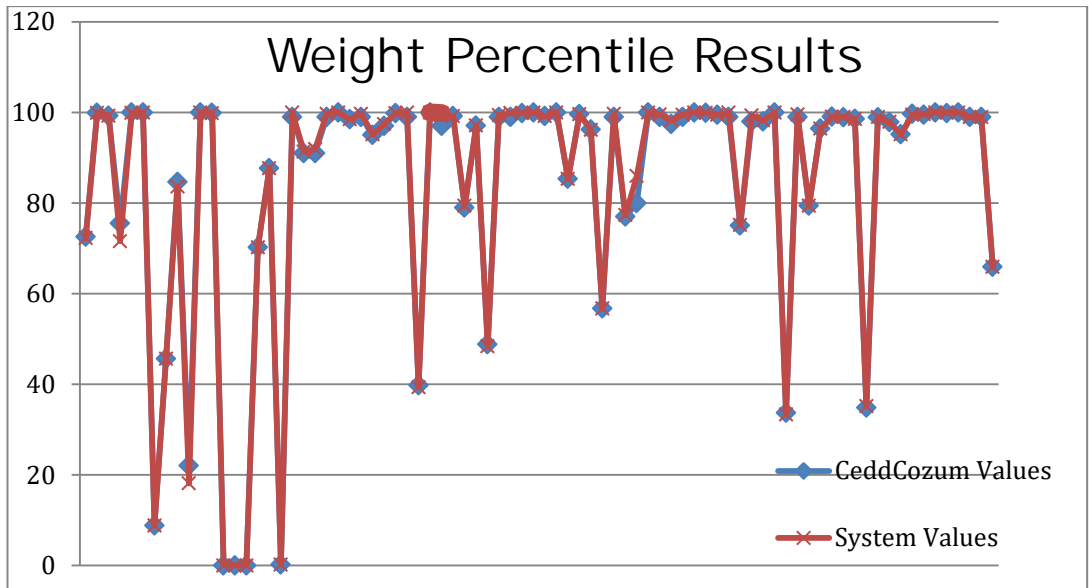
Figure 43: Weight Percentile Comparison
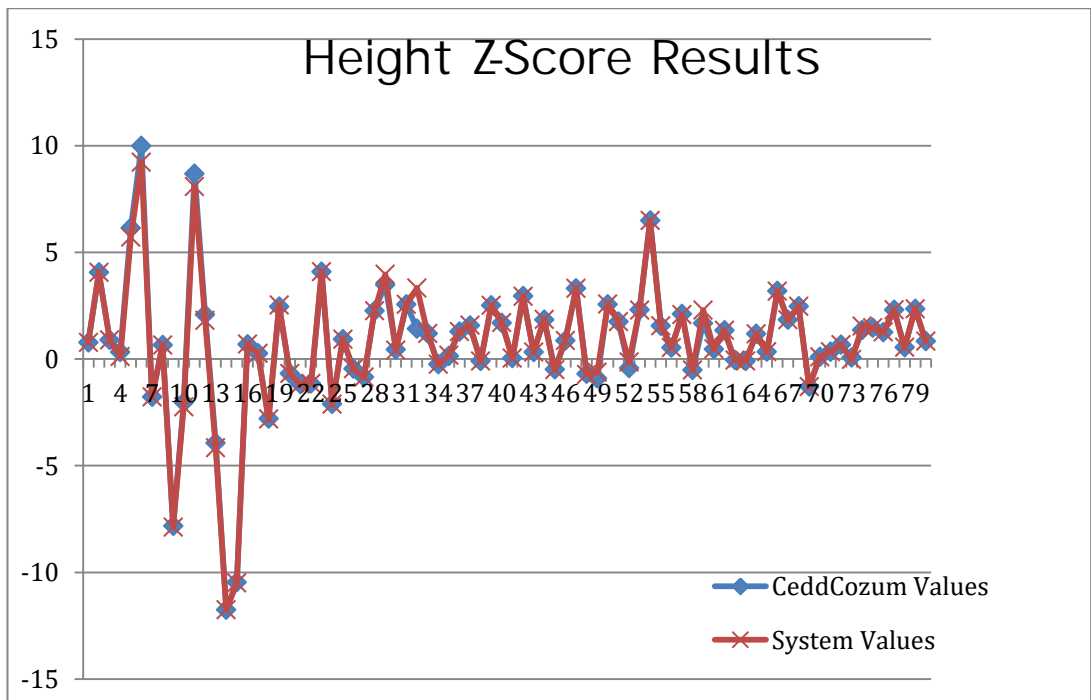
Figure 44: Height Z-Score Comparison
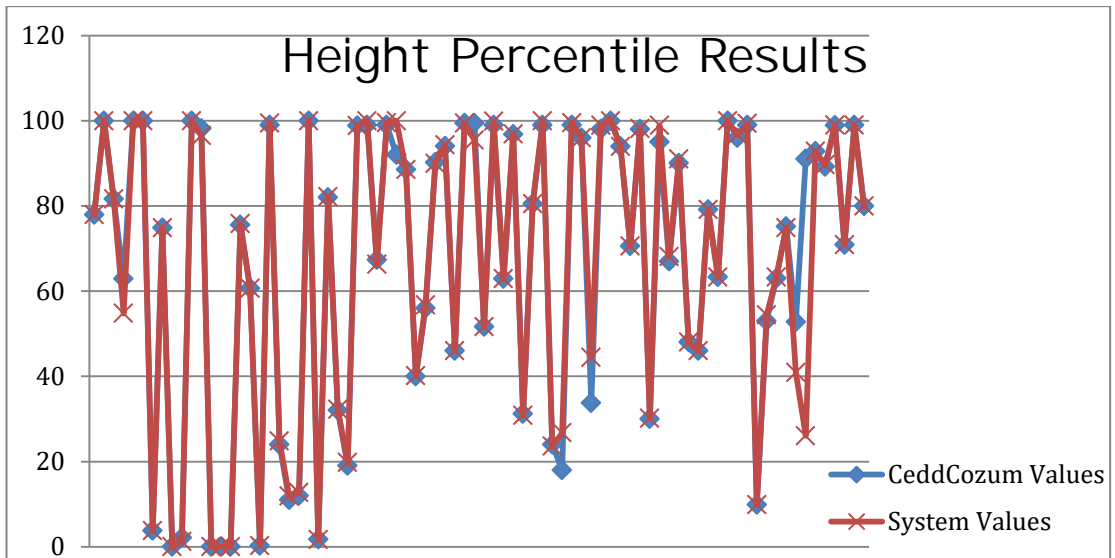
Figure 45: Height Percentile Comparison
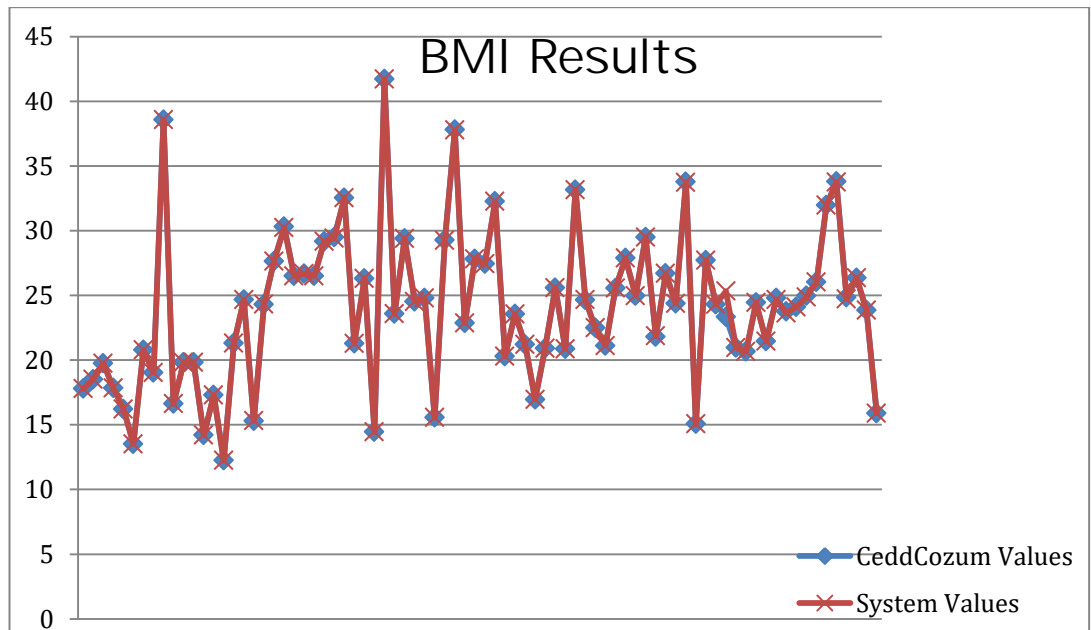
Figure 46: BMI Comparison
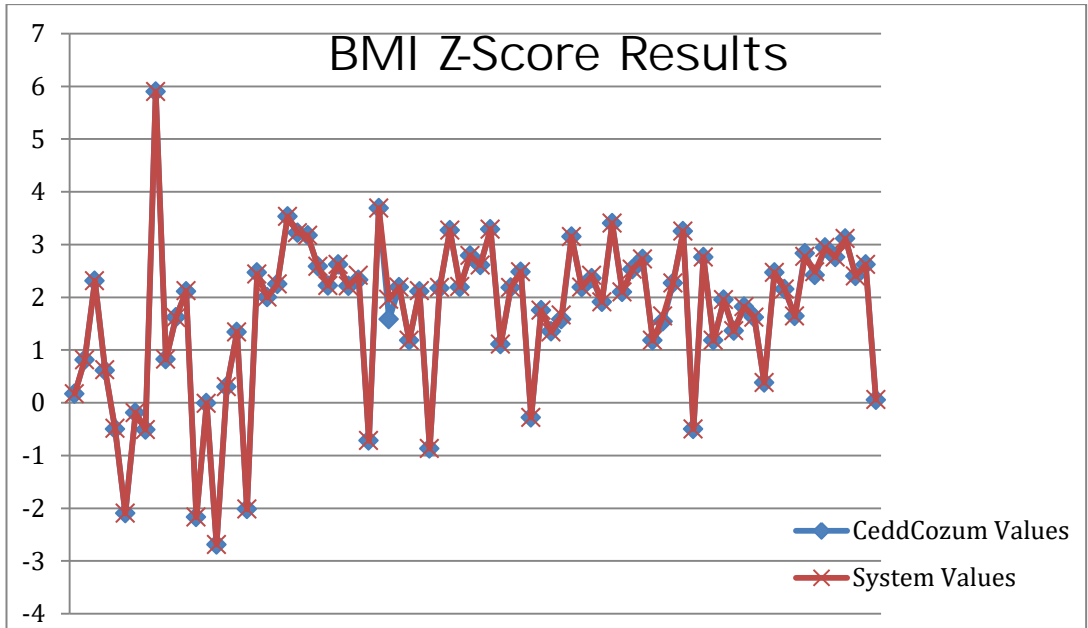
Figure 47: BMI Z-Score Comparison
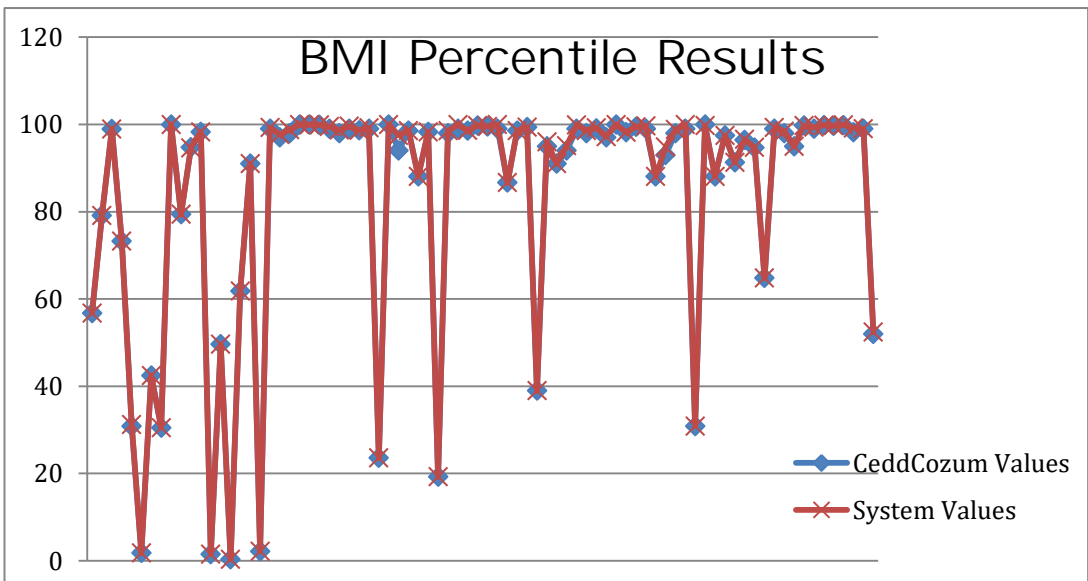
Figure 48: BMI Percentile Comparison

It can be observed that, some of the results slightly differ. The reason for the differences is that, the L, M, S values for the decimal ages that are not included in the reference values provided (Neyzi et al., 2015) are calculated as approximates using statistical and mathematical approximation methods. Estimating the L, M,S values can cause inspection of slight differences in metric percentiles produced by the expert system ontology, for some cases.

The accuracy of the system are calculated for all of the metrics by considering them as units. There are no true negatives in the system yielding the equation for *accuracy$_x$* [72] given as:

$$=??QN=\mathfrak{U}_{\varepsilon}\ L\ \frac{\hat{\Phi}\qquad\hat{\Phi}\qquad Ñ:\mathring{a}\ è Ø\ddot{\Phi}}{\hat{\Phi}\qquad\tilde{\delta}\qquad\grave{u}\ Ñ}\ :H\ srr \tag{8}$$

"X" corresponds to each metric calculated by the proposed system. Weight, height, BMI, weight z-score, height z-score, BMI z-score, weight percentile, height percentile and BMI percentile are the most important metrics for pediatric obesity tracking [3]. Due to this reason, the accuracy calculations for these metrics are considered and calculated to evaluate the proposed system.

For calculating the metric accuracy, the acceptable interval is ±0.1 for z-scores. This is the interval between each number found in the NDT. This means that the comparisons are done correct to one decimal places.

The accuracies are calculated for z-scores only because percentiles are determined by using the z-scores. This means that the accuracies for z-scores and percentiles are aligned and can be accepted as equal. Equations used for all metric accuracy calculations [72] and the results of the system are given as:

$$\text{...} \quad U \quad \text{...} \quad = \frac{\text{...}}{\text{...}} \times 100 \tag{9}$$

$$= \text{...} \times \frac{y\,y}{z\,r} \times 100 = \{x\ddot{a}w\}$$

$$= \text{...} \times \{x\ddot{a}w\}$$

$$= \text{...} \times \frac{\text{...}}{\text{...}} \times 100 \tag{10}$$

$$= ??QN= U \quad = \frac{yu}{zr} \times 100 = \{\ddot{a}w\}$$

$$= ??QN= U \quad = \{\ddot{a}w\}$$

$$= ??QN= U \quad = \frac{\text{...}}{\text{...}} \times 100 \tag{11}$$

$$= ??QN= U_{nyu} \quad = \frac{yx}{zr} \times 100 = \{w\}$$

$$= ??QN= U \quad = \frac{\text{...}}{\text{...}} \times 100 \tag{12}$$

$$= ??QN= U_{nyu} \quad = \frac{y\{}{zr} \times 100 = \{\ddot{a}yw\}$$

$$= ??QN= U_{nyu} \quad = \frac{y\{}{zr} \times 100 = \{\ddot{a}yw\}$$

In addition to the accuracy calculations, the differences between the values calculated in CeddCozum and the proposed system are analyzed. The mean numbers of weight, height and BMI percentiles and SDS values were compared in terms of Ceddcozum and newly designed system. There was no statistically significant difference between the systems in terms of weight, height and BMI percentiles and SDS values as demonstrated in Table 9.

The Statistical Package for Social Sciences Software [74] was used for data analysis. All continuous variables were expressed as the mean, standard deviation, maximum and minimum values. A paired t-test is used to compare two different methods of measurement where the measurements were applied to the same subjects.

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Statistical significance was defined as $p < 0.05$. The results of the analysis are summarized in Table 9.

Table 9: Comparison of weight, height and BMI percentiles and SDS values between systems

		Ceddcozum Mean±SD	Newly Designed System Mean±SD	p value
Weight	%	84.6±25.7	84.5±25.8	0.31
	SDS	1.88±1.66	1.85±1.65	0.23
Height	%	66.7±32.3	66.3±32.3	0.27
	SDS	0.86±1.7	0.85±1.7	0.25
BMI	%	84.0±26.8	85.2±25.5	0.29
	SDS	1.7±1.3	1.7±1.3	0.41

5.2 Suggestion Comparisons

The suggestions proposed by the system for the pediatric patients that are used as case studies in the system are given in . For most of the patients the suggestion set that is proposed is "*SG0_02_GEN, SG1_01_EAT, SG1_02_EAT, SG1_03_EAT, SG1_04_EAT, SG1_05_EAT, SG1_06_PHY, SG1_07_PHY*". The reason for this is that, most of the patients belong to the obese and overweight group and Stage 1 suggestions are proposed by the system for such patients. In addition to the Stage 1 suggestions, *SG0_02_GEN* suggestion is proposed. This is related with the high risk of obesity confirming the high BMI percentiles the related patients possess. The suggestions proposed by the system and the suggestions proposed by the HE for the pediatric patients whose files were retrospectively scanned, are given in Appendix D. In some cases, the system suggests some suggestions that are not suggested by the HE and in some cases vice versa.

The suggestions that are proposed by both the system and the HE are defined as the True Positives(TP) of the system. In addition to this, the suggestions proposed by the system but are not proposed by the HE are defined as False Positives(FP) of the system. The suggestions that are not proposed by the system and are not actually suitable for the pediatric patient are the True Negatives (TN) of the proposed system. Furthermore, the suggestions that are not proposed for the pediatric patient but actually should have been proposed are the False Negatives(FN) of the system. Considering these metrics, the accuracy, precision and recall of the system are calculated with the given formulas [75]:

$$=???QN=L\!\!\!/_{b} \qquad L \ \frac{É \ >Ç}{É \ >Ç \ >É \ >Ç} \tag{13}$$

$$=???QN=L\!\!\!/_{b} \qquad L \ \frac{;59 \ >:655}{;59 \ >:655 \ >78><} $$

$$=???QN=L\!\!\!/_{bM} \qquad L \ \frac{;59 \ >:655}{;59 \ >:655 \ >78><} L \ r \ ä\!\!/ \quad L \ \{ \ ä\ddot{v} $$

$$LNA?EOEKJ_{b} \qquad L \ \frac{É}{É \ >É} \tag{14}$$

$$LNA\!\!\!/_{b} \qquad L \ \frac{ysw}{ysw \ E \ uv} L \ r \ ä\!\!/wv \quad L \ \{v \ ä\ddot{v} $$

$$NA?=HH_{b} \qquad L \ \frac{É}{É \ >Ç} \tag{15}$$

$$NA?=HH_{b} \qquad L \ \frac{:59}{;59 \ ><} L \ r \ ä\!\!/\{ \quad L \ \{ \ ä\{ $$

The metric accuracy$_{suggestions}$ determines how accurate the system is meaning how accurately the suggestions are proposed. Precision metric is related with to what extend the proposed system defines correct suggestions for the pediatric patients. In addition to precision and accuracy, recall is defined as the specificity of the system [75]. In other words, relevantly proposed suggestions affect the metric recall. It can

be observed that for 80 patients, the system has made 749 suggestions. From these 749 suggestions, 34 of them are classified as unnecessary by the HE and are not suggested. In addition to the suggested suggestions, 8 suggestions are suggested additionally for the pediatric patients. 6211 suggestions are not suggested and are not valid meaning that the FN for the system is 6211 for 80 patients.

Considering the precision and recall of the proposed system, it can be said that 95.4% of the suggestions proposed are correct for the pediatric patients considered, and considering the suggestions that should have been proposed, 98.9% of them are assigned by the system.

Chapter 6

CONCLUSION

From the beginning of the childhood and adolescence, obesity causes other health problems to emerge such as Type 2 diabetes, certain types of cancer, high blood pressure, heart diseases, sleep apnea, etc. in the long run. Early detection of obesity during childhood and adolescence is crucial to start individual-based treatments at an early stage like other health problems. In our daily life, due to the widespread use of intelligent mobile devices and increment in the number of m-Health apps to struggle against diseases, m-Health technology can be a good choice to manage obesity for individuals. However, major number of recent mobile-based obesity tracking systems are being developed for adults. The paper discusses an ontology based mobile obesity consultation and tracking system which is a rule-based healthcare expert system for child and adolescence patients. Proposed system provides remote consultation and monitoring of child and adolescent patients during their treatments of obesity management. The system does not only share instant gathered medical data to a physician but also examines the data as a smart medical assistant. It infers instant proper suggestions via its inference engine to perform certain supportive suggestions and physical activities as treatment steps when necessary. The main contributions of the proposed are (1) Obesity Tracking Ontology, (2) Semantic Web Rule Knowledge base and (3) Inference Engine.

OTO is formalized in OWL and implemented as a system ontology. In addition, SQWRL rules is formalized in SWRL and stored in the OTO. In the rule knowledge base, 22 rules are referred as semantic-based medical rules are developed by cooperating with pediatric experts and ontology engineers. Rules hold several dietary habit suggestions, supportive physical activities that can be applied at home, crucial inferred metrics in obesity management (i.e. Body Mass Index (BMI), BMI z-score, Height z-score, Weight z-score, HC z-score, WC z-score, BMI percentile, Height Perce percentile, Weight percentile, HC percentile, WC percentile) calculated using key metrics (i.e. date of birth, height, weight, HC, WC and gender). The rules examine the key metrics and medical profile gathered from patients such as age, height, weight, WC, height circumference in addition to patient's age, gender, parent information, genetic background and so forth. The system has its own modules that provides and guides how to gather the medical data before suggesting several dietary habits and supportive physical activities to its users through its inference engine. The system is expected to be useful for patients and all other people who worked as pediatric healthcare professional or researching in this area.

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APPENDICES

Appendix A: Suggestion Types

#	Stage	Type	Code	Stage Description	Gender	Age Interval - Condition	Suggestion Description
1	0	DS	SG0$^{(*)}$_01_DEV$^{(a)}$	Prevention Councelling	Male & Female	0-2 years BMI Percentile =1	Very poor development! You should consult to expert immediately.
2	0	DS	SG0_02_DEV	Prevention Councelling	Male & Female	0-2 years 1 < BMI Percentile ≤ 5	Poor development! You should consult to expert immediately.
3	0	DS	SG0_03_DEV	Prevention Councelling	Male & Female	0-2 years 5 < BMI Percentile ≤ 15	Slightly poor development. Consult to the expert for help.
4	0	DS	SG0_04_DEV	Prevention Councelling	Male & Female	0-2 years 16 ≤ BMI Percentile ≤ 84	The child development is as expected.
5	0	DS	SG0_05_DEV	Prevention Councelling	Male & Female	2-18 years 16 ≤ BMI Percentile ≤ 84	The child/adolescent development/form is good, keep it, and follow the general health recommendations to protect it. (Suggestion number 61-70)
6	0	DS	SG0_06_DEV	Prevention Councelling	Male & Female	0-2 years 85 < BMI Percentile ≤ 100	Development more than expected. You must consult to the expert.
7	0	IS	SG0_07_INT$^{(b)}$_F$^{(c)}$	Prevention Councelling	Female	0-1 months (15 ≤ BMI Percentile ≤ 84)	Daily approx. 445 kilocalories(kcal) / 1860 kilojoules(kj) , 100-190 ml per kg liquid (met by breast milk)
8	0	IS	SG0_07_INT_M$^{(d)}$	Prevention	Male	0-1 months	Daily approx. 470 kcal / 1965 kj, 100-190 ml per kg

				Councelling		(15≤ BMI Percentile ≤ 84)	liquid (met by breast milk)
9	0	IS	SG0_08_INT_F	Prevention Councelling	Female	1-2 months (15≤ BMI Percentile ≤ 84)	Daily approx. 505 kcal /2115 kj , 100-190 ml per kg liquid (met by breast milk)
10	0	IS	SG0_08_INT_M	Prevention Councelling	Male	1-2 months (15≤ BMI Percentile ≤ 84)	Daily approx. 550 kcal / 2300 kj , 100-190 ml per kg liquid (met by breast milk)
11	0	IS	SG0_09_INT_F	Prevention Councelling	Female	2-3 months (15≤ BMI Percentile ≤ 84)	Daily approx. 545 kcal / 2280 kj , 100-190 ml per kg liquid (met by breast milk)
12	0	IS	SG0_09_INT_M	Prevention Councelling	Male	2-3 months (15≤ BMI Percentile ≤ 84)	Daily approx. 610 kcal / 2550 kj , 100-190 ml per kg liquid (met by breast milk)
13	0	IS	SG0_10_INT_F	Prevention Councelling	Female	3-4 months(15≤ BMI Percentile ≤ 84)	Daily approx. 590 kcal / 2470 kj , 100-190 ml per kg liquid (met by breast milk)

14	0	IS	SG0_10_INT_M	Prevention Councelling	Male	3-4 months (15≤ BMI Percentile ≤ 84)	Daily approx. 655 kcal / 2740 kj , 100-190 ml per kg liquid (met by breast milk)
15	0	IS	SG0_11_INT_F	Prevention Councelling	Female	4-5 months (15≤ BMI Percentile ≤ 84)	Daily approx. 630 kcal / 2635 kj , 100-190 ml per kg liquid (met by breast milk)
16	0	IS	SG0_11_INT_M	Prevention Councelling	Male	4-5 months (15≤ BMI Percentile ≤ 84)	Daily approx. 695 kcal / 2910 kj, 100-190 ml per kg liquid (met by breast milk)
17	0	IS	SG0_12_INT_F	Prevention Councelling	Female	5-6 months (15≤ BMI Percentile ≤ 84)	Daily approx. 670 kcal / 2800 kj, 100-190 ml per kg liquid (met by breast milk)
18	0	IS	SG0_12_INT_M	Prevention Councelling	Male	5-6 months (15≤ BMI Percentile ≤ 84)	Daily approx. 730 kcal / 3055 kj, 100-190 ml per kg liquid (met by breast milk)
19	0	IS	SG0_13_INT_F	Prevention Councelling	Female	6-7 months (15≤ BMI Percentile ≤ 84)	Daily approx. 720 k cal / 3010 kj, 800-1000 ml liquid

20	0	IS	SG0_13_INT_M	Prevention Councelling	Male	6-7 months (15≤ BMI Percentile ≤ 84)	Daily approx. 765 kcal / 3220 kj, 800-1000 ml liquid
21	0	IS	SG0_14_INT_F	Prevention Councelling	Female	7-8 months (15≤ BMI Percentile ≤ 84)	Daily approx. 750 kcal / 3140 kj, 800-1000 ml liquid
22	0	IS	SG0_14_INT_M	Prevention Councelling	Male	7-8 months (15≤ BMI Percentile ≤ 84)	Daily approx. 810 kcal / 3390 kj, 800-1000 ml liquid
23	0	IS	SG0_15_INT_F	Prevention Councelling	Female	8-9 months (15≤ BMI Percentile ≤ 84)	Daily approx. 800 kcal / 3350 kj, 800-1000 ml liquid
24	0	IS	SG0_15_INT_M	Prevention Councelling	Male	8-9 months (15≤ BMI Percentile ≤ 84)	Daily approx. 855 kcal / 3580 kj, 800-1000 ml liquid
25	0	IS	SG0_16_INT_F	Prevention Councelling	Female	9-10 months (15≤ BMI Percentile ≤	Daily approx. 865 kcal / 3260 kj, 800-1000 ml liquid

						84)	
26	0	IS	SG0_16_INT_M	Prevention Councelling	Male	9-10 months (15≤ BMI Percentile ≤ 84)	Daily approx. 925 kcal / 3870 kj, 800-1000 ml liquid
27	0	IS	SG0_17_INT_F	Prevention Councelling	Female	10-11 months (15≤ BMI Percentile ≤ 84)	Daily approx. 905 kcal / 3790 kj, 800-1000 ml liquid
28	0	IS	SG0_17_INT_M	Prevention Councelling	Male	10-11 months (15≤ BMI Percentile ≤ 84)	Daily approx. 970 kcal / 4060 kj, 800-1000 ml liquid
29	0	IS	SG0_18_INT_F	Prevention Councelling	Female	11-13 months (15≤ BMI Percentile ≤ 84)	Daily approx. 975 kcal / 4080 kj, 800-1000 ml liquid
30	0	IS	SG0_18_INT_M	Prevention Councelling	Male	11-13 months (15≤ BMI Percentile ≤ 84)	Daily approx. 1050 cal / 4395 kj, 800-1000 ml liquid
31	0	IS	SG0_19_INT_F	Prevention Councelling	Female	13-24 months (15≤ BMI	Daily approx. 108 kcal per weight, 1100-1200 ml liquid

						Percentile ≤ 84)	
32	0	IS	SG0_19_INT_M	Prevention Councelling	Male	13-24 months (15≤ BMI Percentile ≤ 84)	Daily approx. 104 kcal per weight, 1100-1200 ml liquid
33	0	IS	SG0_20_INT_F	Prevention Councelling	Female	2-3 years (15≤ BMI Percentile ≤ 84)	Daily approx. 0.75-1 portion[i] protein[ii], 175 – 265 g fruits, 180 – 265 g vegetables, 85 – 145 g grains, 2 portion [iii] diary[iv], 1300 ml liquid
34	0	IS	SG0_20_INT_M	Prevention Councelling	Male	2-3 years (15≤ BMI Percentile ≤ 84)	Daily approx. 0.75-1 portion protein , 175 – 265 g fruits, 180 – 265 g vegetables, 85 – 145 g grains[v], 2.5 portion diary, 1300 ml liquid
35	0	IS	SG0_21_INT_F	Prevention Councelling	Female	3-6 years (15≤ BMI Percentile ≤ 84)	Daily approx. 1 portion protein, 175 – 265 g fruits, 275 – 450 g vegetables, 110 – 170g grains, 2.5 portion diary, 1600 ml liquid
36	0	IS	SG0_21_INT_M	Prevention Councelling	Male	3-6 years (15≤ BMI Percentile ≤ 84)	Daily approx. 1-1.5 portion protein, 175 – 350g fruits, 275 – 450 g vegetables, 110 – 170g grains, 2.5 portion diary, 1600 ml liquid
37	0	IS	SG0_22_INT_F	Prevention Councelling	Female	6-8 years (15≤ BMI Percentile ≤ 84)	Daily approx. 1.5 portion protein, 175 – 350g fruits, 275 – 450 g vegetables, 110 – 170g grains, 3 portion diary, 1600 ml liquid
38	0	IS	SG0_22_INT_M	Prevention	Male	6-8 years (15≤	Daily approx. 1.5 portion protein, 175 – 350g fruits,

				Councelling		BMI Percentile ≤ 84)	275 – 450 g vegetables, 110 – 170g grains, 3 portion diary, 1600 ml liquid
39	0	IS	SG0_23_INT_F	Prevention Councelling	Female	8-10 years (15≤ BMI Percentile ≤ 84)	Daily approx. 1.5 portion protein, 265 – 350 g fruits, 275 – 550 g vegetables,140 – 195 g grains , 3 portion diary, 1900 ml liquid
40	0	IS	SG0_23_INT_M	Prevention Councelling	Male	8-10 years (15≤ BMI Percentile ≤ 84)	Daily approx. 1.5 portion protein, 265 – 350 g fruits, 275 – 550 g vegetables,140 – 195 g grains , 3 portion diary, 2100 ml liquid
41	0	IS	SG0_24_INT_F	Prevention Councelling	Female	10-14 years (15≤ BMI Percentile ≤ 84)	Daily approx. 1.5 portion protein, 265 – 350 g fruits, 275 – 550 g vegetables,140 – 195 g grains , 3 portion diary, 1900 ml liquid
42	0	IS	SG0_24_INT_M	Prevention Councelling	Male	10-14 years (15≤ BMI Percentile ≤ 84)	Daily approx. 1.5 portion protein, 265 – 350 g fruits, 365 – 640g vegetables,140 – 255g grains, 3 portion diary , 2100 ml liquid
43	0	IS	SG0_25_INT_F	Prevention Councelling	Female	14 years (15≤ BMI Percentile ≤ 84)	Daily approx. 1.5 portion protein, 265 – 350 g fruits, 455 – 545 g vegetables, 170 – 225g grains, 3 portion diary, 2000 ml liquid
44	0	IS	SG0_25_INT_M	Prevention Councelling	Male	14 years (15≤ BMI Percentile	Daily approx. 1.5 portion protein, 350 – 440g fruits, 455 – 730 g vegetables, 170 – 280g grains, 3 portion

					≤ 84)		diary, 2500 ml liquid
45	0	IS	SG0_26_INT_F	Prevention Councelling	Female	14 -18 years (15≤ BMI Percentile ≤ 84)	Daily approx. 1.5 portion protein, 350 – 440g fruits, 455 – 730 g vegetables, 170 – 280g grains, 3 portion diary, 2000 ml liquid
46	0	IS	SG0_26_INT_M	Prevention Councelling	Male	14 -18 years (15≤ BMI Percentile ≤ 84)	Daily approx. 2 portion protein, 350 – 440g fruits, 455 – 730 g vegetables, 170 – 280g grains, 3 portion diary, 2500 ml liquid
47	0	MS	SG0_27_MOM[e]	Prevention Councelling	Male & Female	0-6 months	Only breastfeeding is suitable. In the absence of breast milk, formula formula, which is the equivalent of breast milk, can be used. Do not start supplementary food earlier than 6 months.
48	0	MS	SG0_28_MOM	Prevention Councelling	Male & Female	0-12 months	If your baby has gas problem, you should avoid gas making food. (i.e legume, cauliflower)
49	0	MS	SG0_29_MOM	Prevention Councelling	Male & Female	0-12 months	You should take enough liquid (approx. 2.5 lt) to support breast milk production. (Oat consumption also supports breast milk production)
50	0	MS	SG0_30_MOM	Prevention Councelling	Male & Female	6-9 months	Avoid honey, including pasteurized or cooked, until 1 year of age for child.
51	0	MS	SG0_31_MOM	Prevention Councelling	Male & Female	6-9 months	Avoid raw or undercooked eggs or products containing raw or undercooked eggs for child
52	0	MS	SG0_32_MOM	Prevention	Male &	6-9 months	Avoid raw or undercooked fish and shellfish for

				Councelling	Female		child.
53	0	MS	SG0_33_MOM	Prevention Councelling	Male & Female	6-9 months	Avoid raw or undercooked meat, deli meats and hotdogs for child.
54	0	MS	SG0_34_MOM	Prevention Councelling	Male & Female	6-9 months	Avoid raw or lightly cooked sprouts for child.
55		MS	SG0_35_MOM	Prevention Councelling	Male & Female	6-9 months	Avoid unpasteurized cow/goat milk and milk products (including raw cheese) for child.
56	0	MS	SG0_36_MOM	Prevention Councelling	Male & Female	6-9 months	Avoid unpasteurized fruit and vegetable juice unless produce is washed and freshly squeezed immediately before consumption for child
57	0	MS	SG0_37_MOM	Prevention Councelling	Male & Female	6-12 months	Start supplementary foods at 6th month and get advice from the pediatrician for the number of meals
58	0	MS	SG0_38_MOM	Prevention Councelling	Male & Female	0-1 years	Do not add salt and sugar to the baby's supplementary foods under the age of 1.
59	0	MS	SG0_39_MOM	Prevention Councelling	Male & Female	0-2 years	If possible, continue breastfeeding until the age of 2
60	0	MS	SG0_40_MOM	Prevention Councelling	Male & Female	0-2 years	Diet is not recommended in this age group since the most important factor affecting growth below 2 years of age is nutrition.
61	0	SS	SG0_41_EAT[f]	Prevention Councelling	Male & Female	2-18 years (5≤ BMI Percentile ≤ 94 with no health risk[g])	Consume more vegetables/fruits per day , 2 cups for 2 years old and 4.5 cups for 17-18 years old
62	0	SS	SG0_42_EAT	Prevention Councelling	Male & Female	2-18 years (5≤ BMI Percentile ≤ 94 with no	Decrase consuming sweetened food (e.g chocolate), avoid from cola)

health risk)

63	0	SS	SG0_43_EAT	Prevention Councelling	Male &Female	2-18 years (5≤ BMI Percentile ≤ 94 with no health risk)	Decrease number of consuming food from outside (max. Once in two weeks)
64	0	SS	SG0_44_EAT	Prevention Councelling	Male & Female	2-18 years (5≤ BMI Percentile ≤ 94 with no health risk)	Reduce amount of oil put in food
65	0	SS	SG0_45_EAT	Prevention Councelling	Male & Female	2-18 years (5≤ BMI Percentile ≤ 94 with no health risk)	Decrease carbohydrate consumption
66	0	SS	SG0_46_EAT	Prevention Councelling	Male & Female	2-18 years (5≤ BMI Percentile ≤ 94 with no health risk)	Promote healthy snacks at predetermined intervals between meals
67	0	SS	SG0_47_EAT	Prevention Councelling	Male & Female	2-18 years (5≤ BMI Percentile ≤ 94 with no health risk)	Eat 3 meals a day
68	0	SS	SG0_48_EAT	Prevention Councelling	Male & Female	2-18 years (5≤ BMI Percentile ≤ 94 with no health risk)	Consume water instead of juice.
69	0	SS	SG0_49_PHY[h]	Prevention Councelling	Male & Female	2-18 years (5≤ BMI Percentile ≤ 94 with no health risk)	Watch TV / use computer max 2 hours a day

70	0	SS	SG0_50_PHY	Prevention Councelling	Male & Female	2-18 years ($5 \leq$ BMI Percentile ≤ 94 with no health risk)	Be active 60 minutes a day
71	1	SS	SG1$^{(**)}$_01_EAT	Prevention Plus	Male & Female	2-18 years($85 \leq$ BMI Percentile ≤ 94 with health risk), 2-5 years (BMI Percentile $\geq$ 95), 6-11 years ($95 \leq$ BMI Percentile), 12-18 years ($95 \leq$ BMI Percentile)	Total calori should be reduced, you need a diet prepared by a specialist
72	1	SS	SG1_02_EAT	Prevention Plus	Male & Female	2-18 years ($85 \leq$ BMI Percentile ≤ 94 with health risk), 2-5 years (BMI Percentile $\geq$ 95), 6-11 years ($95 \leq$ BMI Percentile), 12-18 years ($95 \leq$ BMI Percentile)	Remove sweetened food from eating habits (If consuming is too much decrase to 1 portion a day)

73	1	SS	SG1_03_EAT	Prevention Plus	Male & Female	2-18 years (85≤ BMI Percentile ≤ 94 with health risk), 2-5 years (BMI Percentile ≥ 95), 6-11 years (95≤ BMI Percentile), 12-18 years (95≤ BMI Percentile)	Eat at dinner table at home 5,6 times a week
74	1	SS	SG1_04_EAT	Prevention Plus	Male & Female	2-18 years (85≤ BMI Percentile ≤ 94 with health risk), 2-5 years (BMI Percentile ≥ 95), 6-11 years (95≤ BMI Percentile), 12-18 years (95≤ BMI Percentile)	Eat healthy breakfast every day
75	1	SS	SG1_05_EAT	Prevention Plus	Male & Female	2-18 years (85≤ BMI Percentile ≤ 94	Encourage child/adolescent to regulate his/her own meals

						with health risk), 2-5 years (BMI Percentile ≥ 95), 6-11 years (95≤ BMI Percentile), 12-18 years (95≤ BMI Percentile)	
76	1	SS	SG1_06_PHY	Prevention Plus	Male & Female	2-18 years (85≤ BMI Percentile ≤ 94 with health risk)	Reduce tv/screen activities to less than 2 hours a day Remove tv from room for children younger than 2 years
77	1	SS	SG1_07_PHY	Prevention Plus	Male & Female	2-18 years (85≤ BMI Percentile ≤ 94 with health risk) , 2-5 years (BMI Percentile ≥ 95), 6-11 years (95≤ BMI Percentile), 12-18 years (95≤ BMI Percentile)	Be active more than 1 hour a day
78	2	SS	SG2$^{(***)}$_01_EAT	SVM		All age groups	Consume foods with lower energy (have a planned

					carrying out Stage 0 or Stage 1 suggestions and do not make any improvements can be assigned this suggestion.	diet which has equal nutrition values)
79	2	SS	SG2_02_EAT	SVM		All age groups carrying out Stage 0 or Stage 1 suggestions and do not make any improvements can be assigned this suggestion.	Have low calorie 3 meals and 1 or 2 snacks a day
80	2	SS	SG2_03_PHY	SVM		All age groups carrying out Stage 0 or Stage 1 suggestions and do not make any improvements	Reduce tv/screen activities to less than 1 hours a day

						can be assigned this suggestion.	
81	2	SS	SG2_04_PHY	SVM		All age groups carrying out Stage 0 or Stage 1 suggestions and do not make any improvements can be assigned this suggestion.	Be active 60 minutes a day (planned and controlled activity)
82	3	SS	SG3$^{(****)}$_01_EAT	CMI		All age groups carrying out Stage 2 suggestions and do not make any improvements can be assigned this suggestion.	Go to your doctor and dietician again
83	3	SS	SG3_02_EAT	CMI		All age groups carrying out Stage 2 suggestions and do not	Go to inspection minimum every 8-12 weeks

					make any improvements can be assigned this suggestion.		
84	3	SS	SG3_03_PHY	CMI		All age groups carrying out Stage 2 suggestions and do not make any improvements can be assigned this suggestion.	Be active at least 60 minutes a day
85	0	SS	SG0_01_GEN[j]	-		All age groups BMI Percentile < 5	There is a risk of malnutrition. You must consult to your health expert as soon as possible.
86	0	SS	SG0_02_GEN	-		All age groups BMI Percentile > 95	You have obesity. You must consult to your health expert as soon as possible.
87	0	SS	SG0_03_GEN	-		2-18 years (85≤ BMI Percentile ≤ 94)	You are overweight!!. If you don't take precautions, you can progress to obesity !! You should go a specialist and dietician to prevent obesity!!

(*) Stage 0 (SG0) is the stage for Prevention Counselling(prevention).This category contains development feedbacks and suggestions.

(**) Stage 1 (SG1) is the stage for Prevention Plus (treatment stage) suggestions.

(***) Stage 2 (SG2) SVM(Structured Weight Management)(treatment stage) suggestions.

(****) Stage 3 (SG3) CMI(Comprehensive Multidisciplinary Intervention)(treatment stage) suggestions.
(a) Denotes the development suggestions for pediatric patients.
(b) Denotes the nutritional intake amount suggestions for pediatric patients.
(c) The suggestion is applicable for only female pediatric patients.
(d) The suggestion is applicable for only male pediatric patients.
(e) Denotes the suggestions for mothers.
(f) Denotes the general nutritional suggestions for pediatric patients.
(g) First/second relatives medical history (type 2 diabetes, obesity, hypertension etc.) can impose a health risk on the child, that can increase the risk of obesity.
(h) Denotes the physical suggestions for pediatric patients.
(j) General suggestions for risky conditions of pediatric patients, that do not belong to any treatment stages.
(i) Portion for protein is the amount of protein that should be consumed by the child at that age.
(ii) Protein is denoted by the group of food in table 1.
(iii) Portion of diary is the amount of diary that should be consumed by the child ad that age.
(iv) Diary is denoted by the group of food in table 2.
(v) Grains are food that are made from wheat, rice, oats, barley etc. (i.e bread, pasta, oatmeal etc.)

Appendix B: SQWRL Rules in OTO

#	Rule Code	Related Suggestion Code	SQWRL Rule
1	0_2_Age_Dev_SG_1	SG0_01_DEV	Patient(?p) ^ hasDecimalAge(?p, ?a) ^ hasBMIPercentile(?p, ?bp) ^ swrlb:greaterThanOrEqual(?a, 0) ^ swrlb:lessThanOrEqual(?a, 2) ^ swrlb:equal(?bp, 1) -> hasDevelopmentFeedback(?p, SG0_01_DEV)
2	0_2_Age_Dev_SG_2	SG0_02_DEV	Patient(?p) ^ hasDecimalAge(?p, ?a) ^ swrlb:greaterThanOrEqual(?a, 0) ^ swrlb:lessThanOrEqual(?a, 2) ^ hasBMIPercentile(?p, ?bp) ^ swrlb:greaterThan(?bp, 1) ^ swrlb:lessThanOrEqual(?bp, 5) -> hasDevelopmentFeedback(?p, SG0_02_DEV)
3	0_2_Age_Dev_SG_3	SG0_03_DEV	Patient(?p) ^ hasDecimalAge(?p, ?a) ^ hasBMIPercentile(?p, ?bp) ^ swrlb:greaterThanOrEqual(?a, 0) ^ swrlb:lessThanOrEqual(?a, 2) ^ swrlb:greaterThan(?bp, 5) ^ swrlb:lessThanOrEqual(?bp, 15) -> hasDevelopmentFeedback(?p, SG0_03_DEV)
4	0_2_Age_Dev_SG_4	SG0_04_DEV	Patient(?p) ^ hasDecimalAge(?p, ?a) ^ hasBMIPercentile(?p, ?bp) ^ swrlb:greaterThanOrEqual(?a, 0) ^ swrlb:lessThanOrEqual(?a, 2) ^ swrlb:greaterThan(?bp, 16) ^ swrlb:lessThanOrEqual(?bp, 84) -> hasDevelopmentFeedback(?p, SG0_04_DEV)
5	2_18_Age_Dev_SG_5	SG0_05_DEV	Patient(?p) ^ hasDecimalAge(?p, ?a) ^ hasBMIPercentile(?p, ?bp) ^ swrlb:greaterThanOrEqual(?a, 2) ^ swrlb:lessThanOrEqual(?a, 18) ^ swrlb:greaterThan(?bp, 16) ^ swrlb:lessThanOrEqual(?bp, 84) -> hasDevelopmentFeedback(?p, SG0_06_DEV)
6	0_2_Age_Dev_SG_6	SG0_06_DEV	Patient(?p) ^ hasDecimalAge(?p, ?a) ^ hasBMIPercentile(?p, ?bp) ^ swrlb:greaterThanOrEqual(?a, 0) ^ swrlb:lessThanOrEqual(?a, 2) ^ swrlb:greaterThan(?bp, 85) ^ swrlb:lessThanOrEqual(?bp, 100) -> hasDevelopmentFeedback(?p, SG0_05_DEV)
7	2_11_Age_Dev_SG_2	SG0_02_DEV	swrlb:lessThanOrEqual(?a, 11) ^ swrlb:greaterThanOrEqual(?a, 2) ^ Patient(?p) ^ swrlb:lessThan(?bmip, 5) ^ hasDecimalAge(?p, ?a) ^

			hasBMIPercentile(?p, ?bmip) -> hasDevelopmentFeedback(?p, SG0_02_DEV)
8	0_1_Month_Girl_BMI_Between_5_94	SG0_07_INT_F	Patient(?p) ^ hasGender(?p, Girl) ^ hasDecimalAge(?p, ?a) ^ hasBMIPercentile(?p, ?bp) ^ swrlb:greaterThanOrEqual(?a, 0) ^ swrlb:lessThanOrEqual(?a, 0.083) ^ swrlb:greaterThanOrEqual(?bp, 15) ^ swrlb:lessThanOrEqual(?bp, 84) -> hasIntakeSuggestion(?p, SG0_07_INT_F)
9	0_1_Month_Boy_BMI_Between_5_94	SG0_07_INT_M	Patient(?p) ^ hasGender(?p, Boy) ^ hasDecimalAge(?p, ?a) ^ hasBMIPercentile(?p, ?bp) ^ swrlb:greaterThanOrEqual(?a, 0) ^ swrlb:lessThanOrEqual(?a, 0.083) ^ swrlb:greaterThanOrEqual(?bp, 15) ^ swrlb:lessThanOrEqual(?bp, 84) -> hasIntakeSuggestion(?p, SG0_07_INT_M)
10	1_2_Month_Girl_BMI_Between_5_94	SG0_08_INT_F	Patient(?p) ^ hasGender(?p, Girl) ^ hasDecimalAge(?p, ?a) ^ hasBMIPercentile(?p, ?bp) ^ swrlb:greaterThan(?a, 0.083) ^ swrlb:lessThanOrEqual(?a, 0.17) ^ swrlb:greaterThanOrEqual(?bp, 15) ^ swrlb:lessThanOrEqual(?bp, 84) -> hasIntakeSuggestion(?p, SG0_08_INT_F)
11	1_2_Month_Boy_BMI_Between_5_94	SG0_08_INT_M	Patient(?p) ^ hasGender(?p, Boy) ^ hasDecimalAge(?p, ?a) ^ hasBMIPercentile(?p, ?bp) ^ swrlb:greaterThan(?a, 0.083) ^ swrlb:lessThanOrEqual(?a, 0.17) ^ swrlb:greaterThanOrEqual(?bp, 15) ^ swrlb:lessThanOrEqual(?bp, 84) -> hasIntakeSuggestion(?p, SG0_08_INT_M)
12	2_3_Month_Girl_BMI_Between_5_94	SG0_09_INT_F	Patient(?p) ^ hasGender(?p, Girl) ^ hasDecimalAge(?p, ?a) ^ hasBMIPercentile(?p, ?bp) ^ swrlb:greaterThan(?a, 0.17) ^ swrlb:lessThanOrEqual(?a, 0.25) ^ swrlb:greaterThanOrEqual(?bp, 15) ^ swrlb:lessThanOrEqual(?bp, 84) -> hasIntakeSuggestion(?p, SG0_09_INT_F)
13	2_3_Month_Boy_BMI_Between_5_94	SG0_09_INT_M	Patient(?p) ^ hasGender(?p, Boy) ^ hasDecimalAge(?p, ?a) ^ hasBMIPercentile(?p, ?bp) ^ swrlb:greaterThan(?a, 0.17) ^

			swrlb:lessThanOrEqual(?a, 0.25) ^ swrlb:greaterThanOrEqual(?bp, 15) ^ swrlb:lessThanOrEqual(?bp, 84) -> hasIntakeSuggestion(?p, SG0_09_INT_M)
14	3_4_Month_Girl_BMI_Between _5_94	SG0_10_INT_F	Patient(?p) ^ hasGender(?p, Girl) ^ hasDecimalAge(?p, ?a) ^ hasBMIPercentile(?p, ?bp) ^ swrlb:greaterThan(?a, 0.25) ^ swrlb:lessThanOrEqual(?a, 0.34) ^ swrlb:greaterThanOrEqual(?bp, 15) ^ swrlb:lessThanOrEqual(?bp, 84) -> hasIntakeSuggestion(?p, SG0_10_INT_F)
15	3_4_Month_Boy_BMI_Between _5_94	SG0_10_INT_M	Patient(?p) ^ hasGender(?p, Boy) ^ hasDecimalAge(?p, ?a) ^ hasBMIPercentile(?p, ?bp) ^ swrlb:greaterThan(?a, 0.25) ^ swrlb:lessThanOrEqual(?a, 0.34) ^ swrlb:greaterThanOrEqual(?bp, 15) ^ swrlb:lessThanOrEqual(?bp, 84) -> hasIntakeSuggestion(?p, SG0_10_INT_M)
16	4_5_Month_Girl_BMI_Between _5_94	SG0_11_INT_F	Patient(?p) ^ hasGender(?p, Girl) ^ hasDecimalAge(?p, ?a) ^ hasBMIPercentile(?p, ?bp) ^ swrlb:greaterThan(?a, 0.34) ^ swrlb:lessThanOrEqual(?a, 0.42) ^ swrlb:greaterThanOrEqual(?bp, 15) ^ swrlb:lessThanOrEqual(?bp, 84) -> hasIntakeSuggestion(?p, SG0_11_INT_F)
17	4_5_Month_Boy_BMI_Between _5_94	SG0_11_INT_M	Patient(?p) ^ hasGender(?p, Boy) ^ hasDecimalAge(?p, ?a) ^ hasBMIPercentile(?p, ?bp) ^ swrlb:greaterThan(?a, 0.34) ^ swrlb:lessThanOrEqual(?a, 0.42) ^ swrlb:greaterThanOrEqual(?bp,15) ^ swrlb:lessThanOrEqual(?bp, 84) -> hasIntakeSuggestion(?p, SG0_11_INT_M)
18	5_6_Month_Girl_BMI_Between _5_94	SG0_12_INT_F	Patient(?p) ^ hasGender(?p, Girl) ^ hasDecimalAge(?p, ?a) ^ hasBMIPercentile(?p, ?bp) ^ swrlb:greaterThan(?a, 0.42) ^ swrlb:lessThanOrEqual(?a, 0.50) ^ swrlb:greaterThanOrEqual(?bp, 15) ^ swrlb:lessThanOrEqual(?bp, 84) -> hasIntakeSuggestion(?p, SG0_12_INT_F)
19	5_6_Month_Boy_BMI_Between	SG0_12_INT_M	Patient(?p) ^ hasGender(?p, Boy) ^ hasDecimalAge(?p, ?a) ^

	_5_94		hasBMIPercentile(?p, ?bp) ^ swrlb:greaterThan(?a, 0.42) ^ swrlb:lessThanOrEqual(?a, 0.50) ^ swrlb:greaterThanOrEqual(?bp,15) ^ swrlb:lessThanOrEqual(?bp, 84) -> hasIntakeSuggestion(?p, SG0_12_INT_M)
20	6_7_Month_Girl_BMI_Between _5_94	SG0_13_INT_F	Patient(?p) ^ hasGender(?p, Girl) ^ hasDecimalAge(?p, ?a) ^ hasBMIPercentile(?p, ?bp) ^ swrlb:greaterThan(?a, 0.50) ^ swrlb:lessThanOrEqual(?a, 0.58) ^ swrlb:greaterThanOrEqual(?bp, 15) ^ swrlb:lessThanOrEqual(?bp, 84) -> hasIntakeSuggestion(?p, SG0_13_INT_F)
21	6_7_Month_Boy_BMI_Between _5_94	SG0_13_INT_M	Patient(?p) ^ hasGender(?p, Boy) ^ hasDecimalAge(?p, ?a) ^ hasBMIPercentile(?p, ?bp) ^ swrlb:greaterThan(?a, 0.50) ^ swrlb:lessThanOrEqual(?a, 0.58) ^ swrlb:greaterThanOrEqual(?bp, 15) ^ swrlb:lessThanOrEqual(?bp, 84) -> hasIntakeSuggestion(?p, SG0_13_INT_M)
22	7_8_Month_Girl_BMI_Between _5_94	SG0_14_INT_F	Patient(?p) ^ hasGender(?p, Girl) ^ hasDecimalAge(?p, ?a) ^ hasBMIPercentile(?p, ?bp) ^ swrlb:greaterThan(?a, 0.58) ^ swrlb:lessThanOrEqual(?a, 0.67) ^ swrlb:greaterThanOrEqual(?bp,15) ^ swrlb:lessThanOrEqual(?bp, 84) -> hasIntakeSuggestion(?p, SG0_14_INT_F)
23	7_8_Month_Boy_BMI_Between _5_94	SG0_14_INT_M	Patient(?p) ^ hasGender(?p, Boy) ^ hasDecimalAge(?p, ?a) ^ hasBMIPercentile(?p, ?bp) ^ swrlb:greaterThan(?a, 0.58) ^ swrlb:lessThanOrEqual(?a, 0.67) ^ swrlb:greaterThanOrEqual(?bp,15) ^ swrlb:lessThanOrEqual(?bp, 84) -> hasIntakeSuggestion(?p, SG0_14_INT_M)
24	8_9_Month_Girl_BMI_Between _5_94	SG0_15_INT_F	Patient(?p) ^ hasGender(?p, Girl) ^ hasDecimalAge(?p, ?a) ^ hasBMIPercentile(?p, ?bp) ^ swrlb:greaterThan(?a, 0.67) ^ swrlb:lessThanOrEqual(?a, 0.75) ^ swrlb:greaterThanOrEqual(?bp, 15) ^ swrlb:lessThanOrEqual(?bp, 84) -> hasIntakeSuggestion(?p, SG0_15_INT_F)

25	8_9_Month_Boy_BMI_Between _5_94	SG0_15_INT_M	Patient(?p) ^ hasGender(?p, Boy) ^ hasDecimalAge(?p, ?a) ^ hasBMIPercentile(?p, ?bp) ^ swrlb:greaterThan(?a, 0.67) ^ swrlb:lessThanOrEqual(?a, 0.75) ^ swrlb:greaterThanOrEqual(?bp,15) ^ swrlb:lessThanOrEqual(?bp, 84) -> hasIntakeSuggestion(?p, SG0_15_INT_M)
26	9_10_Month_Girl_BMI_Between_5_94	SG0_16_INT_F	Patient(?p) ^ hasGender(?p, Girl) ^ hasDecimalAge(?p, ?a) ^ hasBMIPercentile(?p, ?bp) ^ swrlb:greaterThan(?a, 0.75) ^ swrlb:lessThanOrEqual(?a, 0.83) ^ swrlb:greaterThanOrEqual(?bp, 15) ^ swrlb:lessThanOrEqual(?bp, 84) -> hasIntakeSuggestion(?p, SG0_16_INT_F)
27	9_10_Month_Boy_BMI_Between_5_94	SG0_16_INT_M	Patient(?p) ^ hasGender(?p, Boy) ^ hasDecimalAge(?p, ?a) ^ hasBMIPercentile(?p, ?bp) ^ swrlb:greaterThan(?a, 0.75) ^ swrlb:lessThanOrEqual(?a, 0.83) ^ swrlb:greaterThanOrEqual(?bp, 15) ^ swrlb:lessThanOrEqual(?bp, 84) -> hasIntakeSuggestion(?p, SG0_16_INT_M)
28	10_11_Month_Girl_BMI_Between_5_94	SG0_17_INT_F	Patient(?p) ^ hasGender(?p, Girl) ^ hasDecimalAge(?p, ?a) ^ hasBMIPercentile(?p, ?bp) ^ swrlb:greaterThan(?a, 0.83) ^ swrlb:lessThanOrEqual(?a, 0.92) ^ swrlb:greaterThanOrEqual(?bp, 15) ^ swrlb:lessThanOrEqual(?bp, 84) -> hasIntakeSuggestion(?p, SG0_17_INT_F)
29	10_11_Month_Boy_BMI_Between_5_94	SG0_17_INT_M	Patient(?p) ^ hasGender(?p, Boy) ^ hasDecimalAge(?p, ?a) ^ hasBMIPercentile(?p, ?bp) ^ swrlb:greaterThan(?a, 0.83) ^ swrlb:lessThanOrEqual(?a, 0.92) ^ swrlb:greaterThanOrEqual(?bp, 15) ^ swrlb:lessThanOrEqual(?bp, 84) -> hasIntakeSuggestion(?p, SG0_17_INT_M)
30	11_12_Month_Girl_BMI_Between_5_94	SG0_18_INT_F	Patient(?p) ^ hasGender(?p, Girl) ^ hasDecimalAge(?p, ?a) ^ hasBMIPercentile(?p, ?bp) ^ swrlb:greaterThan(?a, 0.92) ^ swrlb:lessThanOrEqual(?a, 1) ^ swrlb:greaterThanOrEqual(?bp, 15) ^ swrlb:lessThanOrEqual(?bp, 84) -> hasIntakeSuggestion(?p,

			SG0_18_INT_F)
31	11_12_Month_Boy_BMI_Between_5_94	SG0_18_INT_M	Patient(?p) ^ hasGender(?p, Boy) ^ hasDecimalAge(?p, ?a) ^ hasBMIPercentile(?p, ?bp) ^ swrlb:greaterThan(?a, 0.92) ^ swrlb:lessThanOrEqual(?a, 1) ^ swrlb:greaterThanOrEqual(?bp, 15) ^ swrlb:lessThanOrEqual(?bp, 84) -> hasIntakeSuggestion(?p, SG0_18_INT_M)
32	1_2_Years_Girl_BMI_Between_5_94	SG0_19_INT_F	Patient(?p) ^ hasGender(?p, Girl) ^ hasDecimalAge(?p, ?a) ^ hasBMIPercentile(?p, ?bp) ^ swrlb:greaterThan(?a, 1) ^ swrlb:lessThanOrEqual(?a, 2) ^ swrlb:greaterThanOrEqual(?bp, 15) ^ swrlb:lessThanOrEqual(?bp, 84) -> hasIntakeSuggestion(?p, SG0_19_INT_F)
33	1_2_Years_Boy_BMI_Between_5_94	SG0_19_INT_M	Patient(?p) ^ hasGender(?p, Boy) ^ hasDecimalAge(?p, ?a) ^ hasBMIPercentile(?p, ?bp) ^ swrlb:greaterThan(?a, 1) ^ swrlb:lessThanOrEqual(?a, 2) ^ swrlb:greaterThanOrEqual(?bp, 15) ^ swrlb:lessThanOrEqual(?bp, 84) -> hasIntakeSuggestion(?p, SG0_19_INT_M)
34	2_3_Years_Girl_BMI_Between_5_94	SG0_20_INT_F	Patient(?p) ^ hasGender(?p, Girl) ^ hasDecimalAge(?p, ?a) ^ hasBMIPercentile(?p, ?bp) ^ swrlb:greaterThan(?a, 2) ^ swrlb:lessThanOrEqual(?a, 3) ^ swrlb:greaterThanOrEqual(?bp, 15) ^ swrlb:lessThanOrEqual(?bp, 84) -> hasIntakeSuggestion(?p, SG0_20_INT_F)
35	2_3_Years_Boy_BMI_Between_5_94	SG0_20_INT_M	Patient(?p) ^ hasGender(?p, Boy) ^ hasDecimalAge(?p, ?a) ^ hasBMIPercentile(?p, ?bp) ^ swrlb:greaterThan(?a, 2) ^ swrlb:lessThanOrEqual(?a, 3) ^ swrlb:greaterThanOrEqual(?bp, 15) ^ swrlb:lessThanOrEqual(?bp, 84) -> hasIntakeSuggestion(?p, SG0_20_INT_M)
36	3_6_Years_Girl_BMI_Between_5_94	SG0_21_INT_F	Patient(?p) ^ hasGender(?p, Girl) ^ hasDecimalAge(?p, ?a) ^ hasBMIPercentile(?p, ?bp) ^ swrlb:greaterThan(?a, 3) ^ swrlb:lessThanOrEqual(?a, 6) ^ swrlb:greaterThanOrEqual(?bp, 15) ^

			swrlb:lessThanOrEqual(?bp, 84) -> hasIntakeSuggestion(?p, SG0_21_INT_F)
37	3_6_Years_Boy_BMI_Between_5_94	SG0_21_INT_M	Patient(?p) ^ hasGender(?p, Boy) ^ hasDecimalAge(?p, ?a) ^ hasBMIPercentile(?p, ?bp) ^ swrlb:greaterThan(?a, 3) ^ swrlb:lessThanOrEqual(?a, 6) ^ swrlb:greaterThanOrEqual(?bp, 15) ^ swrlb:lessThanOrEqual(?bp, 84) -> hasIntakeSuggestion(?p, SG0_21_INT_M)
38	6_8_Years_Girl_BMI_Between_5_94	SG0_22_INT_F	Patient(?p) ^ hasGender(?p, Girl) ^ hasDecimalAge(?p, ?a) ^ hasBMIPercentile(?p, ?bp) ^ swrlb:greaterThan(?a, 6) ^ swrlb:lessThanOrEqual(?a, 8) ^ swrlb:greaterThanOrEqual(?bp, 15) ^ swrlb:lessThanOrEqual(?bp, 84) -> hasIntakeSuggestion(?p, SG0_22_INT_F)
39	6_8_Years_Boy_BMI_Between_5_94	SG0_22_INT_M	Patient(?p) ^ hasGender(?p, Boy) ^ hasDecimalAge(?p, ?a) ^ hasBMIPercentile(?p, ?bp) ^ swrlb:greaterThan(?a, 6) ^ swrlb:lessThanOrEqual(?a, 8) ^ swrlb:greaterThanOrEqual(?bp, 15) ^ swrlb:lessThanOrEqual(?bp, 84) -> hasIntakeSuggestion(?p, SG0_22_INT_M)
40	8_10_Years_Girl_BMI_Between_5_94	SG0_23_INT_F	Patient(?p) ^ hasGender(?p, Girl) ^ hasDecimalAge(?p, ?a) ^ hasBMIPercentile(?p, ?bp) ^ swrlb:greaterThan(?a, 8) ^ swrlb:lessThanOrEqual(?a, 10) ^ swrlb:greaterThanOrEqual(?bp, 15) ^ swrlb:lessThanOrEqual(?bp, 84) -> hasIntakeSuggestion(?p, SG0_23_INT_F)
41	8_10_Years_Boy_BMI_Between_5_94	SG0_23_INT_M	Patient(?p) ^ hasGender(?p, Boy) ^ hasDecimalAge(?p, ?a) ^ hasBMIPercentile(?p, ?bp) ^ swrlb:greaterThan(?a, 8) ^ swrlb:lessThanOrEqual(?a, 10) ^ swrlb:greaterThanOrEqual(?bp, 15) ^ swrlb:lessThanOrEqual(?bp, 84) -> hasIntakeSuggestion(?p, SG0_23_INT_M)
42	10_13_Years_Girl_BMI_Between_5_94	SG0_24_INT_F	Patient(?p) ^ hasGender(?p, Girl) ^ hasDecimalAge(?p, ?a) ^ hasBMIPercentile(?p, ?bp) ^ swrlb:greaterThan(?a, 10) ^

			swrlb:lessThanOrEqual(?a, 13) ^ swrlb:greaterThanOrEqual(?bp, 15) ^ swrlb:lessThanOrEqual(?bp, 84) -> hasIntakeSuggestion(?p, SG0_24_INT_F)
43	10_13_Years_Boy_BMI_Between_5_94	SG0_24_INT_M	Patient(?p) ^ hasGender(?p, Boy) ^ hasDecimalAge(?p, ?a) ^ hasBMIPercentile(?p, ?bp) ^ swrlb:greaterThan(?a, 10) ^ swrlb:lessThanOrEqual(?a, 13) ^ swrlb:greaterThanOrEqual(?bp, 15) ^ swrlb:lessThanOrEqual(?bp, 84) -> hasIntakeSuggestion(?p, SG0_24_INT_M)
44	14_Years_Girl_BMI_Between_5_94	SG0_25_INT_F	Patient(?p) ^ hasGender(?p, Girl) ^ hasDecimalAge(?p, ?a) ^ hasBMIPercentile(?p, ?bp) ^ swrlb:equal(?a, 14) ^ swrlb:greaterThanOrEqual(?bp, 15) ^ swrlb:lessThanOrEqual(?bp, 84) -> hasIntakeSuggestion(?p, SG0_25_INT_F)
45	14_Years_Boy_BMI_Between_5_94	SG0_25_INT_M	Patient(?p) ^ hasGender(?p, Boy) ^ hasDecimalAge(?p, ?a) ^ hasBMIPercentile(?p, ?bp) ^ swrlb:equal(?a, 14) ^ swrlb:greaterThanOrEqual(?bp, 15) ^ swrlb:lessThanOrEqual(?bp, 84) -> hasIntakeSuggestion(?p, SG0_25_INT_M)
46	14_18_Years_Girl_BMI_Between_5_94	SG0_26_INT_F	Patient(?p) ^ hasGender(?p, Girl) ^ hasDecimalAge(?p, ?a) ^ hasBMIPercentile(?p, ?bp) ^ swrlb:greaterThan(?a, 14) ^ swrlb:lessThanOrEqual(?a, 18) ^ swrlb:greaterThanOrEqual(?bp, 15) ^ swrlb:lessThanOrEqual(?bp, 84) -> hasIntakeSuggestion(?p, SG0_26_INT_F)
47	14_18_Years_Boy_BMI_Between_5_94	SG0_26_INT_M	Patient(?p) ^ hasGender(?p, Boy) ^ hasDecimalAge(?p, ?a) ^ hasBMIPercentile(?p, ?bp) ^ swrlb:greaterThan(?a, 14) ^ swrlb:lessThanOrEqual(?a, 18) ^ swrlb:greaterThanOrEqual(?bp, 15) ^ swrlb:lessThanOrEqual(?bp, 84) -> hasIntakeSuggestion(?p, SG0_26_INT_M)
48	0_1_Years_Mom_Suggestions	SG0_28_MOM[(f)], SG0_29_MOM , SG0_38_MOM	Patient(?p) ^ hasDecimalAge(?p, ?a) ^ swrlb:greaterThanOrEqual(?a, 0) ^ swrlb:lessThanOrEqual(?a, 1) -> hasMomSuggestion(?p, SG0_28_MOM) ^ hasMomSuggestion(?p, SG0_29_MOM) ^ hasMomSuggestion(?p,

			SG0_38_MOM)
49	0_6_Month_Mom_Suggestions	SG0_27_MOM	Patient(?p) ^ hasDecimalAge(?p, ?a) ^ swrlb:greaterThanOrEqual(?a, 0) ^ swrlb:lessThanOrEqual(?a, 0.5) -> hasMomSuggestion(?p, SG0_27_MOM)
50	6_9_Month_Mom_Suggestions	SG0_30_MOM, SG0_31_MOM, SG0_32_MOM, SG0_33_MOM, SG0_34_MOM, SG0_35_MOM, SG0_36_MOM	Patient(?p) ^ hasDecimalAge(?p, ?a) ^ swrlb:greaterThanOrEqual(?a, 0.5) ^ swrlb:lessThanOrEqual(?a, 0.75) -> hasMomSuggestion(?p, SG0_28_MOM) ^ hasMomSuggestion(?p, SG0_29_MOM) ^ hasMomSuggestion(?p, SG0_30_MOM) ^ hasMomSuggestion(?p, SG0_31_MOM) ^ hasMomSuggestion(?p, SG0_32_MOM) ^ hasMomSuggestion(?p, SG0_33_MOM) ^ hasMomSuggestion(?p, SG0_34_MOM)
51	6_12_Month_Mom_Suggestions	SG0_37_MOM	Patient(?p) ^ hasDecimalAge(?p, ?a) ^ swrlb:greaterThanOrEqual(?a, 0.5) ^ swrlb:lessThanOrEqual(?a, 1) -> hasMomSuggestion(?p, SG0_37_MOM)
52	0_2_Age_Mom_Suggestions	SG0_39_MOM, SG0_40_MOM	Patient(?p) ^ hasDecimalAge(?p, ?a) ^ swrlb:greaterThanOrEqual(?a, 0) ^ swrlb:lessThanOrEqual(?a, 2) -> hasMomSuggestion(?p, SG0_39_MOM) ^ hasMomSuggestion(?p, SG0_40_MOM)
53	0_2_Age_Eat_Phy_SG_0	SG0_35_EAT, SG0_36_EAT, SG0_37_EAT, SG0_38_EAT, SG0_39_EAT, SG0_40_EAT, SG0_41_EAT, SG0_42_EAT, SG0_43_PHY, SG0_44_PHY	Patient(?p) ^ hasDecimalAge(?p, ?a) ^ swrlb:lessThanOrEqual(?a, 2) ^ swrlb:greaterThanOrEqual(?a, 0) ^ hasBMIPercentile(?p, ?wp) ^ swrlb:lessThan(?wp, 95)-> hasSuggestion(?p, SG0_35_EAT) ^ hasSuggestion(?p, SG0_36_EAT) ^ hasSuggestion(?p, SG0_37_EAT) ^ hasSuggestion(?p, SG0_38_EAT) ^ hasSuggestion(?p, SG0_39_EAT) ^ hasSuggestion(?p, SG0_40_EAT) ^ hasSuggestion(?p, SG0_41_EAT) ^ hasSuggestion(?p, SG0_42_EAT) ^ hasSuggestion(?p, SG0_43_PHY) ^ hasSuggestion(?p, SG0_44_PHY)
54	2_18_Age_SG_NoHealthRisk_SG0	SG0_35_EAT, SG0_36_EAT,	Patient(?p) ^ hasDecimalAge(?p, ?a) ^ swrlb:greaterThanOrEqual(?a, 2) ^ swrlb:lessThanOrEqual(?a, 18) ^ hasBMIPercentile(?p, ?bmip) ^

		SG0_37_EAT, SG0_38_EAT, SG0_39_EAT, SG0_40_EAT, SG0_41_EAT, SG0_42_EAT, SG0_43_PHY, SG0_44_PHY	swrlb:greaterThanOrEqual(?bmip, 5) ^ swrlb:lessThanOrEqual(?bmip, 94) ^ hasHealthRisk(?p, ?hr) ^ swrlb:equal(?hr, false) ^ -> hasSuggestion(?p, SG0_35_EAT) ^ hasSuggestion(?p, SG0_36_EAT) ^ hasSuggestion(?p, SG0_37_EAT) ^ hasSuggestion(?p, SG0_38_EAT) ^ hasSuggestion(?p, SG0_39_EAT) ^ hasSuggestion(?p, SG0_40_EAT) ^ hasSuggestion(?p, SG0_41_EAT) ^ hasSuggestion(?p, SG0_42_EAT) ^ hasSuggestion(?p, SG0_43_PHY) ^ hasSuggestion(?p, SG0_44_PHY)
55	2_18_Age_SG_HealthRisk_BMI _LessThan_85	SG0_35_EAT, SG0_36_EAT, SG0_37_EAT, SG0_38_EAT, SG0_39_EAT, SG0_40_EAT, SG0_41_EAT, SG0_42_EAT, SG0_43_PHY, SG0_44_PHY	Patient(?p) ^ hasDecimalAge(?p, ?a) ^ swrlb:greaterThanOrEqual(?a, 2) ^ swrlb:lessThanOrEqual(?a, 18) ^ hasBMIPercentile(?p, ?bmip) ^ swrlb:lessThan(?bmip, 85) ^ hasHealthRisk(?p, ?hr) ^ swrlb:equal(?hr, true) -> hasSuggestion(?p, SG0_35_EAT) ^ hasSuggestion(?p, SG0_36_EAT) ^ hasSuggestion(?p, SG0_37_EAT) ^ hasSuggestion(?p, SG0_38_EAT) ^ hasSuggestion(?p, SG0_39_EAT) ^ hasSuggestion(?p, SG0_40_EAT) ^ hasSuggestion(?p, SG0_41_EAT) ^ hasSuggestion(?p, SG0_42_EAT) ^ hasSuggestion(?p, SG0_43_PHY) ^ hasSuggestion(?p, SG0_44_PHY)
56	2_18_Age_SG_HealthRisk_BMI _85_94	SG1_01_EAT, SG1_02_EAT, SG1_03_EAT, SG1_04_EAT, SG1_05_EAT, SG1_06_PHY, SG1_07_PHY	Patient(?p) ^ hasDecimalAge(?p, ?a) ^ swrlb:greaterThanOrEqual(?a, 2) ^ swrlb:lessThanOrEqual(?a, 18) ^ hasBMIPercentile(?p, ?bmip) ^ swrlb:greaterThanOrEqual(?bmip, 85) ^ swrlb:lessThanOrEqual(?bmip, 94) ^ hasHealthRisk(?p, ?hr) ^ swrlb:equal(?hr, true) -> hasSuggestion(?p, SG1_01_EAT) ^ hasSuggestion(?p, SG1_02_EAT) ^ hasSuggestion(?p, SG1_03_EAT) ^ hasSuggestion(?p, SG1_04_EAT) ^ hasSuggestion(?p, SG1_05_EAT) ^ hasSuggestion(?p, SG1_06_PHY) ^ hasSuggestion(?p, SG1_07_PHY)
57	2_5_Age_SG_BMI_GreaterTha n_95	SG1_01_EAT, SG1_02_EAT, SG1_03_EAT,	Patient(?p) ^ hasDecimalAge(?p, ?a) ^ swrlb:greaterThanOrEqual(?a, 2) ^ swrlb:lessThanOrEqual(?a, 5) ^ hasBMIPercentile(?p, ?bmip) ^ swrlb:greaterThanOrEqual(?bmip, 95) -> hasSuggestion(?p,

		SG1_04_EAT, SG1_05_EAT, SG1_06_PHY, SG1_07_PHY	SG1_01_EAT) ^ hasSuggestion(?p, SG1_02_EAT) ^ hasSuggestion(?p, SG1_03_EAT) ^ hasSuggestion(?p, SG1_04_EAT) ^ hasSuggestion(?p, SG1_05_EAT) ^ hasSuggestion(?p, SG1_06_PHY) ^ hasSuggestion(?p, SG1_07_PHY)
58	6_11_Age_SG_BMI_GreaterThan_95	SG1_01_EAT, SG1_02_EAT, SG1_03_EAT, SG1_04_EAT, SG1_05_EAT, SG1_06_PHY, SG1_07_PHY	Patient(?p) ^ hasDecimalAge(?p, ?a) ^ swrlb:greaterThanOrEqual(?a, 6) ^ swrlb:lessThanOrEqual(?a, 11) ^ hasBMIPercentile(?p, ?bmip) ^ swrlb:greaterThanOrEqual(?bmip, 99) -> hasSuggestion(?p, SG1_01_EAT) ^ hasSuggestion(?p, SG1_02_EAT) ^ hasSuggestion(?p, SG1_03_EAT) ^ hasSuggestion(?p, SG1_04_EAT) ^ hasSuggestion(?p, SG1_05_EAT) ^ hasSuggestion(?p, SG1_06_PHY) ^ hasSuggestion(?p, SG1_07_PHY)
59	12_18_Age_SG_BMI_GreaterThan_95	SG1_01_EAT, SG1_02_EAT, SG1_03_EAT, SG1_04_EAT, SG1_05_EAT, SG1_06_PHY, SG1_07_PHY	Patient(?p) ^ hasDecimalAge(?p, ?a) ^ swrlb:greaterThanOrEqual(?a, 12) ^ swrlb:lessThanOrEqual(?a, 18) ^ hasBMIPercentile(?p, ?bmip) ^ swrlb:greaterThanOrEqual(?bmip, 95) -> hasSuggestion(?p, SG1_01_EAT) ^ hasSuggestion(?p, SG1_02_EAT) ^ hasSuggestion(?p, SG1_03_EAT) ^ hasSuggestion(?p, SG1_04_EAT) ^ hasSuggestion(?p, SG1_05_EAT) ^ hasSuggestion(?p, SG1_06_PHY) ^ hasSuggestion(?p, SG1_07_PHY)
60	-	SG0_01_GEN	Patient(?p) ^ hasDecimalAge(?p, ?a) ^ hasBMIPercentile(?p, ?bp) ^ swrlb:greaterThanOrEqual(?a, 0) ^ swrlb:lessThanOrEqual(?a, 18) ^ swrlb:lessThan(?bp, 5) -> hasSuggestion(?p, SG0_01_GEN)
61	-	SG0_02_GEN	Patient(?p) ^ hasDecimalAge(?p, ?a) ^ swrlb:lessThanOrEqual(?a, 18) ^ swrlb:greaterThan(?bp, 95) ^ hasBMIPercentile(?p, ?bp) ^ swrlb:greaterThanOrEqual(?a, 0) -> hasSuggestion(?p, SG0_02_GEN)
62	-	SG0_03_GEN	Patient(?p) ^ hasDecimalAge(?p, ?a) ^ swrlb:lessThanOrEqual(?a, 94) ^ swrlb:greaterThan(?bp, 84) ^ hasBMIPercentile(?p, ?bp) ^ swrlb:greaterThanOrEqual(?a, 0) -> hasSuggestion(?p, SG0_03_GEN)

Appendix C: Calculation Result Comparisons for CeddCozum and System

#	Pediatric Patient Info	CeddCozum Result	System Result
1	*Decimal Age:* 0.75(9 months) *Gender:* Boy *Weight:* 10 kg *Height:* 75 cm *Waist Circumference:* 45 cm *Head Circumference:* 48 cm	*Weight Z-Score:* 0.59 *Weight Percentile:* 72.57 *Height Z-Score:* 0.77 *Height Percentile:* 77.94 *Head Circ. Z-Score:* -0.55 *Head Circ. Percentile:* 29.12 *BMI:* 17.78 kg/m^2 *BMI Z-Score:* 0.17 *BMI Percentile:* 56.75	*Weight Z-Score:* 0.59 *Weight Percentile:* 72.24 *Height Z-Score:* 0.78 *Height Percentile:* 77.94 *Waist Circ. Z-Score:* 12.15 *Waist Circ. Percentile:* 99.98 *Head Circ. Z-Score:* -0.55 *Head Circ. Percentile:* 29.12 *BMI:* 17.78 kg/m^2 *BMI Z-Score:* 0.17 *BMI Percentile:* 56.75
2	*Decimal Age:* 1 *Gender:* Boy *Weight:* 15 kg *Height:* 90 cm *Waist Circumference:* 50 cm *Head Circumference:* 48 cm	*Weight Z-Score:* 3.15 *Weight Percentile:* 99.92 *Height Z-Score:* 4.06 *Height Percentile:* 99.98 *Head Circ. Z-Score:* 0.62 *Head Circ. Percentile:* 73.57 *BMI:* 18.52 kg/m^2 *BMI Z-Score:* 0.81 *BMI Percentile :* 79.10	*Weight Z-Score:* 3.15 *Weight Percentile:* 99.92 *Height Z-Score:* 4.06 *Height Percentile:* 99.98 *Waist Circ. Z-Score:* 9.12 *Waist Circ. Percentile:* 99.98 *Head Circ. Z-Score:* 0.62 *Head Circ. Percentile:* 73.24 *BMI:* 18.52 kg/m^2 *BMI Z-Score:* 0.81 *BMI Percentile :* 79.10
3	*Decimal Age:* 2 *Gender:* Girl *Weight:* 16 kg *Height:* 90 cm	*Weight Z-Score:* 2.44 *Weight Percentile:* 99.27 *Height Z-Score:* 0.90 *Height Percentile:* 81.59	*Weight Z-Score:* 2.44 *Weight Percentile:* 99.27 *Height Z-Score:* 0.90 *Height Percentile:* 81.59

	Waist Circumference: 45 cm *Head Circumference:* 42 cm	*Head Circ. Z-Score:* -4.17 *Head Circ. Percentile:* 0.02 *BMI:* 19.75 kg/m^2 *BMI Z-Score:* 2.31 *BMI Percentile:* 98.96	*Waist Circ. Z-Score:* -0.38 *Waist Circ. Percentile:* 35.20 *Head Circ. Z-Score:* -4.17 *Head Circ. Percentile:* 0.02 *BMI:* 19.75 kg/m^2 *BMI Z-Score:* 2.31 *BMI Percentile:* 98.96
4	*Decimal Age:* 1.31 (1years 3 months 21 days) *Gender:* Boy *Weight:* 12 kg *Height:* 82 cm *Waist Circumference:* 55 cm *Head Circumference:* 50 cm	*Weight Z-Score:* 0.68 *Weight Percentile:* 75.49 *Height Z-Score:* 0.33 *Height Percentile:* 62.93 *Head Circ. Z-Score:* 1.39 *Head Circ. Percentile:* 91.77 *BMI:* 17.85 kg/m^2 *BMI Z-Score:* 0.61 *BMI Percentile:* 73.24	*Weight Z-Score:* 0.58 *Weight Percentile:* 71.57 *Height Z-Score:* 0.12 *Height Percentile:* 54.78 *Waist Circ. Z-Score:* 2.94 *Waist Circ. Percentile:* 99.84 *Head Circ. Z-Score:* 1.28 *Head Circ. Percentile:* 89.97 *BMI:* 17.85 kg/m^2 *BMI Z-Score:* 0.62 *BMI Percentile:* 73.24 kg/m^2
5	*Decimal Age:* 0.67 (8 months) *Gender:* Girl *Weight:* 8.5 kg *Height:* 68 cm *Waist Circumference:* 39 cm *Head Circumference:* 40 cm	*Weight Z-Score:* 0.30 *Weight Percentile:* 61.79 *Height Z-Score:* -0.60 *Height Percentile:* 27.43 *Head Circ. Z-Score:* -3.02 *Head Circ. Percentile:* 0.13 *BMI:* 18.38 kg/m^2 *BMI Z-Score:* 0.90 *BMI Percentile:* 81.59	*Weight Z-Score:* 0.31 *Weight Percentile:* 61.80 *Height Z-Score:* -0.62 *Height Percentile:* 27.45 *Waist Circ. Z-Score:* -1.13 *Waist Circ. Percentile:* 12.92 *Head Circ. Z-Score:* -3.29 *Head Circ. Percentile:* 0.050 *BMI:* 18.38 kg/m^2 *BMI Z-Score:* 0.90 *BMI Percentile:* 81.59

6	**Decimal Age:** 0.3 (3 months 18 days) **Gender:** Girl **Weight:** 6.5 kg **Height:** 60 cm **Waist Circumference:** 40 cm **Head Circumference:** 45 cm	**Weight Z-Score:** 0.47 **Weight Percentile:** 68.08 **Height Z-Score:** -0.5 **Height Percentile:** 30.85 **Head Circ. Z-Score:** 3.52 **Head Circ. Percentile:** 99.98 **BMI:** 18.02 kg/m^2 **BMI Z-Score:** 1.06 **BMI Percentile:** 85.54	**Weight Z-Score:** 0.49 **Weight Percentile:** 68.10 **Height Z-Score:** -0.51 **Height Percentile:** 30.86 **Waist Circ. Z-Score:** -0.075 **Waist Circ. Percentile:** 47.21 **Head Circ. Z-Score:** 2.91 **Head Circ. Percentile:** 99.82 **BMI:** 18.02 kg/m^2 **BMI Z-Score:** 1.06 **BMI Percentile:** 85.54
7	**Decimal Age:** 16 **Gender:** Girl **Weight:** 48 kg **Height:** 152 cm **Waist Circumference:** 70 cm **Head Circumference:** 62 cm **Health Risk :** No	**Weight Z-Score:** -1.35 **Weight Percentile:** 8.85 **Height Z-Score:** -1.78 **Height Percentile:** 3.75 **Head Circ. Z-Score:** 4.83 **Head Circ. Percentile:** 99.98 **BMI:** 20.78 kg/m^2 **BMI Z-Score:** -0.19 **BMI Percentile:** 42.47	**Weight Z-Score:** -1.35 **Weight Percentile:** 8.85 **Height Z-Score:** -1.78 **Height Percentile:** 3.75 **Waist Circ. Z-Score:** 0.64 **Waist Circ. Percentile:** 73.89 **Head Circ. Z-Score:** 4.83 **Head Circ. Percentile:** 99.98 **BMI:** 20.78 kg/m^2 **BMI Z-Score:** -0.19 **BMI Percentile:** 42.47
8	**Decimal Age:** 14 **Gender:** Boy **Weight:** 55 kg **Height:** 170 cm **Waist Circumference:** 78 cm **Head Circumference:** 64.5 cm **Health Risk :** Yes	**Weight Z-Score:** -0.11 **Weight Percentile:** 45.62 **Height Z-Score:** 0.66 **Height Percentile:** 74.86 **Head Circ. Z-Score:** 5.70 **Head Circ. Percentile:** 99.98 **BMI:** 19.03 kg/m^2	**Weight Z-Score:** -0.11 **Weight Percentile:** 45.62 **Height Z-Score:** 0.66 **Height Percentile:** 74.86 **Waist Circ. Z-Score:** 1.12 **Waist Circ. Percentile:** 86.86 **Head Circ. Z-Score:** 5.70

		BMI Z-Score: -0.51 *BMI Percentile:* 30.50	*Head Circ. Percentile:* 99.98 *BMI:* 19.03 kg/m^2 *BMI Z-Score:* -0.51 *BMI Percentile:* 30.50
9	*Decimal Age:* 4.3 (4 years 3 months 18 days) *Gender:* Boy *Weight:* 17 kg *Height:* 105 cm *Waist Circumference:* 60 cm *Head Circumference:* 56 cm *HealthRisk :* No	*Weight Z-Score:* -0.15 *Weight Percentile:* 44.04 *Height Z-Score:* -7.82 *Height Percentile:* -0.23 *Head Circ. Z-Score:* 40.09 *Head Circ. Percentile:* 99.91 *BMI:* 15.42 kg/m^2 *BMI Z-Score:* -0.16 *BMI Percentile:* 43.64	*Weight Z-Score:* -0.16 *Weight Percentile:* 44.60 *Height Z-Score:* -0.23 *Height Percentile:* 40.90 *Waist Circ. Z-Score:* 2.25 *Waist Circ. Percentile:* 98.78 *Head Circ. Z-Score:* 3.12 *Head Circ. Percentile:* 99.91 *BMI:* 15. 42kg/m^2 *BMI Z-Score:* -0.16 *BMI Percentile:* 43.64
10	*Decimal Age:* 4.3 (4 years 3 months 18 days) *Gender:* Girl *Weight:* 15 kg *Height:* 95 cm *Waist Circumference:* 60 cm *Head Circumference:* 42 cm *Health Risk :* No	*Weight Z-Score:* -0.77 *Weight Percentile:* 22.06 *Height Z-Score:* -2.03 *Height Percentile:* 2.12 *Head Circ. Z-Score:* -5.65 *Head Circ. Percentile:* 0.02 *BMI:* 16.62 kg/m^2 *BMI Z-Score:* 0.82 *BMI Percentile:* 79.39	*Weight Z-Score:* -0.91 *Weight Percentile:* 18.14 *Height Z-Score:* -2.24 *Height Percentile:* 1.25 *Waist Circ. Z-Score:* 2.17 *Waist Circ. Percentile:* 98.50 *Head Circ. Z-Score:* -5.70 *Head Circ. Percentile:* 0.02 *BMI:* 16.62 kg/m^2 *BMI Z-Score:* 0.82 *BMI Percentile:* 79.39
11	*Decimal Age:* 0.33 (3 months 27 days) *Gender:* Boy	*Weight Z-Score:* 1.51 *Weight Percentile:* 93.45 *Height Z-Score:* 1.70	*Weight Z-Score:* 1.51 *Weight Percentile:* 93.45 *Height Z-Score:* 1.70

	Weight: 8.4 kg **Height:** 68 cm **Waist Circumference:** 53 cm **Head Circumference:** 52 cm	**Height Percentile:** 95.54 **Head Circ. Z-Score:** 6.68 **Head Circ. Percentile:** 99.98 **BMI:** 18.17 kg/m^2 **BMI Z-Score:** 0.66 **BMI Percentile:** 74.86	**Height Percentile:** 95.54 **Waist Circ. Z-Score:** 3.90 **Waist Circ. Percentile:** 99.98 **Head Circ. Z-Score:** 6.68 **Head Circ. Percentile:** 99.98 **BMI:** 18.17 kg/m^2 **BMI Z-Score:** 0.66 **BMI Percentile:** 74.86
12	**Decimal Age:** 1.41 (1 years 4 months 27 days) **Gender:** Girl **Weight:** 15 kg **Height:** 87 cm **Waist Circumference:** 38.5 cm **Head Circumference:** 55 cm	**Weight Z-Score:** 3.08 **Weight Percentile:** 99.90 **Height Z-Score:** 2.08 **Height Percentile:** 98.12 **Head Circ. Z-Score:** 6.10 **Head Circ. Percentile:** 99.98 **BMI:** 19.82 kg/m^2 **BMI Z-Score:** 2.11 **BMI Percentile:** 98.26	**Weight Z-Score:** 2.94 **Weight Percentile:** 99.84 **Height Z-Score:** 1.81 **Height Percentile:** 96.49 **Waist Circ. Z-Score:** -2.32 **Waist Circ. Percentile:** 1.02 **Head Circ. Z-Score:** 5.97 **Head Circ. Percentile:** 99.98 **BMI:** 19.82 kg/m^2 **BMI Z-Score:** 2.12 **BMI Percentile:** 98.30
13	**Decimal Age:** 1.07 (1 years 27 days) **Gender:** Boy **Weight:** 6 kg **Height:** 65 cm **Waist Circumference:** 66 cm **Head Circumference:** 52 cm	**Weight Z-Score:** -4.19 **Weight Percentile:** 0.02 **Height Z-Score:** -3.94 **Height Percentile:** 0.02 **Head Circ. Z-Score:** 3.2 **Head Circ. Percentile:** 99.93 **BMI:** 14.20 kg/m^2 **BMI Z-Score:** -2.17 **BMI Percentile:** 1.50	**Weight Z-Score:** -4.39 **Weight Percentile:** 0.02 **Height Z-Score:** -4.16 **Height Percentile:** 0.02 **Waist Circ. Z-Score:** 5.64 **Waist Circ. Percentile:** 99.98 **Head Circ. Z-Score:** 3.06 **Head Circ. Percentile:** 99.89 **BMI:** 14.20 kg/m^2 **BMI Z-Score:** -2.17

			BMI Percentile: 1.50 kg/m²
14	*Decimal Age:* 10.2 (10 years 2 months 10 days) *Gender:* Boy *Weight:* 30 kg *Height:* 140 cm *Waist Circumference:* 78 cm *Head Circumference:* 57 cm *Health Risk :* Yes	*Weight Z-Score:* -0.57 *Weight Percentile:* 28.43 *Height Z-Score:* 0.20 *Height Percentile:* 57.93 *Head Circ. Z-Score:* 2.35 *Head Circ. Percentile:* 99.06 *BMI:* 15.31 kg/m² *BMI Z-Score:* -0.97 *BMI Percentile:* 16.60	*Weight Z-Score:* -0.57 *Weight Percentile:* 28.44 *Height Z-Score:* 0.20 *Height Percentile:* 57.94 *Waist Circ. Z-Score:* 2.06 *Waist Circ. Percentile:* 98.03 *Head Circ. Z-Score:* 2.33 *Head Circ. Percentile:* 99.00 *BMI:* 15.31 kg/m² *BMI Z-Score:* -0.97 *BMI Percentile:* 16.60
15	*Decimal Age:* 7.45 (7 years 5 months 12 days) *Gender:* Girl *Weight:* 30 kg *Height:* 122 cm *Waist Circumference:* 60 cm *Head Circumference:* 43 cm *Health Risk :* Yes	*Weight Z-Score:* 1.26 *Weight Percentile:* 89.62 *Height Z-Score:* -0.32 *Height Percentile:* 37.45 *Head Circ. Z-Score:* -5.94 *Head Circ. Percentile:* 0.02 *BMI:* 20.16 kg/m² *BMI Z-Score:* 1.69 *BMI Percentile:* 95.45	*Weight Z-Score:* 1.28 *Weight Percentile:* 89.65 *Height Z-Score:* -0.32 *Height Percentile:* 37.45 *Waist Circ. Z-Score:* 1.11 *Waist Circ. Percentile:* 86.65 *Head Circ. Z-Score:* -5.96 *Head Circ. Percentile:* 0.02 *BMI:* 20.16 kg/m² *BMI Z-Score:* 1.69 *BMI Percentile:* 95.45

| 16 | **Decimal Age:** 13.72
Gender: Boy
Weight: 60.35 kg
Height: 168.3 cm
Waist Circumference: -
Head Circumference: - | **Weight Z-Score:** 0.53
Weight Percentile: 70.19
Height Z-Score: 0.69
Height Percentile: 75.54
Head Circ. Z-Score: -
Head Circ. Percentile: -
BMI: 21.31 kg/m^2
BMI Z-Score: 0.30
BMI Percentile: 61.79 | **Weight Z-Score:** 0.53
Weight Percentile: 70.19
Height Z-Score: 0.70
Height Percentile: 75.80
Waist Circ. Z-Score: -
Waist Circ. Percentile: -
Head Circ. Z-Score: -
Head Circ. Percentile: -
BMI: 21.31 kg/m^2
BMI Z-Score: 0.30
BMI Percentile: 61.79 |
| 17 | **Decimal Age:** 12.34
Gender: Boy
Weight: 59.25 kg
Height: 155 cm | **Weight Z-Score:** 1.16
Weight Percentile: 87.70
Height Z-Score: 0.27
Height Percentile: 60.64
Head Circ. Z-Score: -
Head Circ. Percentile: -
BMI: 24.66 kg/m^2
BMI Z-Score: 1.34
BMI Percentile: 90.99 | **Weight Z-Score:** 1.16
Weight Percentile: 87.70
Height Z-Score: 0.27
Height Percentile: 60.64
Waist Circ. Z-Score: -
Waist Circ. Percentile: -
Head Circ. Z-Score: -
Head Circ. Percentile: -
BMI: 24.66 kg/m^2
BMI Z-Score: 1.34
BMI Percentile: 90.99 |

| 18 | *Decimal Age:* 13.58
Gender: Boy
Weight: 30 kg
Height: 140 cm | *Weight Z-Score:* -2.86
Weight Percentile: 0.21
Height Z-Score: -2.80
Height Percentile: 0.26
Head Circ. Z-Score: -
Head Circ. Percentile: -
BMI: 15.30 kg/m^2
BMI Z-Score: -2.02
BMI Percentile: 2.17 | *Weight Z-Score:* -2.87
Weight Percentile: 0.21
Height Z-Score: -2.81
Height Percentile: 0.25
Waist Circ. Z-Score: -
Waist Circ. Percentile: -
Head Circ. Z-Score: -
Head Circ. Percentile: -
BMI: 15.31 kg/m^2
BMI Z-Score: -2.02
BMI Percentile: 2.17 |
| 19 | *Decimal Age:* 8.04
Gender: Girl
Weight: 48 kg
Height: 140.5 cm | *Weight Z-Score:* 3.19
Weight Percentile: 99.93
Height Z-Score: 2.55
Height Percentile: 99.46
Head Circ. Z-Score: -
Head Circ. Percentile: -
BMI: 24.32 kg/m^2
BMI Z-Score: 2.44
BMI Percentile: 99.27 | *Weight Z-Score:* 3.20
Weight Percentile: 99.93
Height Z-Score: 2.54
Height Percentile: 99.45
Waist Circ. Z-Score: -
Waist Circ. Percentile: -
Head Circ. Z-Score: -
Head Circ. Percentile: -
BMI: 24.32 kg/m^2
BMI Z-Score: 2.44
BMI Percentile: 99.27 |

| 20 | **Decimal Age:** 11.73
Gender: Boy
Weight: 57.3 kg
Height: 144 cm | **Weight Z-Score:** 1.36
Weight Percentile: 91.31
Height Z-Score: -0.68
Height Percentile: 24.83
Head Circ. Z-Score: -
Head Circ. Percentile: -
BMI: 27.63 kg/m^2
BMI Z-Score: 2.00
BMI Percentile: 97.72 | **Weight Z-Score:** 1.36
Weight Percentile: 91.31
Height Z-Score: -0.68
Height Percentile: 24.83
Waist Circ. Z-Score: -
Waist Circ. Percentile: -
Head Circ. Z-Score: -
Head Circ. Percentile: -
BMI: 27.63 kg/m^2
BMI Z-Score: 2.00
BMI Percentile: 97.72 |
| 21 | **Decimal Age:** 13.82
Gender: Boy
Weight: 72.15 kg
Height: 154.5 cm | **Weight Z-Score:** 1.40
Weight Percentile: 91.92
Height Z-Score: -1.18
Height Percentile: 11.90
Head Circ. Z-Score: -
Head Circ. Percentile: -
BMI: 30.23 kg/m^2
BMI Z-Score: 2.25
BMI Percentile: 98.78 | **Weight Z-Score:** 1.40
Weight Percentile: 91.92
Height Z-Score: -1.18
Height Percentile: 11.90
Waist Circ. Z-Score: -
Waist Circ. Percentile: -
Head Circ. Z-Score: -
Head Circ. Percentile: -
BMI: 30.23 kg/m^2
BMI Z-Score: 2.25
BMI Percentile: 98.78 |

22	**Decimal Age:** 5.41 **Gender:** Girl **Weight:** 29.9 kg **Height:** 106.2 cm	**Weight Z-Score:** 2.76 **Weight Percentile:** 99.71 **Height Z-Score:** -1.14 **Height Percentile:** 12.71 **Head Circ. Z-Score:** - **Head Circ. Percentile:** - **BMI:** 26.51 kg/m^2 **BMI Z-Score:** 3.53 **BMI Percentile:** 99.98	**Weight Z-Score:** 2.76 **Weight Percentile:** 99.71 **Height Z-Score:** -1.14 **Height Percentile:** 12.71 **Waist Circ. Z-Score:** - **Waist Circ. Percentile:** - **Head Circ. Z-Score:** - **Head Circ. Percentile:** - **BMI:** 26.51 kg/m^2 **BMI Z-Score:** 3.53 **BMI Percentile:** 99.98
23	**Decimal Age:** 6.04 **Gender:** Girl **Weight:** 48.6 kg **Height:** 135 cm	**Weight Z-Score:** 4.84 **Weight Percentile:** 99.98 **Height Z-Score:** 4.09 **Height Percentile:** 99.98 **Head Circ. Z-Score:** - **Head Circ. Percentile:** - **BMI:** 26.67 kg/m^2 **BMI Z-Score:** 3.22 **BMI Percentile:** 99.94	**Weight Z-Score:** 4.84 **Weight Percentile:** 99.98 **Height Z-Score:** 4.10 **Height Percentile:** 99.98 **Waist Circ. Z-Score:** - **Waist Circ. Percentile:** - **Head Circ. Z-Score:** - **Head Circ. Percentile:** - **BMI:** 26.67 kg/m^2 **BMI Z-Score:** 3.22 **BMI Percentile:** 99.94

| 24 | **Decimal Age:** 6.20
Gender: Girl
Weight: 29.9 kg
Height: 106.2 cm | **Weight Z-Score:** 2.16
Weight Percentile: 98.50
Height Z-Score: -2.11
Height Percentile: 1.74
Head Circ. Z-Score: -
Head Circ. Percentile: -
BMI: 26.51 kg/m^2
BMI Z-Score: 3.17
BMI Percentile: 99.92 | **Weight Z-Score:** 2.16
Weight Percentile: 98.46
Height Z-Score: -2.12
Height Percentile: 1.70
Waist Circ. Z-Score: -
Waist Circ. Percentile: -
Head Circ. Z-Score: -
Head Circ. Percentile: -
BMI: 26.51 kg/m^2
BMI Z-Score: 3.17
BMI Percentile: 99.92 |
| 25 | **Decimal Age:** 11.30
Gender: Girl
Weight: 69.15 kg
Height: 154 cm | **Weight Z-Score:** 2.76
Weight Percentile: 99.71
Height Z-Score: 0.92
Height Percentile: 82.12
Head Circ. Z-Score: -
Head Circ. Percentile: -
BMI: 29.16 kg/m^2
BMI Z-Score: 2.58
BMI Percentile: 99.51 | **Weight Z-Score:** 2.76
Weight Percentile: 99.71
Height Z-Score: 0.93
Height Percentile: 82.12
Waist Circ. Z-Score: -
Waist Circ. Percentile: -
Head Circ. Z-Score: -
Head Circ. Percentile: -
BMI: 29.16 kg/m^2
BMI Z-Score: 2.58
BMI Percentile: 99.51 |

26	**Decimal Age:** 12.00 **Gender:** Boy **Weight:** 64 kg **Height:** 147.5 cm	**Weight Z-Score:** 1.66 **Weight Percentile:** 95.15 **Height Z-Score:** -0.45 **Height Percentile:** 32.64 **Head Circ. Z-Score:** - **Head Circ. Percentile:** - **BMI:** 29.49 kg/m^2 **BMI Z-Score:** 2.22 **BMI Percentile:** 98.68	**Weight Z-Score:** 1.66 **Weight Percentile:** 95.15 **Height Z-Score:** -0.46 **Height Percentile:** 32.28 **Waist Circ. Z-Score:** - **Waist Circ. Percentile:** - **Head Circ. Z-Score:** - **Head Circ. Percentile:** - **BMI:** 29.42 kg/m^2 **BMI Z-Score:** 2.22 **BMI Percentile:** 98.68
27	**Decimal Age:** 13.60 **Gender:** Boy **Weight:** 78.15 kg **Height:** 155 cm	**Weight Z-Score:** 1.94 **Weight Percentile:** 97.38 **Height Z-Score:** -0.86 **Height Percentile:** 19.49 **Head Circ. Z-Score:** - **Head Circ. Percentile:** - **BMI:** 32.53 kg/m^2 **BMI Z-Score:** 2.62 **BMI Percentile:** 99.56	**Weight Z-Score:** 1.95 **Weight Percentile:** 97.44 **Height Z-Score:** -0.85 **Height Percentile:** 19.77 **Waist Circ. Z-Score:** - **Waist Circ. Percentile:** - **Head Circ. Z-Score:** - **Head Circ. Percentile:** - **BMI:** 32.53 kg/m^2 **BMI Z-Score:** 2.62 **BMI Percentile:** 99.56

28	**Decimal Age:** 6.26 **Gender:** Girl **Weight:** 34.6 kg **Height:** 127.5 cm	**Weight Z-Score:** 2.93 **Weight Percentile:** 99.83 **Height Z-Score:** 2.26 **Height Percentile:** 98.81 **Head Circ. Z-Score:** - **Head Circ. Percentile:** - **BMI:** 21.28 kg/m^2 **BMI Z-Score:** 2.21 **BMI Percentile:** 98.64	**Weight Z-Score:** 2.93 **Weight Percentile:** 99.83 **Height Z-Score:** 2.27 **Height Percentile:** 98.84 **Waist Circ. Z-Score:** - **Waist Circ. Percentile:** - **Head Circ. Z-Score:** - **Head Circ. Percentile:** - **BMI:** 21.28 kg/m^2 **BMI Z-Score:** 2.21 **BMI Percentile:** 98.64
29	**Decimal Age:** 9.69 **Gender:** Girl **Weight:** 68.2 kg **Height:** 161 cm	**Weight Z-Score:** 3.56 **Weight Percentile:** 99.98 **Height Z-Score:** 3.97 **Height Percentile:** 99.98 **Head Circ. Z-Score:** - **Head Circ. Percentile:** - **BMI:** 26.31 kg/m^2 **BMI Z-Score:** 2.41 **BMI Percentile:** 99.20	**Weight Z-Score:** 3.56 **Weight Percentile:** 99.98 **Height Z-Score:** 3.97 **Height Percentile:** 99.98 **Waist Circ. Z-Score:** - **Waist Circ. Percentile:** - **Head Circ. Z-Score:** - **Head Circ. Percentile:** - **BMI:** 26.31 kg/m^2 **BMI Z-Score:** 2.41 **BMI Percentile:** 99.20

| 30 | **Decimal Age:** 6.15
Gender: Girl
Weight: 20.10 kg
Height: 118 cm | **Weight Z-Score:** -0.27
Weight Percentile: 39.36
Height Z-Score: 0.42
Height Percentile: 66.28
Head Circ. Z-Score: -
Head Circ. Percentile: -
BMI: 14.44 kg/m^2
BMI Z-Score: -0.72
BMI Percentile: 23.58 | **Weight Z-Score:** -0.27
Weight Percentile: 39.36
Height Z-Score: 0.42
Height Percentile: 66.28
Waist Circ. Z-Score: -
Waist Circ. Percentile: -
Head Circ. Z-Score: -
Head Circ. Percentile: -
BMI: 14.44 kg/m^2
BMI Z-Score: -0.72
BMI Percentile: 23.58 |
| 31 | **Decimal Age:** 13.31
Gender: Boy
Weight: 135.1 kg
Height: 180 cm | **Weight Z-Score:** 4.89
Weight Percentile: 99.98
Height Z-Score: 2.56
Height Percentile: 99.48
Head Circ. Z-Score: -
Head Circ. Percentile: -
BMI: 41.70 kg/m^2
BMI Z-Score: 3.69
BMI Percentile: 99.98 | **Weight Z-Score:** 4.89
Weight Percentile: 99.98
Height Z-Score: 2.56
Height Percentile: 99.48
Waist Circ. Z-Score: -
Waist Circ. Percentile: -
Head Circ. Z-Score: -
Head Circ. Percentile: -
BMI: 41.70 kg/m^2
BMI Z-Score: 3.69
BMI Percentile: 99.98 |

| 32 | **Decimal Age:** 9.57
Gender: Girl
Weight: 57.4 kg
Height: 156 cm | **Weight Z-Score:** 2.92
Weight Percentile: 99.82
Height Z-Score: 3.33
Height Percentile: 99.96
Head Circ. Z-Score: -
Head Circ. Percentile: -
BMI: 23.59 kg/m^2
BMI Z-Score: 1.96
BMI Percentile: 97.50 | **Weight Z-Score:** 2.92
Weight Percentile: 99.82
Height Z-Score: 3.33
Height Percentile: 99.96
Waist Circ. Z-Score: -
Waist Circ. Percentile: -
Head Circ. Z-Score: -
Head Circ. Percentile: -
BMI: 23.59 kg/m^2
BMI Z-Score: 1.96
BMI Percentile: 97.5 |
| 33 | **Decimal Age:** 12.64
Gender: Boy
Weight: 79.35 kg
Height: 164.3 cm | **Weight Z-Score:** 2.40
Weight Percentile: 99.18
Height Z-Score: 1.20
Height Percentile: 88.49
Head Circ. Z-Score: -
Head Circ. Percentile: -
BMI: 29.39 kg/m^2
BMI Z-Score: 2.19
BMI Percentile: 98.60 | **Weight Z-Score:** 2.40
Weight Percentile: 99.18
Height Z-Score: 1.20
Height Percentile: 88.49
Waist Circ. Z-Score: -
Waist Circ. Percentile: -
Head Circ. Z-Score: -
Head Circ. Percentile: -
BMI: 29.39 kg/m^2
BMI Z-Score: 2.19
BMI Percentile: 98.57 |

34	**Decimal Age:** 13.45 **Gender:** Boy **Weight:** 62 kg **Height:** 159 cm	**Weight Z-Score:** 0.81 **Weight Percentile:** 79.39 **Height Z-Score:** -0.25 **Height Percentile:** 40.13 **Head Circ. Z-Score:** - **Head Circ. Percentile:** - **BMI:** 24.52 kg/m^2 **BMI Z-Score:** 1.18 **BMI Percentile:** 88.0	**Weight Z-Score:** 0.82 **Weight Percentile:** 79.39 **Height Z-Score:** -0.25 **Height Percentile:** 40.13 **Waist Circ. Z-Score:** - **Waist Circ. Percentile:** - **Head Circ. Z-Score:** - **Head Circ. Percentile:** - **BMI:** 24.52 kg/m^2 **BMI Z-Score:** 1.18 **BMI Percentile:** 88.1
35	**Decimal Age:** 9.92 **Gender:** Boy **Weight:** 47.2 kg **Height:** 138 cm	**Weight Z-Score:** 1.89 **Weight Percentile:** 97.06 **Height Z-Score:** 0.15 **Height Percentile:** 55.96 **Head Circ. Z-Score:** - **Head Circ. Percentile:** - **BMI:** 24.78 kg/m^2 **BMI Z-Score:** 2.11 **BMI Percentile:** 98.26	**Weight Z-Score:** 1.90 **Weight Percentile:** 97.13 **Height Z-Score:** 0.17 **Height Percentile:** 56.75 **Waist Circ. Z-Score:** - **Waist Circ. Percentile:** - **Head Circ. Z-Score:** - **Head Circ. Percentile:** - **BMI:** 24.78 kg/m^2 **BMI Z-Score:** 2.12 **BMI Percentile:** 98.30

36	**Decimal Age:** 10.47 **Gender:** Girl **Weight:** 35 kg **Height:** 150 cm	**Weight Z-Score:** -0.030 **Weight Percentile:** 48.80 **Height Z-Score:** 1.29 **Height Percentile:** 90.15 **Head Circ. Z-Score:** - **Head Circ. Percentile:** - **BMI:** 15.56 kg/m^2 **BMI Z-Score:** -0.87 **BMI Percentile:** 19.22	**Weight Z-Score:** -0.041 **Weight Percentile:** 48.40 **Height Z-Score:** 1.28 **Height Percentile:** 89.97 **Waist Circ. Z-Score:** - **Waist Circ. Percentile:** - **Head Circ. Z-Score:** - **Head Circ. Percentile:** - **BMI:** 15.56 kg/m^2 **BMI Z-Score:** -0.87 **BMI Percentile:** 19.22
37	**Decimal Age:** 12.37 **Gender:** Boy **Weight:** 79.6 kg **Height:** 165 cm	**Weight Z-Score:** 2.51 **Weight Percentile:** 99.40 **Height Z-Score:** 1.57 **Height Percentile:** 94.18 **Head Circ. Z-Score:** - **Head Circ. Percentile:** - **BMI:** 29.24 kg/m^2 **BMI Z-Score:** 2.17 **BMI Percentile:** 98.54	**Weight Z-Score:** 2.51 **Weight Percentile:** 99.40 **Height Z-Score:** 1.58 **Height Percentile:** 94.29 **Waist Circ. Z-Score:** - **Waist Circ. Percentile:** - **Head Circ. Z-Score:** - **Head Circ. Percentile:** - **BMI:** 29.24 kg/m^2 **BMI Z-Score:** 2.18 **BMI Percentile:** 98.54

| 38 | **Decimal Age:** 12.51
Gender: Boy
Weight: 89 kg
Height: 153.5 cm | **Weight Z-Score:** 2.98
Weight Percentile: 99.86
Height Z-Score: -0.10
Height Percentile: 46.02
Head Circ. Z-Score: -
Head Circ. Percentile: -
BMI: 37.77 kg/m^2
BMI Z-Score: 3.27
BMI Percentile: 99.95 | **Weight Z-Score:** 2.98
Weight Percentile: 99.86
Height Z-Score: -0.10
Height Percentile: 46.02
Waist Circ. Z-Score: -
Waist Circ. Percentile: -
Head Circ. Z-Score: -
Head Circ. Percentile: -
BMI: 37.77 kg/m^2
BMI Z-Score: 3.27
BMI Percentile: 99.95 |
| 39 | **Decimal Age:** 7.98
Gender: Girl
Weight : 44.8 kg
Height: 140 cm | **Weight Z-Score:** 2.91
Weight Percentile: 99.82
Height Z-Score: 2.52
Height Percentile: 99.41
Head Circ. Z-Score: -
Head Circ. Percentile: -
BMI: 22.86 kg/m^2
BMI Z-Score: 2.19
BMI Percentile: 98.60 | **Weight Z-Score:** 2.91
Weight Percentile: 99.82
Height Z-Score: 2.52
Height Percentile: 99.41
Waist Circ. Z-Score: -
Waist Circ. Percentile: -
Head Circ. Z-Score: -
Head Circ. Percentile: -
BMI: 22.86 kg/m^2
BMI Z-Score: 2.20
BMI Percentile: 98.61 |

| 40 | **Decimal Age:** 8.69
Gender: Girl
Weight: 54.5 kg
Height: 140 cm | **Weight Z-Score:** 3.31
Weight Percentile: 99.95
Height Z-Score: 1.69
Height Percentile: 99.45
Head Circ. Z-Score: -
Head Circ. Percentile: -
BMI: 27.80 kg/m^2
BMI Z-Score: 2.79
BMI Percentile: 99.74 | **Weight Z-Score:** 3.30
Weight Percentile: 99.95
Height Z-Score: 1.70
Height Percentile: 95.45
Waist Circ. Z-Score: -
Waist Circ. Percentile: -
Head Circ. Z-Score: -
Head Circ. Percentile: -
BMI: 27.81 kg/m^2
BMI Z-Score: 2.79
BMI Percentile: 99.74 |
| 41 | **Decimal Age:** 9.46
Gender: Girl
Weight: 50 kg
Height: 135 cm | **Weight Z-Score:** 2.40
Weight Percentile: 99.15
Height Z-Score: 0.04
Height Percentile: 51.60
Head Circ. Z-Score: -
Head Circ. Percentile: -
BMI: 27.43 kg/m^2
BMI Z-Score: 2.61
BMI Percentile: 99.55 | **Weight Z-Score:** 2.40
Weight Percentile: 99.16
Height Z-Score: 0.04
Height Percentile: 51.60
Waist Circ. Z-Score: -
Waist Circ. Percentile: -
Head Circ. Z-Score: -
Head Circ. Percentile: -
BMI: 27.43 kg/m^2
BMI Z-Score: 2.61
BMI Percentile: 99.55 |

| 42 | **Decimal Age:** 8.23
Gender: Girl
Weight: 66.9 kg
Height: 144 cm | **Weight Z-Score:** 4.43
Weight Percentile: 99.98
Height Z-Score: 2.94
Height Percentile: 99.84
Head Circ. Z-Score: -
Head Circ. Percentile: -
BMI: 32.26 kg/m^2
BMI Z-Score: 3.29
BMI Percentile: 99.95 | **Weight Z-Score:** 4.44
Weight Percentile: 99.98
Height Z-Score: 2.94
Height Percentile: 99.84
Waist Circ. Z-Score: -
Waist Circ. Percentile: -
Head Circ. Z-Score: -
Head Circ. Percentile: -
BMI: 32.26 kg/m^2
BMI Z-Score: 3.29
BMI Percentile: 99.95 |
| 43 | **Decimal Age:** 10
Gender: Boy
Weight: 39.5 kg
Height: 139.5 cm | **Weight Z-Score:** 1.05
Weight Percentile: 85.31
Height Z-Score: 0.33
Height Percentile: 62.93
Head Circ. Z-Score: -
Head Circ. Percentile: -
BMI: 20.30 kg/m^2
BMI Z-Score: 1.11
BMI Percentile: 86.65 | **Weight Z-Score:** 1.05
Weight Percentile: 85.31
Height Z-Score: 0.33
Height Percentile: 62.93
Waist Circ. Z-Score: -
Waist Circ. Percentile: -
Head Circ. Z-Score: -
Head Circ. Percentile: -
BMI: 20.30 kg/m^2
BMI Z-Score: 1.11
BMI Percentile: 86.65 |

| 44 | Decimal Age: 8.62
Gender: Girl
Weight: 46.5 kg
Height: 140.5 cm | Weight Z-Score: 2.65
Weight Percentile: 99.60
Height Z-Score: 1.85
Height Percentile: 96.78
Head Circ. Z-Score: -
Head Circ. Percentile: -
BMI: 23.56 kg/m^2
BMI Z-Score: 2.18
BMI Percentile: 98.57 | Weight Z-Score: 2.65
Weight Percentile: 99.60
Height Z-Score: 1.86
Height Percentile: 96.86
Waist Circ. Z-Score: -
Waist Circ. Percentile: -
Head Circ. Z-Score: -
Head Circ. Percentile: -
BMI: 23.56 kg/m^2
BMI Z-Score: 2.18
BMI Percentile: 98.54 |
| 45 | Decimal Age: 5.32
Gender: Girl
Weight: 25.05 kg
Height: 108.7 cm | Weight Z-Score: 1.78
Weight Percentile: 96.25
Height Z-Score : -0.49
Height Percentile: 31.21
Head Circ. Z-Score: -
Head Circ. Percentile: -
BMI: 21.20 kg/m^2
BMI Z-Score: 2.48
BMI Percentile: 99.34 | Weight Z-Score: 1.78
Weight Percentile: 96.16
Height Z-Score: -0.50
Height Percentile: 30.85
Waist Circ. Z-Score: -
Waist Circ. Percentile: -
Head Circ. Z-Score: -
Head Circ. Percentile: -
BMI: 21.20 kg/m^2
BMI Z-Score: 2.48
BMI Percentile: 99.34 |

| 46 | **Decimal Age:** 10.5
Gender: Boy
Weight: 36.15 kg
Height: 146 cm | **Weight Z-Score:** 0.17
Weight Percentile: 56.75
Height Z-Score: 0.86
Height Percentile: 80.50
Head Circ. Z-Score: -
Head Circ. Percentile: -
BMI: 16.95 kg/m^2
BMI Z-Score: -0.28
BMI Percentile: 38.97 | **Weight Z-Score:** 0.17
Weight Percentile: 56.75
Height Z-Score: 0.86
Height Percentile: 80.51
Waist Circ. Z-Score: -
Waist Circ. Percentile: -
Head Circ. Z-Score: -
Head Circ. Percentile: -
BMI: 16.96 kg/m^2
BMI Z-Score: -0.28
BMI Percentile: 38.97 |
| 47 | **Decimal Age:** 8.1
Gender: Girl
Weight: 43.95 kg
Height: 145 cm | **Weight Z-Score:** 2.74
Weight Percentile: 99.69
Height Z-Score: 3.31
Height Percentile: 99.95
Head Circ. Z-Score: -
Head Circ. Percentile: -
BMI: 20.90 kg/m^2
BMI Z-Score: 1.75
BMI Percentile: 95.99 | **Weight Z-Score:** 2.74
Weight Percentile: 99.69
Height Z-Score: 3.31
Height Percentile: 99.95
Waist Circ. Z-Score: -
Waist Circ. Percentile: -
Head Circ. Z-Score: -
Head Circ. Percentile: -
BMI: 20.90 kg/m^2
BMI Z-Score: 1.75
BMI Percentile: 95.99 |

48	**Decimal Age:** 14.11 **Gender:** Boy **Weight:** 65.5 kg **Height:** 160 cm	**Weight Z-Score:** 0.76 **Weight Percentile:** 77.0 **Height Z-Score:** -0.70 **Height Percentile:** 24.0 **Head Circ. Z-Score:** - **Head Circ. Percentile:** - **BMI:** 25.59 kg/m^2 **BMI Z-Score:** 1.35 **BMI Percentile:** 91.0	**Weight Z-Score:** 0.75 **Weight Percentile:** 77.34 **Height Z-Score:** -0.72 **Height Percentile:** 23.58 **Waist Circ. Z-Score:** - **Waist Circ. Percentile:** - **Head Circ. Z-Score:** - **Head Circ. Percentile:** - **BMI:** 25.59 kg/m^2 **BMI Z-Score:** 1.34 **BMI Percentile:** 90.99
49	**Decimal Age:** 8.41 **Gender:** Girl **Weight:** 32.85 kg **Height:** 125.5 cm	**Weight Z-Score:** 1.08 **Weight Percentile:** 85.99 **Height Z-Score:** -0.62 **Height Percentile:** 26.76 **Head Circ. Z-Score:** - **Head Circ. Percentile:** - **BMI:** 20.86 kg/m^2 **BMI Z-Score:** 1.66 **BMI Percentile:** 95.15	**Weight Z-Score:** 1.08 **Weight Percentile:** 85.99 **Height Z-Score:** -0.62 **Height Percentile:** 26.76 **Waist Circ. Z-Score:** - **Waist Circ. Percentile:** - **Head Circ. Z-Score:** - **Head Circ. Percentile:** - **BMI:** 20.86 kg/m^2 **BMI Z-Score:** 1.66 **BMI Percentile:** 95.15

| 50 | **Decimal Age:** 10.28
Gender: Girl
Weight: 85.95 kg
Height: 161 cm | **Weight Z-Score:** 4.20
Weight Percentile: 99.98
Height Z-Score: 3.19
Height Percentile: 99.93
Head Circ. Z-Score: -
Head Circ. Percentile: -
BMI: 33.16 kg/m^2
BMI Z-Score: 3.18
BMI Percentile: 99.93 | **Weight Z-Score:** 4.18
Weight Percentile: 99.98
Height Z-Score: 3.19
Height Percentile: 99.51
Waist Circ. Z-Score: -
Waist Circ. Percentile: -
Head Circ. Z-Score: -
Head Circ. Percentile: -
BMI: 33.16 kg/m^2
BMI Z-Score: 3.15
BMI Percentile: 99.92 |
| 51 | **Decimal Age:** 9.46
Gender: Girl
Weight: 52.2 kg
Height: 145.5 cm | **Weight Z-Score:** 4.61
Weight Percentile: 99.98
Height Z-Score: 1.76
Height Percentile: 95.99
Head Circ. Z-Score: -
Head Circ. Percentile: -
BMI: 33.16 kg/m^2
BMI Z-Score: 3.24
BMI Percentile: 99.94 | **Weight Z-Score:** 4.60
Weight Percentile: 99.98
Height Z-Score: 1.76
Height Percentile: 99.51
Waist Circ. Z-Score: -
Waist Circ. Percentile: -
Head Circ. Z-Score: -
Head Circ. Percentile: -
BMI: 33.16 kg/m^2
BMI Z-Score: 3.15
BMI Percentile: 99.92 |

52	**Decimal Age:** 6.82 **Gender:** Girl **Weight:** 31.3 kg **Height:** 118 cm	**Weight Z-Score:** 1.95 **Weight Percentile:** 97.44 **Height Z-Score:** -0.42 **Height Percentile:** 33.72 **Head Circ. Z-Score:** - **Head Circ. Percentile:** - **BMI:** 22.48 kg/m^2 **BMI Z-Score:** 2.36 **BMI Percentile:** 99.09	**Weight Z-Score:** 2.11 **Weight Percentile:** 98.26 **Height Z-Score:** -0.14 **Height Percentile:** 44.43 **Waist Circ. Z-Score:** - **Waist Circ. Percentile:** - **Head Circ. Z-Score:** - **Head Circ. Percentile:** - **BMI:** 22.48 kg/m^2 **BMI Z-Score:** 2.41 **BMI Percentile:** 99.20
53	**Decimal Age:** 7.54 **Gender:** Girl **Weight:** 39.05 kg **Height:** 136 cm	**Weight Z-Score:** 2.57 **Weight Percentile:** 99.49 **Height Z-Score:** 2.30 **Height Percentile:** 98.93 **Head Circ. Z-Score:** - **Head Circ. Percentile:** - **BMI:** 21.11 kg/m^2 **BMI Z-Score:** 1.91 **BMI Percentile:** 97.19	**Weight Z-Score:** 2.57 **Weight Percentile:** 99.49 **Height Z-Score:** 2.30 **Height Percentile:** 98.93 **Waist Circ. Z-Score:** - **Waist Circ. Percentile:** - **Head Circ. Z-Score:** - **Head Circ. Percentile:** - **BMI:** 21.11 kg/m^2 **BMI Z-Score:** 1.91 **BMI Percentile:** 97.19

| 54 | **Decimal Age:** 6.59
Gender: Boy
Weight: 58.3 kg
Height: 151 cm | **Weight Z-Score:** 4.84
Weight Percentile: 99.98
Height Z-Score: 6.49
Height Percentile: 99.98
Head Circ. Z-Score: -
Head Circ. Percentile: -
BMI: 25.56 kg/m^2
BMI Z-Score: 3.40
BMI Percentile: 99.97 | **Weight Z-Score:** 4.84
Weight Percentile: 99.98
Height Z-Score: 6.49
Height Percentile: 99.98
Waist Circ. Z-Score: -
Waist Circ. Percentile: -
Head Circ. Z-Score: -
Head Circ. Percentile: -
BMI: 25.57 kg/m^2
BMI Z-Score: 3.40
BMI Percentile: 99.97 |
| 55 | **Decimal Age:** 16
Gender: Girl
Weight: 82 kg
Height: 171.5 cm | **Weight Z-Score:** 3.03
Weight Percentile: 99.88
Height Z-Score: 1.55
Height Percentile: 93.94
Head Circ. Z-Score: -
Head Circ. Percentile: -
BMI: 27.88 kg/m^2
BMI Z-Score: 2.10
BMI Percentile: 98.21 | **Weight Z-Score:** 3.03
Weight Percentile: 99.88
Height Z-Score: 1.56
Height Percentile: 93.94
Waist Circ. Z-Score: -
Waist Circ. Percentile: -
Head Circ. Z-Score: -
Head Circ. Percentile: -
BMI: 27.88 kg/m^2
BMI Z-Score: 2.10
BMI Percentile: 98.21 |

56	**Decimal Age:** 8.08 **Gender:** Girl **Weight:** 42.2 kg **Height:** 130 cm	**Weight Z-Score:** 2.57 **Weight Percentile:** 99.49 **Height Z-Score:** 0.54 **Height Percentile:** 70.54 **Head Circ. Z-Score:** - **Head Circ. Percentile:** - **BMI:** 24.97 kg/m^2 **BMI Z-Score:** 2.53 **BMI Percentile:** 99.43	**Weight Z-Score:** 2.56 **Weight Percentile:** 99.48 **Height Z-Score:** 0.54 **Height Percentile:** 70.54 **Waist Circ. Z-Score:** - **Waist Circ. Percentile:** - **Head Circ. Z-Score:** - **Head Circ. Percentile:** - **BMI:** 24.97 kg/m^2 **BMI Z-Score:** 2.53 **BMI Percentile:** 99.43
57	**Decimal Age:** 10.59 **Gender:** Girl **Weight:** 72.25 kg **Height:** 156.5 cm	**Weight Z-Score:** 3.31 **Weight Percentile:** 99.95 **Height Z-Score:** 2.10 **Height Percentile:** 98.21 **Head Circ. Z-Score:** - **Head Circ. Percentile:** - **BMI:** 29.5 kg/m^2 **BMI Z-Score :** 2.72 **BMI Percentile:** 99.67	**Weight Z-Score:** 3.31 **Weight Percentile:** 99.95 **Height Z-Score:** 2.09 **Height Percentile:** 98.17 **Waist Circ. Z-Score:** - **Waist Circ. Percentile:** - **Head Circ. Z-Score:** - **Head Circ. Percentile:** - **BMI:** 29.50 kg/m^2 **BMI Z-Score:** 2.72 **BMI Percentile:** 99.67

| 58 | **Decimal Age:** 11.08
Gender: Girl
Weight: 44.4 kg
Height: 142.5 cm | **Weight Z-Score:** 0.68
Weight Percentile: 75.0
Height Z-Score: -0.52
Height Percentile: 30.0
Head Circ. Z-Score: -
Head Circ. Percentile: -
BMI: 21.80 kg/m^2
BMI Z-Score: 1.18
BMI Percentile: 88.10 | **Weight Z-Score:** 0.68
Weight Percentile: 75.17
Height Z-Score: -0.52
Height Percentile: 30.15
Waist Circ. Z-Score: -
Waist Circ. Percentile: -
Head Circ. Z-Score: -
Head Circ. Percentile: -
BMI: 21.87 kg/m^2
BMI Z-Score: 1.18
BMI Percentile: 88.10 |
| 59 | **Decimal Age:** 13.52
Gender: Boy
Weight: 86 kg
Height: 179.5 cm | **Weight Z-Score:** 2.45
Weight Percentile: 99.29
Height Z-Score: 2.30
Height Percentile: 98.93
Head Circ. Z-Score: -
Head Circ. Percentile: -
BMI: 26.69 kg/m^2
BMI Z-Score: 1.63
BMI Percentile: 94.84 | **Weight Z-Score:** 2.45
Weight Percentile: 99.29
Height Z-Score: 2.30
Height Percentile: 98.93
Waist Circ. Z-Score: -
Waist Circ. Percentile: -
Head Circ. Z-Score: -
Head Circ. Percentile: -
BMI: 26.69 kg/m^2
BMI Z-Score: 1.64
BMI Percentile: 94.84 |

| 60 | **Decimal Age:** 9.23
Gender: Boy
Weight: 45.1 kg
Height: 136 cm | **Weight Z-Score:** 2.11
Weight Percentile: 98.26
Height Z-Score: 0.47
Height Percentile: 68.08
Head Circ. Z-Score: -
Head Circ. Percentile: -
BMI: 24.38 kg/m^2
BMI Z-Score: 2.27
BMI Percentile: 98.84 | **Weight Z-Score:** 2.11
Weight Percentile: 98.26
Height Z-Score: 0.47
Height Percentile: 68.08
Waist Circ. Z-Score: -
Waist Circ. Percentile: -
Head Circ. Z-Score: -
Head Circ. Percentile: -
BMI: 24.38 kg/m^2
BMI Z-Score: 2.27
BMI Percentile: 98.84 |
| 61 | **Decimal Age:** 9.91
Gender: Girl
Weight: 71.9 kg
Height: 146 cm | **Weight Z-Score:** 3.63
Weight Percentile: 99.98
Height Z-Score: 1.34
Height Percentile: 90.0
Head Circ. Z-Score: -
Head Circ. Percentile: -
BMI: 33.78 kg/m^2
BMI Z-Score: 3.25
BMI Percentile: 99.0 | **Weight Z-Score:** 3.63
Weight Percentile: 99.98
Height Z-Score: 1.34
Height Percentile: 90.99
Waist Circ. Z-Score: -
Waist Circ. Percentile: -
Head Circ. Z-Score: -
Head Circ. Percentile: -
BMI: 33.73 kg/m^2
BMI Z-Score: 3.25
BMI Percentile: 99.94 |

| 62 | **Decimal Age:** 8.19
 Gender: Girl
 Weight: 24.5 kg
 Height: 127.5 cm | **Weight Z-Score:** -0.42
 Weight Percentile: 33.72
 Height Z-Score: -0.05
 Height Percentile: 48.01
 Head Circ. Z-Score: -
 Head Circ. Percentile: -
 BMI: 15.07 kg/m^2
 BMI Z-Score: -0.50
 BMI Percentile: 30.85 | **Weight Z-Score:** -0.43
 Weight Percentile: 33.36
 Height Z-Score: -0.052
 Height Percentile: 48.01
 Waist Circ. Z-Score: -
 Waist Circ. Percentile: -
 Head Circ. Z-Score: -
 Head Circ. Percentile: -
 BMI: 15.07 kg/m^2
 BMI Z-Score: -0.50
 BMI Percentile: 30.85 |
| 63 | **Decimal Age:** 8.81
 Gender: Girl
 Weight: 47.2 kg
 Height: 130.5 cm | **Weight Z-Score:** 2.59
 Weight Percentile: 99.0
 Height Z-Score: -0.10
 Height Percentile: 46.0
 Head Circ. Z-Score: -
 Head Circ. Percentile: -
 BMI: 27.72 kg/m^2
 BMI Z-Score: 2.76
 BMI Percentile: 99.98 | **Weight Z-Score:** 2.60
 Weight Percentile: 99.52
 Height Z-Score: -0.10
 Height Percentile: 46.02
 Waist Circ. Z-Score: -
 Waist Circ. Percentile: -
 Head Circ. Z-Score: -
 Head Circ. Percentile: -
 BMI: 27.72 kg/m^2
 BMI Z-Score: 2.76
 BMI Percentile: 99.71 |

| 64 | **Decimal Age:** 15
Gender: Girl
Weight: 61.01 kg
Height: 158.5 cm | **Weight Z-Score:** 0.82
Weight Percentile: 79.39
Height Z-Score: 1.18
Height Percentile: 79.12
Head Circ. Z-Score: -
Head Circ. Percentile: -
BMI: 24.30 kg/m^2
BMI Z-Score: 1.18
BMI Percentile: 88.10 | **Weight Z-Score:** 0.82
Weight Percentile: 79.39
Height Z-Score: 1.18
Height Percentile: 79.12
Waist Circ. Z-Score: -
Waist Circ. Percentile: -
Head Circ. Z-Score: -
Head Circ. Percentile: -
BMI: 24.30 kg/m^2
BMI Z-Score: 1.18
BMI Percentile: 88.10 |
| 65 | **Decimal Age:** 11.13
Gender: Girl
Weight: 56 kg
Height: 148.7 cm | **Weight Z-Score:** 1.80
Weight Percentile: 96.41
Height Z-Score: 0.34
Height Percentile: 63.31
Head Circ. Z-Score: -
Head Circ. Percentile: -
BMI: 23.33 kg/m^2
BMI Z-Score: 1.95
BMI Percentile: 97.44 | **Weight Z-Score:** 1.80
Weight Percentile: 96.41
Height Z-Score: 0.34
Height Percentile: 63.31
Waist Circ. Z-Score: -
Waist Circ. Percentile: -
Head Circ. Z-Score: -
Head Circ. Percentile: -
BMI: 25.33 kg/m^2
BMI Z-Score: 1.95
BMI Percentile: 97.44 |

| 66 | **Decimal Age:** 9.61
Gender: Girl
Weight: 50.65 kg
Height: 155.5 cm | **Weight Z-Score:** 2.34
Weight Percentile: 99.04
Height Z-Score: 3.19
Height Percentile: 99.93
Head Circ. Z-Score: -
Head Circ. Percentile: -
BMI: 20.95 kg/m^2
BMI Z-Score: 1.36
BMI Percentile: 91.31 | **Weight Z-Score:** 2.34
Weight Percentile: 99.04
Height Z-Score: 3.18
Height Percentile: 99.93
Waist Circ. Z-Score: -
Waist Circ. Percentile: -
Head Circ. Z-Score: -
Head Circ. Percentile: -
BMI: 20.95 kg/m^2
BMI Z-Score: 1.36
BMI Percentile: 91.31 |
| 67 | **Decimal Age:** 7.44
Gender: Girl
Weight: 36.55 kg
Height: 133 cm | **Weight Z-Score:** 2.31
Weight Percentile: 98.91
Height Z-Score: 1.84
Height Percentile: 96.0
Head Circ. Z-Score: -
Head Circ. Percentile: -
BMI: 20.66 kg/m^2
BMI Z-Score: 1.82
BMI Percentile: 96.40 | **Weight Z-Score:** 2.31
Weight Percentile: 98.96
Height Z-Score: 1.84
Height Percentile: 96.71
Waist Circ. Z-Score: -
Waist Circ. Percentile: -
Head Circ. Z-Score: -
Head Circ. Percentile: -
BMI: 20.66 kg/m^2
BMI Z-Score: 1.82
BMI Percentile: 96.56 |

| 68 | **Decimal Age:** 11.06
Gender: Boy
Weight: 62.8 kg
Height: 160.3 cm | **Weight Z-Score:** 2.18
Weight Percentile: 98.54
Height Z-Score: 2.47
Height Percentile: 99.0
Head Circ. Z-Score: -
Head Circ. Percentile: -
BMI: 24.44 kg/m^2
BMI Z-Score: 1.62
BMI Percentile: 94.70 | **Weight Z-Score:** 2.18
Weight Percentile: 98.54
Height Z-Score: 2.48
Height Percentile: 99.31
Waist Circ. Z-Score: -
Waist Circ. Percentile: -
Head Circ. Z-Score: -
Head Circ. Percentile: -
BMI: 24.44 kg/m^2
BMI Z-Score: 1.62
BMI Percentile: 94.74 |
| 69 | **Decimal Age:** 13.47
Gender: Boy
Weight: 48.9 kg
Height: 151 cm | **Weight Z-Score:** -0.39
Weight Percentile: 34.83
Height Z-Score: -1.29
Height Percentile: 9.85
Head Circ. Z-Score: -
Head Circ. Percentile: -
BMI: 21.45 kg/m^2
BMI Z-Score: 0.38
BMI Percentile: 64.80 | **Weight Z-Score:** -0.38
Weight Percentile: 35.20
Height Z-Score: -1.29
Height Percentile: 9.85
Waist Circ. Z-Score: -
Waist Circ. Percentile: -
Head Circ. Z-Score: -
Head Circ. Percentile: -
BMI: 21.45 kg/m^2
BMI Z-Score: 0.38
BMI Percentile: 64.80 |

| 70 | **Decimal Age:** 8.08
Gender: Girl
Weight: 40.4 kg
Height: 128 cm | **Weight Z-Score:** 2.31
Weight Percentile: 98.90
Height Z-Score: 0.10
Height Percentile: 53.0
Head Circ. Z-Score: -
Head Circ. Percentile: -
BMI: 24.78 kg/m^2
BMI Z-Score: 2.47
BMI Percentile: 99.0 | **Weight Z-Score:** 2.32
Weight Percentile: 98.98
Height Z-Score: 0.10
Height Percentile: 54.38
Waist Circ. Z-Score: -
Waist Circ. Percentile: -
Head Circ. Z-Score: -
Head Circ. Percentile: -
BMI: 24.66 kg/m^2
BMI Z-Score: 2.47
BMI Percentile: 99.32 |
| 71 | **Decimal Age:** 8.75
Gender: Girl
Weight: 41.8 kg
Height: 133 cm | **Weight Z-Score:** 2.03
Weight Percentile: 97.82
Height Z-Score: 0.34
Height Percentile: 63.0
Head Circ. Z-Score: -
Head Circ. Percentile: -
BMI: 23.75 kg/m^2
BMI Z-Score: 2.15
BMI Percentile: 98.0 | **Weight Z-Score:** 2.03
Weight Percentile: 97.88
Height Z-Score: 0.34
Height Percentile: 63.31
Waist Circ. Z-Score: -
Waist Circ. Percentile: -
Head Circ. Z-Score: -
Head Circ. Percentile: -
BMI: 23.63 kg/m^2
BMI Z-Score: 2.15
BMI Percentile: 98.42 |

| 72 | **Decimal Age:** 11.41
Gender: Girl
Weight: 56.45 kg
Height: 153 cm | **Weight Z-Score:** 1.66
Weight Percentile: 95.15
Height Z-Score: 0.67
Height Percentile: 75.17
Head Circ. Z-Score: -
Head Circ. Percentile: -
BMI: 24.11 kg/m^2
BMI Z-Score: 1.64
BMI Percentile: 94.95 | **Weight Z-Score:** 1.66
Weight Percentile: 95.15
Height Z-Score: 0.67
Height Percentile: 74.86
Waist Circ. Z-Score: -
Waist Circ. Percentile: -
Head Circ. Z-Score: -
Head Circ. Percentile: -
BMI: 24.11 kg/m^2
BMI Z-Score: 1.64
BMI Percentile: 94.95 |
| 73 | **Decimal Age:** 6.84
Gender: Girl
Weight: 35.2 kg
Height: 119 cm | **Weight Z-Score:** 2.57
Weight Percentile: 99.49
Height Z-Score: -0.23
Height Percentile: 40.90
Head Circ. Z-Score: -
Head Circ. Percentile: -
BMI: 24.86 kg/m^2
BMI Z-Score: 2.77
BMI Percentile: 99.72 | **Weight Z-Score:** 2.57
Weight Percentile: 99.49
Height Z-Score: -0.23
Height Percentile: 40.90
Waist Circ. Z-Score: -
Waist Circ. Percentile: -
Head Circ. Z-Score: -
Head Circ. Percentile: -
BMI: 24.86 kg/m^2
BMI Z-Score: 2.77
BMI Percentile: 99.72 |

| 74 | **Decimal Age:** 9.38
Gender: Boy
Weight: 53.25 kg
Height: 143 cm | **Weight Z-Score:** 2.68
Weight Percentile: 99.63
Height Z-Score: 1.54
Height Percentile: 93.82
Head Circ. Z-Score: -
Head Circ. Percentile: -
BMI: 26.04 kg/m^2
BMI Z-Score: 2.48
BMI Percentile: 99.34 | **Weight Z-Score:** 2.68
Weight Percentile: 99.63
Height Z-Score: 1.54
Height Percentile: 93.82
Waist Circ. Z-Score: -
Waist Circ. Percentile: -
Head Circ. Z-Score: -
Head Circ. Percentile: -
BMI: 26.04 kg/m^2
BMI Z-Score: 2.48
BMI Percentile: 99.34 |
| 75 | **Decimal Age:** 17.61
Gender: Girl
Weight: 94.0 kg
Height: 171.5 cm | **Weight Z-Score:** 4.05
Weight Percentile: 99.98
Height Z-Score: 1.46
Height Percentile: 92.79
Head Circ. Z-Score: -
Head Circ. Percentile: -
BMI: 31.96 kg/m^2
BMI Z-Score: 2.94
BMI Percentile: 99.84 | **Weight Z-Score:** 4.05
Weight Percentile: 99.98
Height Z-Score: 1.46
Height Percentile: 92.79
Waist Circ. Z-Score: -
Waist Circ. Percentile: -
Head Circ. Z-Score: -
Head Circ. Percentile: -
BMI: 31.96 kg/m^2
BMI Z-Score: 2.94
BMI Percentile: 99.84 |

76	**Decimal Age:** 13.91 **Gender:** Boy **Weight:** 102.15 kg **Height:** 174 cm	**Weight Z-Score:** 3.22 **Weight Percentile:** 99.80 **Height Z-Score:** 1.26 **Height Percentile:** 89.19 **Head Circ. Z-Score:** - **Head Circ. Percentile:** - **BMI:** 33.80 kg/m^2 **BMI Z-Score:** 2.76 **BMI Percentile:** 99.65	**Weight Z-Score:** 3.22 **Weight Percentile:** 99.94 **Height Z-Score:** 1.27 **Height Percentile:** 89.62 **Waist Circ. Z-Score:** - **Waist Circ. Percentile:** - **Head Circ. Z-Score:** - **Head Circ. Percentile:** - **BMI:** 33.74 kg/m^2 **BMI Z-Score:** 2.76 **BMI Percentile:** 99.71
77	**Decimal Age:** 5.66 **Gender:** Girl **Weight:** 38 kg **Height:** 99.99	**Weight Z-Score:** 3.88 **Weight Percentile:** 99.98 **Height Z-Score:** 2.31 **Height Percentile:** 98.90 **Head Circ. Z-Score:** - **Head Circ. Percentile:** - **BMI:** 24.83 kg/m^2 **BMI Z-Score:** 3.11 **BMI Percentile:** 99.80	**Weight Z-Score:** 3.88 **Weight Percentile:** 99.98 **Height Z-Score:** 2.31 **Height Percentile:** 98.96 **Waist Circ. Z-Score:** - **Waist Circ. Percentile:** - **Head Circ. Z-Score:** - **Head Circ. Percentile:** - **BMI:** 24.71 kg/m^2 **BMI Z-Score:** 3.11 **BMI Percentile:** 99.91

| 78 | Decimal Age: 9.76
Gender: Boy
Weight: 51.3 kg
Height: 139.5 cm | Weight Z-Score: 2.38
Weight Percentile: 98.96
Height Z-Score: 0.55
Height Percentile: 70.88
Head Circ. Z-Score: -
Head Circ. Percentile: -
BMI: 26.36 kg/m^2
BMI Z-Score: 2.40
BMI Percentile: 98.18 | Weight Z-Score: 2.32
Weight Percentile: 98.96
Height Z-Score: 0.55
Height Percentile: 70.88
Waist Circ. Z-Score: -
Waist Circ. Percentile: -
Head Circ. Z-Score: -
Head Circ. Percentile: -
BMI: 26.36 kg/m^2
BMI Z-Score: 2.40
BMI Percentile: 99.18 |
| 79 | Decimal Age: 7.92
Gender: Boy
Weight: 46.1 kg
Height: 139 cm | Weight Z-Score: 3.34
Weight Percentile: 99.0
Height Z-Score: 2.36
Height Percentile: 99.0
Head Circ. Z-Score: -
Head Circ. Percentile: -
BMI: 23.86 kg/m^2
BMI Z-Score: 2.62
BMI Percentile: 99.0 | Weight Z-Score: 3.34
Weight Percentile: 99.0
Height Z-Score: 2.36
Height Percentile: 99.0
Waist Circ. Z-Score: -
Waist Circ. Percentile: -
Head Circ. Z-Score: -
Head Circ. Percentile: -
BMI: 23.86 kg/m^2
BMI Z-Score: 2.62
BMI Percentile: 99.0 |

| 80 | **Decimal Age:** 7.63
Gender: Girl
Weight: 26.45 kg
Height: 129 cm | **Weight Z-Score:** 0.41
Weight Percentile: 65.91
Height Z-Score: 0.84
Height Percentile: 79.95
Head Circ. Z-Score: -
Head Circ. Percentile: -
BMI: 15.89 kg/m^2
BMI Z-Score: 0.05
BMI Percentile: 51.99 | **Weight Z-Score:** 0.41
Weight Percentile: 65.91
Height Z-Score: 0.84
Height Percentile: 79.95
Waist Circ. Z-Score: -
Waist Circ. Percentile: -
Head Circ. Z-Score: -
Head Circ. Percentile: -
BMI: 15.89 kg/m^2
BMI Z-Score: 0.055
BMI Percentile: 52.39 |

Appendix D: Suggestion Comparisons

#	Pediatric Patient Info	Suggestions Assigned By System		Suggestions Assigned By HE	
1	*Decimal Age:* 0.75(9 months) *Gender:* Boy *Weight:* 10 kg *Height:* 75 cm *Waist Circumference:* 45 cm *Head Circumference:* 48 cm *BMI:* 17.78 kg/m^2 *BMI Z-Score:* 0.17 *BMI Percentile:* 56.75	SG0_04_DEV SG0_15_INT_M SG0_28_MOM SG0_29_MOM SG0_30_MOM SG0_31_MOM SG0_32_MOM SG0_33_MOM SG0_34_MOM SG0_35_MOM SG0_36_MOM SG0_37_MOM SG0_38_MOM SG0_39_MOM SG0_40_MOM	SG0_41_EAT SG0_42_EAT SG0_43_EAT SG0_44_EAT SG0_45_EAT SG0_46_EAT SG0_47_EAT SG0_48_EAT SG0_49_PHY SG0_50_PHY	SG0_04_DEV SG0_15_INT_M SG0_28_MOM SG0_29_MOM SG0_30_MOM SG0_31_MOM SG0_32_MOM SG0_33_MOM SG0_34_MOM SG0_35_MOM SG0_36_MOM SG0_37_MOM SG0_38_MOM SG0_39_MOM SG0_40_MOM	SG0_41_EAT SG0_43_EAT SG0_44_EAT SG0_48_EAT
2	*Decimal Age:* 1 *Gender:* Boy *Weight:* 15 kg *Height:* 90 cm *Waist Circumference:* 50 cm *Head Circumference:* 48 cm *BMI:* 18.52 kg/m^2 *BMI Z-Score:* 0.81 *BMI Percentile :* 79.10	SG0_04_DEV SG0_18_INT_M SG0_28_MOM SG0_29_MOM SG0_37_MOM SG0_38_MOM SG0_39_MOM SG0_40_MOM SG0_41_EAT SG0_42_EAT SG0_43_EAT	SG0_44_EAT SG0_45_EAT SG0_46_EAT SG0_47_EAT SG0_48_EAT SG0_49_PHY SG0_50_PHY	SG0_04_DEV SG0_18_INT_M SG0_28_MOM SG0_29_MOM SG0_37_MOM SG0_38_MOM SG0_39_MOM SG0_40_MOM SG0_41_EAT SG0_42_EAT	SG0_44_EAT SG0_46_EAT SG0_47_EAT SG0_48_EAT

#	Characteristics	Codes (set 1)		Codes (set 2)	
3	*Decimal Age:* 2 *Gender:* Girl *Weight:* 16 kg *Height:* 90 cm *Waist Circumference:* 45 cm *Head Circumference:* 42 cm *BMI:* 19.75 kg/m^2 *BMI Z-Score:* 2.31 *BMI Percentile:* 98.96	SG0_06_DEV SG0_02_GEN		SG0_06_DEV SG0_02_GEN	
4	*Decimal Age:* 1.31 (1years 3 months 21 days) *Gender:* Boy *Weight:* 12 kg *Height:* 82 cm *Waist Circumference:* 55 cm *Head Circumference:* 50 cm *BMI:* 17.85 kg/m^2 *BMI Z-Score:* 0.61 *BMI Percentile:* 73.24	SG0_04_DEV SG0_19_INT_M SG0_39_MOM SG0_40_MOM SG0_41_EAT SG0_42_EAT SG0_43_EAT SG0_44_EAT SG0_45_EAT SG0_46_EAT SG0_47_EAT	SG0_48_EAT SG0_49_PHY SG0_50_PHY	SG0_04_DEV SG0_19_INT_M SG0_39_MOM SG0_40_MOM SG0_41_EAT SG0_42_EAT SG0_44_EAT SG0_45_EAT SG0_46_EAT SG0_47_EAT	SG0_48_EAT SG0_49_PHY
5	*Decimal Age:* 0.67 (8 months) *Gender:* Girl *Weight:* 8.5 kg *Height:* 68 cm *Waist Circumference:* 39 cm *Head Circumference:* 40 cm *BMI:* 18.38 kg/m^2 *BMI Z-Score:* 1.69	SG0_04_DEV SG0_15_INT_F SG0_28_MOM SG0_29_MOM SG0_30_MOM SG0_31_MOM SG0_32_MOM SG0_33_MOM SG0_34_MOM	SG0_39_MOM SG0_40_MOM SG0_41_EAT SG0_42_EAT SG0_43_EAT SG0_44_EAT SG0_45_EAT SG0_46_EAT SG0_47_EAT	SG0_04_DEV SG0_15_INT_F SG0_28_MOM SG0_29_MOM SG0_30_MOM SG0_31_MOM SG0_32_MOM SG0_33_MOM SG0_34_MOM	SG0_39_MOM SG0_40_MOM SG0_41_EAT SG0_44_EAT SG0_48_EAT

	BMI Percentile: 81.59	SG0_35_MOM SG0_36_MOM SG0_37_MOM SG0_38_MOM	SG0_48_EAT SG0_49_PHY SG0_50_PHY	SG0_35_MOM SG0_36_MOM SG0_37_MOM SG0_38_MOM	
6	*Decimal Age:* 0.3 (3 months 18 days) *Gender:* Girl *Weight:* 6.5 kg *Height:* 60 cm *Waist Circumference:* 40 cm *Head Circumference:* 45 cm *BMI:* 18.02 kg/m^2 *BMI Z-Score:* 1.06 *BMI Percentile:* 85.54	SG0_06_DEV SG0_27_MOM SG0_28_MOM SG0_29_MOM SG0_30_MOM SG0_31_MOM SG0_32_MOM SG0_33_MOM SG0_34_MOM SG0_35_MOM SG0_36_MOM SG0_37_MOM SG0_38_MOM	SG0_39_MOM SG0_40_MOM SG0_41_EAT SG0_42_EAT SG0_43_EAT SG0_44_EAT SG0_45_EAT SG0_46_EAT SG0_47_EAT SG0_48_EAT SG0_49_PHY SG0_50_PHY	SG0_27_MOM SG0_29_MOM SG0_30_MOM SG0_31_MOM SG0_32_MOM SG0_33_MOM SG0_34_MOM SG0_35_MOM SG0_36_MOM SG0_37_MOM SG0_38_MOM	SG0_39_MOM SG0_40_MOM
7	*Decimal Age:* 16 *Gender:* Girl *Weight:* 48 kg *Height:* 152 cm *Waist Circumference:* 70 cm *Head Circumference:* 62 cm *Health Risk :* No *BMI:* 20.78 kg/m^2 *BMI Z-Score:* -0.19 *BMI Percentile:* 42.47	SG0_26_INT_F SG0_41_EAT SG0_42_EAT SG0_43_EAT SG0_44_EAT SG0_45_EAT SG0_46_EAT SG0_47_EAT SG0_48_EAT SG0_49_PHY	SG0_50_PHY	SG0_26_INT_F SG0_41_EAT SG0_42_EAT SG0_43_EAT SG0_44_EAT SG0_45_EAT SG0_46_EAT SG0_47_EAT SG0_48_EAT SG0_49_PHY	SG0_50_PHY
8	*Decimal Age:* 14 *Gender:* Boy	SG0_25_INT_M SG0_41_EAT	SG0_46_EAT SG0_47_EAT	SG0_25_INT_M SG0_41_EAT	SG0_46_EAT SG0_47_EAT

	Weight: 55 kg *Height:* 170 cm *Waist Circumference:* 78 cm *Head Circumference:* 64.5 cm *Health Risk :* Yes *BMI:* 19.03 kg/m^2 *BMI Z-Score:* -0.51 *BMI Percentile:* 30.50	SG0_42_EAT SG0_43_EAT SG0_44_EAT SG0_45_EAT	SG0_48_EAT SG0_49_PHY SG0_50_PHY	SG0_42_EAT SG0_43_EAT SG0_44_EAT SG0_45_EAT	SG0_48_EAT SG0_49_PHY SG0_50_PHY
9	*Decimal Age:* 4.3 (4 years 3 months 18 days) *Gender:* Boy *Weight:* 17 kg *Height:* 105 cm *Waist Circumference:* 60 cm *Head Circumference:* 56 cm *HealthRisk :* No *BMI:* 15.42 kg/m^2 *BMI Z-Score:* -0.16 *BMI Percentile:* 43.64	SG0_21_INT_M SG0_41_EAT SG0_42_EAT SG0_43_EAT SG0_44_EAT SG0_45_EAT SG0_46_EAT SG0_47_EAT SG0_48_EAT SG0_49_PHY SG0_50_PHY		SG0_21_INT_M SG0_41_EAT SG0_42_EAT SG0_43_EAT SG0_44_EAT SG0_45_EAT SG0_46_EAT SG0_47_EAT SG0_48_EAT SG0_49_PHY SG0_50_PHY	
10	*Decimal Age:* 4.3 (4 years 3 months 18 days) *Gender:* Girl *Weight:* 15 kg *Height:* 95 cm *Waist Circumference:* 60 cm *Head Circumference:* 42 cm *Health Risk :* No *BMI:* 16.62 kg/m^2	SG0_21_INT_F SG0_41_EAT SG0_42_EAT SG0_43_EAT SG0_44_EAT SG0_45_EAT SG0_46_EAT SG0_47_EAT SG0_48_EAT		SG0_21_INT_F SG0_41_EAT SG0_42_EAT SG0_43_EAT SG0_44_EAT SG0_45_EAT SG0_46_EAT SG0_47_EAT SG0_48_EAT	

	BMI Z-Score: 0.82 *BMI Percentile:* 79.39	SG0_49_PHY SG0_50_PHY		SG0_49_PHY SG0_50_PHY	
11	*Decimal Age:* 0.33 (3 months 27 days) *Gender:* Boy *Weight:* 8.4 kg *Height:* 68 cm *Waist Circumference:* 53 cm *Head Circumference:* 52 cm *BMI:* 18.17 kg/m^2 *BMI Z-Score:* 0.66 *BMI Percentile:* 74.86	SG0_04_DEV SG0_10_INT_F SG0_41_EAT SG0_42_EAT SG0_43_EAT SG0_44_EAT SG0_45_EAT SG0_46_EAT SG0_47_EAT SG0_48_EAT SG0_49_PHY SG0_50_PHY	SG0_27_MOM SG0_28_MOM SG0_29_MOM SG0_38_MOM SG0_39_MOM SG0_40_MOM	SG0_04_DEV SG0_10_INT_F SG0_41_EAT SG0_42_EAT SG0_43_EAT SG0_44_EAT SG0_45_EAT SG0_46_EAT SG0_47_EAT SG0_48_EAT SG0_49_PHY SG0_50_PHY	SG0_27_MOM SG0_28_MOM SG0_29_MOM SG0_38_MOM SG0_39_MOM SG0_40_MOM
12	*Decimal Age:* 1.41 (1 years 4 months 27 days) *Gender:* Girl *Weight:* 15 kg *Height:* 87 cm *Waist Circumference:* 38.5 cm *Head Circumference:* 55 cm *BMI:* 19.82 kg/m^2 *BMI Z-Score:* 2.11 *BMI Percentile:* 98.26	SG0_06_DEV SG_02_GEN		SG0_06_DEV SG_02_GEN	
13	*Decimal Age:* 1.07 (1 years 27 days) *Gender:* Boy *Weight:* 6 kg	SG0_02_DEV SG0_01_GEN		SG0_02_DEV SG0_01_GEN	

	Height: 65 cm *Waist Circumference:* 66 cm *Head Circumference:* 52 cm *BMI:* 14.20 kg/m^2 *BMI Z-Score:* -2.17 *BMI Percentile:* 1.50				
14	*Decimal Age:* 10.2 (10 years 2 months 10 days) *Gender:* Boy *Weight:* 30 kg *Height:* 140 cm *Waist Circumference:* 78 cm *Head Circumference:* 57 cm *Health Risk :* Yes *BMI:* 15.31 kg/m^2 *BMI Z-Score:* -0.97 *BMI Percentile:* 16.60	SG0_24_INT_M SG0_41_EAT SG0_42_EAT SG0_43_EAT SG0_44_EAT SG0_45_EAT SG0_46_EAT SG0_47_EAT SG0_48_EAT	SG0_49_PHY SG0_50_PHY	SG0_24_INT_M SG0_41_EAT SG0_42_EAT SG0_43_EAT SG0_44_EAT SG0_45_EAT SG0_46_EAT SG0_47_EAT SG0_48_EAT	SG0_49_PHY SG0_50_PHY
15	*Decimal Age:* 7.45 (7 years 5 months 12 days) *Gender:* Girl *Weight:* 30 kg *Height:* 122 cm *Waist Circumference:* 60 cm *Head Circumference:* 43 cm *Health Risk :* Yes *BMI:* 20.16 kg/m^2 *BMI Z-Score:* 1.69 *BMI Percentile:* 95.45	SG0_02_GEN SG0_41_EAT SG0_42_EAT SG0_43_EAT SG0_44_EAT SG0_45_EAT SG0_46_EAT SG0_47_EAT SG0_48_EAT	SG0_49_PHY SG0_50_PHY	SG0_02_GEN SG0_41_EAT SG0_42_EAT SG0_43_EAT SG0_44_EAT SG0_45_EAT SG0_46_EAT SG0_47_EAT SG0_48_EAT	SG0_49_PHY SG0_50_PHY

16	**Decimal Age:** 13.72 **Gender:** Boy **Weight:** 60.35 kg **Height:** 168.3 cm **Waist Circumference:** - **Head Circumference:** - **BMI:** 21.31 kg/m^2 **BMI Z-Score:** 0.30 **BMI Percentile:** 61.79	SG0_41_EAT SG0_42_EAT SG0_43_EAT SG0_44_EAT SG0_45_EAT SG0_46_EAT SG0_47_EAT SG0_48_EAT	SG0_49_PHY SG0_50_PHY	SG0_41_EAT SG0_42_EAT SG0_43_EAT SG0_44_EAT SG0_45_EAT SG0_46_EAT SG0_47_EAT SG0_48_EAT	SG0_49_PHY SG0_50_PHY
17	**Decimal Age:** 12.34 **Gender:** Boy **Weight:** 59.25 kg **Height:** 155 cm **BMI:** 24.66 kg/m^2 **BMI Z-Score:** 1.34 **BMI Percentile:** 90.99	SG0_03_GEN SG0_41_EAT SG0_42_EAT SG0_43_EAT SG0_44_EAT SG0_45_EAT	SG0_46_EAT SG0_47_EAT SG0_48_EAT SG0_49_PHY SG0_50_PHY	SG0_03_GEN SG0_41_EAT SG0_42_EAT SG0_43_EAT SG0_44_EAT SG0_45_EAT	SG0_46_EAT SG0_47_EAT SG0_48_EAT SG0_49_PHY SG0_50_PHY
18	**Decimal Age:** 13.58 **Gender:** Boy **Weight:** 30 kg **Height:** 140 cm **BMI:** 15.30 kg/m^2 **BMI Z-Score:** -2.02 **BMI Percentile:** 2.17	SG0_01_GEN		SG0_01_GEN SG0_02_DEV	

19	**Decimal Age:** 8 **Gender:** Girl **Weight:** 48 kg **Height:** 140.5 cm **BMI:** 24.32 kg/m^2 **BMI Z-Score:** 2.44 **BMI Percentile:** 99.27	SG0_02_GEN SG1_01_EAT SG1_02_EAT SG1_03_EAT SG1_04_EAT SG1_05_EAT SG1_06_PHY SG1_07_PHY	SG0_02_GEN SG1_01_EAT SG1_02_EAT SG1_03_EAT SG1_04_EAT SG1_05_EAT SG1_06_PHY SG1_07_PHY
20	**Decimal Age:** 11.73 **Gender:** Boy **Weight:** 57.3 kg **Height:** 144 cm **BMI:** 27.63 kg/m^2 **BMI Z-Score:** 2.00 **BMI Percentile:** 97.72	SG0_02_GEN SG1_01_EAT SG1_02_EAT SG1_03_EAT SG1_04_EAT SG1_05_EAT SG1_06_PHY SG1_07_PHY	SG0_02_GEN SG1_03_EAT SG1_04_EAT SG1_05_EAT SG1_06_PHY SG1_07_PHY
21	**Decimal Age:** 13.83 **Gender:** Boy **Weight:** 72.15 kg **Height:** 154.5 cm **BMI:** 30.23 kg/m^2 **BMI Z-Score:** 2.25 **BMI Percentile:** 98.78	SG0_02_GEN SG1_01_EAT SG1_02_EAT SG1_03_EAT SG1_04_EAT SG1_05_EAT SG1_06_PHY SG1_07_PHY	SG0_02_GEN SG1_01_EAT SG1_02_EAT SG1_03_EAT SG1_04_EAT SG1_05_EAT SG1_06_PHY SG1_07_PHY
22	**Decimal Age:** 5.41 **Gender:** Girl **Weight:** 29.9 kg **Height:** 106.2 cm **BMI:** 26.51 kg/m^2	SG0_02_GEN SG1_01_EAT SG1_02_EAT SG1_03_EAT SG1_04_EAT	SG0_02_GEN SG1_01_EAT SG1_02_EAT SG1_03_EAT SG1_04_EAT

	BMI Z-Score: 3.53 **BMI Percentile:** 99.98	SG1_05_EAT SG1_06_PHY SG1_07_PHY	SG1_05_EAT SG1_06_PHY SG1_07_PHY
23	**Decimal Age:** 6.04 **Gender:** Girl **Weight:** 48.6 kg **Height:** 135 cm **BMI:** 26.67 kg/m^2 **BMI Z-Score:** 3.22 **BMI Percentile:** 99.94	SG0_02_GEN SG1_01_EAT SG1_02_EAT SG1_03_EAT SG1_04_EAT SG1_05_EAT SG1_06_PHY SG1_07_PHY	SG0_02_GEN SG1_01_EAT SG1_02_EAT SG1_03_EAT SG1_04_EAT SG1_05_EAT SG1_06_PHY SG1_07_PHY
24	**Decimal Age:** 6.20 **Gender:** Girl **Weight:** 29.9 kg **Height:** 106.2 cm **BMI:** 26.51 kg/m^2 **BMI Z-Score:** 3.17 **BMI Percentile:** 99.92	SG0_02_GEN SG1_01_EAT SG1_02_EAT SG1_03_EAT SG1_04_EAT SG1_05_EAT SG1_06_PHY SG1_07_PHY	SG0_02_GEN SG1_01_EAT SG1_02_EAT SG1_03_EAT SG1_04_EAT SG1_05_EAT SG1_06_PHY SG1_07_PHY
25	**Decimal Age:** 11.30 **Gender:** Girl **Weight:** 69.15 kg **Height:** 154 cm **BMI:** 29.16 kg/m^2 **BMI Z-Score:** 2.58 **BMI Percentile:** 99.51	SG0_02_GEN SG1_01_EAT SG1_02_EAT SG1_03_EAT SG1_04_EAT SG1_05_EAT SG1_06_PHY SG1_07_PHY	SG0_02_GEN SG1_01_EAT SG1_02_EAT SG1_03_EAT SG1_04_EAT SG1_05_EAT SG1_06_PHY SG1_07_PHY

26	*Decimal Age:* 12.00 *Gender:* Boy *Weight:* 64 kg *Height:* 147.5 cm *BMI:* 29.49 kg/m^2 *BMI Z-Score:* 2.22 *BMI Percentile:* 98.68	SG0_02_GEN SG1_01_EAT SG1_02_EAT SG1_03_EAT SG1_04_EAT SG1_05_EAT SG1_06_PHY SG1_07_PHY	SG0_02_GEN SG1_01_EAT SG1_02_EAT SG1_03_EAT SG1_04_EAT SG1_05_EAT SG1_06_PHY SG1_07_PHY
27	*Decimal Age:* 13.60 *Gender:* Boy *Weight:* 78.15 kg *Height:* 155 cm *BMI:* 32.53 kg/m^2 *BMI Z-Score:* 2.62 *BMI Percentile:* 99.56	SG0_02_GEN SG1_01_EAT SG1_02_EAT SG1_03_EAT SG1_04_EAT SG1_05_EAT SG1_06_PHY SG1_07_PHY	SG0_02_GEN SG1_01_EAT SG1_02_EAT SG1_03_EAT SG1_04_EAT SG1_05_EAT SG1_06_PHY SG1_07_PHY
28	*Decimal Age:* 6.26 *Gender:* Girl *Weight:* 34.6 kg *Height:* 127.5 cm *BMI:* 21.28 kg/m^2 *BMI Z-Score:* 2.21 *BMI Percentile:* 98.64	SG0_02_GEN SG1_01_EAT SG1_02_EAT SG1_03_EAT SG1_04_EAT SG1_05_EAT SG1_06_PHY SG1_07_PHY	SG0_02_GEN SG1_01_EAT SG1_02_EAT SG1_03_EAT SG1_04_EAT SG1_05_EAT SG1_06_PHY SG1_07_PHY

29	*Decimal Age:* 10.07 *Gender:* Girl *Weight:* 68.2 kg *Height:* 161 cm *BMI:* 26.31 kg/m^2 *BMI Z-Score:* 2.41 *BMI Percentile:* 99.20	SG0_02_GEN SG1_01_EAT SG1_02_EAT SG1_03_EAT SG1_04_EAT SG1_05_EAT SG1_06_PHY SG1_07_PHY	SG0_02_GEN SG1_01_EAT SG1_02_EAT SG1_03_EAT SG1_04_EAT SG1_05_EAT SG1_06_PHY SG1_07_PHY
30	*Decimal Age:* 6.13 *Gender:* Girl *Weight:* 20.10 kg *Height:* 118 cm *BMI:* 14.44 kg/m^2 *BMI Z-Score:* -0.72 *BMI Percentile:* 23.58	SG0_22_INT_F SG0_41_EAT SG0_42_EAT SG0_43_EAT SG0_44_EAT SG0_45_EAT SG0_46_EAT SG0_47_EAT SG0_48_EAT SG0_49_PHY SG0_50_PHY	SG0_22_INT_F SG0_41_EAT SG0_42_EAT SG0_43_EAT SG0_44_EAT SG0_45_EAT SG0_46_EAT SG0_47_EAT SG0_48_EAT SG0_49_PHY SG0_50_PHY
31	*Decimal Age:* 13.31 *Gender:* Boy *Weight:* 135.1 kg *Height:* 180 cm *BMI:* 41.70 kg/m^2 *BMI Z-Score:* 3.69 *BMI Percentile:* 99.98	SG0_02_GEN SG1_01_EAT SG1_02_EAT SG1_03_EAT SG1_04_EAT SG1_05_EAT SG1_06_PHY SG1_07_PHY	SG0_02_GEN SG1_01_EAT SG1_02_EAT SG1_03_EAT SG1_04_EAT SG1_05_EAT SG1_06_PHY SG1_07_PHY

32	*Decimal Age:* 11.12 *Gender:* Girl *Weight:* 57.4 kg *Height:* 156 cm *BMI:* 23.59 kg/m^2 *BMI Z-Score:* 1.96 *BMI Percentile:* 97.50	SG0_02_GEN SG1_01_EAT SG1_02_EAT SG1_03_EAT SG1_04_EAT SG1_05_EAT SG1_06_PHY SG1_07_PHY	SG0_02_GEN SG1_01_EAT SG1_02_EAT SG1_03_EAT SG1_04_EAT SG1_05_EAT SG1_06_PHY SG1_07_PHY
33	*Decimal Age:* 12.64 *Gender:* Boy *Weight:* 79.35 kg *Height:* 164.3 cm *BMI:* 29.39 kg/m^2 *BMI Z-Score:* 2.19 *BMI Percentile:* 98.60	SG0_02_GEN SG1_01_EAT SG1_02_EAT SG1_03_EAT SG1_04_EAT SG1_05_EAT SG1_06_PHY SG1_07_PHY	SG0_02_GEN SG1_01_EAT SG1_02_EAT SG1_03_EAT SG1_04_EAT SG1_05_EAT SG1_06_PHY SG1_07_PHY
34	*Decimal Age:* 13.45 *Gender:* Boy *Weight:* 62 kg *Height:* 159 cm *BMI:* 24.52 kg/m^2 *BMI Z-Score:* 1.18 *BMI Percentile:* 88.0	SG0_41_EAT SG0_42_EAT SG0_43_EAT SG0_44_EAT SG0_45_EAT SG0_46_EAT SG0_47_EAT SG0_48_EAT SG0_49_PHY SG0_50_PHY	SG0_03_GEN SG0_50_PHY SG0_41_EAT SG0_42_EAT SG0_43_EAT SG0_44_EAT SG0_45_EAT SG0_46_EAT SG0_47_EAT SG0_48_EAT SG0_49_PHY

35	**Decimal Age:** 9.92 **Gender:** Boy **Weight:** 47.2 kg **Height:** 138 cm **BMI:** 24.78 kg/m^2 **BMI Z-Score:** 2.11 **BMI Percentile:** 98.26	SG0_02_GEN SG1_01_EAT SG1_02_EAT SG1_03_EAT SG1_04_EAT SG1_05_EAT SG1_06_PHY SG1_07_PHY		SG0_02_GEN SG1_01_EAT SG1_02_EAT SG1_03_EAT SG1_04_EAT SG1_05_EAT SG1_06_PHY SG1_07_PHY	
36	**Decimal Age:** 10.47 **Gender:** Girl **Weight:** 35 kg **Height:** 150 cm **BMI:** 15.56 kg/m^2 **BMI Z-Score:** -0.87 **BMI Percentile:** 19.22	SG0_24_INT_F SG0_41_EAT SG0_42_EAT SG0_43_EAT SG0_44_EAT SG0_45_EAT SG0_46_EAT SG0_47_EAT SG0_48_EAT SG0_49_PHY	SG0_50_PHY	SG0_05_DEV SG0_24_INT_F SG0_41_EAT SG0_42_EAT SG0_43_EAT SG0_44_EAT SG0_45_EAT SG0_46_EAT SG0_47_EAT SG0_48_EAT	SG0_49_PHY SG0_50_PHY
37	**Decimal Age:** 12.37 **Gender:** Boy **Weight:** 79.6 kg **Height:** 165 cm **BMI:** 29.24 kg/m^2 **BMI Z-Score:** 2.17 **BMI Percentile:** 98.54	SG0_02_GEN SG1_01_EAT SG1_02_EAT SG1_03_EAT SG1_04_EAT SG1_05_EAT SG1_06_PHY SG1_07_PHY		SG0_02_GEN SG1_01_EAT SG1_02_EAT SG1_03_EAT SG1_04_EAT SG1_05_EAT SG1_06_PHY SG1_07_PHY	

38	*Decimal Age:* 12.50 *Gender:* Boy *Weight:* 89 kg *Height:* 153.5 cm *BMI:* 37.77 kg/m^2 *BMI Z-Score:* 3.27 *BMI Percentile:* 99.95	SG0_02_GEN SG1_01_EAT SG1_02_EAT SG1_03_EAT SG1_04_EAT SG1_05_EAT SG1_06_PHY SG1_07_PHY	SG0_02_GEN SG1_01_EAT SG1_02_EAT SG1_03_EAT SG1_04_EAT SG1_05_EAT SG1_06_PHY SG1_07_PHY
39	*Decimal Age:* 7.98 *Gender:* Girl *Weight :* 44.8 kg *Height:* 140 cm *BMI:* 22.86 kg/m^2 *BMI Z-Score:* 2.19 *BMI Percentile:* 98.60	SG0_02_GEN SG1_01_EAT SG1_02_EAT SG1_03_EAT SG1_04_EAT SG1_05_EAT SG1_06_PHY SG1_07_PHY	SG0_02_GEN SG1_01_EAT SG1_02_EAT SG1_03_EAT SG1_04_EAT SG1_05_EAT SG1_06_PHY SG1_07_PHY
40	*Decimal Age:* 8.69 *Gender:* Girl *Weight:* 54.5 kg *Height:* 140 cm *BMI:* 27.80 kg/m^2 *BMI Z-Score:* 2.79 *BMI Percentile:* 99.74	SG0_02_GEN SG1_01_EAT SG1_02_EAT SG1_03_EAT SG1_04_EAT SG1_05_EAT SG1_06_PHY SG1_07_PHY	SG0_02_GEN SG1_01_EAT SG1_02_EAT SG1_03_EAT SG1_04_EAT SG1_05_EAT SG1_06_PHY SG1_07_PHY

41	**Decimal Age:** 9.46 **Gender:** Girl **Weight:** 50 kg **Height:** 135 cm **BMI:** 27.43 kg/m^2 **BMI Z-Score:** 2.61 **BMI Percentile:** 99.55	SG0_02_GEN SG1_01_EAT SG1_02_EAT SG1_03_EAT SG1_04_EAT SG1_05_EAT SG1_06_PHY SG1_07_PHY		SG0_02_GEN SG1_01_EAT SG1_02_EAT SG1_03_EAT SG1_04_EAT SG1_05_EAT SG1_06_PHY SG1_07_PHY	
42	**Decimal Age:** 8.23 **Gender:** Girl **Weight:** 66.9 kg **Height:** 144 cm **BMI:** 32.26 kg/m^2 **BMI Z-Score:** 3.29 **BMI Percentile:** 99.95	SG0_02_GEN SG1_01_EAT SG1_02_EAT SG1_03_EAT SG1_04_EAT SG1_05_EAT SG1_06_PHY	SG1_07_PHY	SG0_02_GEN SG1_01_EAT SG1_02_EAT SG1_03_EAT SG1_04_EAT SG1_05_EAT SG1_06_PHY	SG1_07_PHY
43	**Decimal Age:** 10 **Gender:** Boy **Weight:** 39.5 kg **Height:** 139.5 cm **BMI:** 20.30 kg/m^2 **BMI Z-Score:** 1.11 **BMI Percentile:** 86.65	SG0_03_GEN SG0_24_INT_M SG0_41_EAT SG0_42_EAT SG0_43_EAT SG0_44_EAT SG0_45_EAT SG0_46_EAT SG0_47_EAT SG0_48_EAT SG0_49_PHY SG0_50_PHY		SG0_03_GEN SG0_41_EAT SG0_42_EAT SG0_43_EAT SG0_44_EAT SG0_45_EAT SG0_46_EAT SG0_47_EAT SG0_48_EAT SG0_49_PHY SG0_50_PHY	

44	*Decimal Age:* 8.62 *Gender:* Girl *Weight:* 46.5 kg *Height:* 140.5 cm *BMI:* 23.56 kg/m^2 *BMI Z-Score:* 2.18 *BMI Percentile:* 98.57	SG0_02_GEN SG1_01_EAT SG1_02_EAT SG1_03_EAT SG1_04_EAT SG1_05_EAT SG1_06_PHY SG1_07_PHY	SG0_02_GEN SG1_01_EAT SG1_02_EAT SG1_03_EAT SG1_04_EAT SG1_05_EAT SG1_06_PHY SG1_07_PHY
45	*Decimal Age:* 5.32 *Gender:* Girl *Weight:* 25.05 kg *Height:* 108.7 cm *BMI:* 21.20 kg/m^2 *BMI Z-Score:* 2.48 *BMI Percentile:* 99.34	SG0_02_GEN SG1_01_EAT SG1_02_EAT SG1_03_EAT SG1_04_EAT SG1_05_EAT SG1_06_PHY SG1_07_PHY	SG0_02_GEN SG1_01_EAT SG1_02_EAT SG1_03_EAT SG1_04_EAT SG1_05_EAT SG1_06_PHY SG1_07_PHY
46	*Decimal Age:* 10.5 *Gender:* Boy *Weight:* 36.15 kg *Height:* 146 cm *BMI:* 16.95 kg/m^2 *BMI Z-Score:* -0.28 *BMI Percentile:* 38.97	SG0_24_INT_M SG0_41_EAT SG0_42_EAT SG0_43_EAT SG0_44_EAT SG0_45_EAT SG0_46_EAT SG0_47_EAT SG0_48_EAT SG0_49_PHY SG0_50_PHY	SG0_24_INT_M SG0_03_GEN SG0_41_EAT SG0_42_EAT SG0_43_EAT SG0_44_EAT SG0_45_EAT SG0_46_EAT SG0_47_EAT SG0_48_EAT SG0_49_PHY SG0_50_PHY

47	*Decimal Age:* 8.1 *Gender:* Girl *Weight:* 43.95 kg *Height:* 145 cm *BMI:* 20.90 kg/m^2 *BMI Z-Score:* 1.75 *BMI Percentile:* 95.99	SG0_02_GEN SG1_01_EAT SG1_02_EAT SG1_03_EAT SG1_04_EAT SG1_05_EAT SG1_06_PHY SG1_07_PHY	SG0_02_GEN SG1_01_EAT SG1_02_EAT SG1_03_EAT SG1_04_EAT SG1_05_EAT SG1_06_PHY SG1_07_PHY
48	*Decimal Age:* 14.09 *Gender:* Boy *Weight:* 65.5 kg *Height:* 160 cm *BMI:* 25.59 kg/m^2 *BMI Z-Score:* 1.35 *BMI Percentile:* 91.0	SG0_41_EAT SG0_42_EAT SG0_43_EAT SG0_44_EAT SG0_45_EAT SG0_46_EAT SG0_47_EAT SG0_48_EAT SG0_49_PHY SG0_50_PHY	SG0_41_EAT SG0_42_EAT SG0_43_EAT SG0_44_EAT SG0_45_EAT SG0_46_EAT SG0_47_EAT SG0_48_EAT SG0_49_PHY SG0_50_PHY
49	*Decimal Age:* 8.73 *Gender:* Girl *Weight:* 32.85 kg *Height:* 125.5 cm *BMI:* 20.86 kg/m^2 *BMI Z-Score:* 1.66 *BMI Percentile:* 95.15	SG0_02_GEN SG1_01_EAT SG1_02_EAT SG1_03_EAT SG1_04_EAT SG1_05_EAT SG1_06_PHY SG1_07_PHY	SG0_02_GEN SG1_01_EAT SG1_02_EAT SG1_03_EAT SG1_04_EAT SG1_05_EAT SG1_06_PHY SG1_07_PHY

50	**Decimal Age:** 10.76 **Gender:** Girl **Weight:** 85.95 kg **Height:** 161 cm **BMI:** 33.16 kg/m^2 **BMI Z-Score:** 3.18 **BMI Percentile:** 99.93	SG0_02_GEN SG1_01_EAT SG1_02_EAT SG1_03_EAT SG1_04_EAT SG1_05_EAT SG1_06_PHY SG1_07_PHY	SG0_02_GEN SG1_01_EAT SG1_02_EAT SG1_03_EAT SG1_04_EAT SG1_05_EAT SG1_06_PHY SG1_07_PHY
51	**Decimal Age:** 9.46 **Gender:** Girl **Weight:** 52.2 kg **Height:** 145.5 cm **BMI:** 33.16 kg/m^2 **BMI Z-Score:** 3.24 **BMI Percentile:** 99.94	SG0_02_GEN SG1_01_EAT SG1_02_EAT SG1_03_EAT SG1_04_EAT SG1_05_EAT SG1_06_PHY SG1_07_PHY	SG0_02_GEN SG1_01_EAT SG1_02_EAT SG1_03_EAT SG1_04_EAT SG1_05_EAT SG1_06_PHY SG1_07_PHY
52	**Decimal Age:** 6.82 **Gender:** Girl **Weight:** 31.3 kg **Height:** 118 cm **BMI:** 22.48 kg/m^2 **BMI Z-Score:** 2.36 **BMI Percentile:** 99.09	SG0_02_GEN SG1_01_EAT SG1_02_EAT SG1_03_EAT SG1_04_EAT SG1_05_EAT SG1_06_PHY SG1_07_PHY	SG0_02_GEN SG1_01_EAT SG1_02_EAT SG1_03_EAT SG1_04_EAT SG1_05_EAT SG1_06_PHY SG1_07_PHY

53	**Decimal Age:** 7.54 **Gender:** Girl **Weight:** 39.05 kg **Height:** 136 cm **BMI:** 21.11 kg/m^2 **BMI Z-Score:** 1.91 **BMI Percentile:** 97.19	SG0_02_GEN SG1_01_EAT SG1_02_EAT SG1_03_EAT SG1_04_EAT SG1_05_EAT SG1_06_PHY SG1_07_PHY	SG0_02_GEN SG1_01_EAT SG1_02_EAT SG1_03_EAT SG1_04_EAT SG1_05_EAT SG1_06_PHY SG1_07_PHY
54	**Decimal Age:** 6.59 **Gender:** Boy **Weight:** 58.3 kg **Height:** 151 cm **BMI:** 25.56 kg/m^2 **BMI Z-Score:** 3.40 **BMI Percentile:** 99.97	SG0_02_GEN SG1_01_EAT SG1_02_EAT SG1_03_EAT SG1_04_EAT SG1_05_EAT SG1_06_PHY SG1_07_PHY	SG0_02_GEN SG1_01_EAT SG1_02_EAT SG1_03_EAT SG1_04_EAT SG1_05_EAT SG1_06_PHY SG1_07_PHY
55	**Decimal Age:** 16 **Gender:** Girl **Weight:** 82 kg **Height:** 171.5 cm **BMI:** 27.88 kg/m^2 **BMI Z-Score:** 2.10 **BMI Percentile:** 98.21	SG0_02_GEN SG1_01_EAT SG1_02_EAT SG1_03_EAT SG1_04_EAT SG1_05_EAT SG1_06_PHY SG1_07_PHY	SG0_02_GEN SG1_01_EAT SG1_02_EAT SG1_03_EAT SG1_04_EAT SG1_05_EAT SG1_06_PHY SG1_07_PHY

56	*Decimal Age:* 8.08 *Gender:* Girl *Weight:* 42.2 kg *Height:* 130 cm *BMI:* 24.97 kg/m^2 *BMI Z-Score:* 2.53 *BMI Percentile:* 99.43	SG0_02_GEN SG1_01_EAT SG1_02_EAT SG1_03_EAT SG1_04_EAT SG1_05_EAT SG1_06_PHY SG1_07_PHY	SG0_02_GEN SG1_01_EAT SG1_02_EAT SG1_03_EAT SG1_04_EAT SG1_05_EAT SG1_06_PHY SG1_07_PHY
57	*Decimal Age:* 10.59 *Gender:* Girl *Weight:* 72.25 kg *Height:* 156.5 cm *BMI:* 29.5 kg/m^2 *BMI Z-Score :* 2.72 *BMI Percentile:* 99.67	SG0_02_GEN SG1_01_EAT SG1_02_EAT SG1_03_EAT SG1_04_EAT SG1_05_EAT SG1_06_PHY SG1_07_PHY	SG0_02_GEN SG1_01_EAT SG1_02_EAT SG1_03_EAT SG1_04_EAT SG1_05_EAT SG1_06_PHY SG1_07_PHY
58	*Decimal Age:* 11.08 *Gender:* Girl *Weight:* 44.4 kg *Height:* 142.5 cm *BMI:* 21.80 kg/m^2 *BMI Z-Score:* 1.18 *BMI Percentile:* 88.10	SG0_03_GEN SG0_35_EAT SG0_36_EAT SG0_37_EAT SG0_38_EAT SG0_39_EAT SG0_40_EAT SG0_41_EAT SG0_42_EAT SG0_43_PHY SG0_44_PHY	SG0_03_GEN SG0_35_EAT SG0_36_EAT SG0_37_EAT SG0_38_EAT SG0_39_EAT SG0_40_EAT SG0_41_EAT SG0_42_EAT SG0_43_PHY SG0_44_PHY

59	**Decimal Age:** 14.35 **Gender:** Boy **Weight:** 86 kg **Height:** 179.5 cm **BMI:** 26.69 kg/m^2 **BMI Z-Score:** 1.63 **BMI Percentile:** 94.84	SG0_02_GEN SG1_01_EAT SG1_02_EAT SG1_03_EAT SG1_04_EAT SG1_05_EAT SG1_06_PHY SG1_07_PHY	SG0_02_GEN SG1_01_EAT SG1_02_EAT SG1_03_EAT SG1_04_EAT SG1_05_EAT SG1_06_PHY SG1_07_PHY
60	**Decimal Age:** 9.24 **Gender:** Boy **Weight:** 45.1 kg **Height:** 136 cm **BMI:** 24.38 kg/m^2 **BMI Z-Score:** 2.27 **BMI Percentile:** 98.84	SG0_02_GEN SG1_01_EAT SG1_02_EAT SG1_03_EAT SG1_04_EAT SG1_05_EAT SG1_06_PHY SG1_07_PHY	SG0_02_GEN SG1_01_EAT SG1_02_EAT SG1_03_EAT SG1_04_EAT SG1_05_EAT SG1_06_PHY SG1_07_PHY
61	**Decimal Age:** 9.91 **Gender:** Girl **Weight:** 71.9 kg **Height:** 146 cm **BMI:** 33.78 kg/m^2 **BMI Z-Score:** 3.25 **BMI Percentile:** 99.0	SG0_02_GEN SG1_01_EAT SG1_02_EAT SG1_03_EAT SG1_04_EAT SG1_05_EAT SG1_06_PHY SG1_07_PHY	SG0_02_GEN SG1_01_EAT SG1_02_EAT SG1_03_EAT SG1_04_EAT SG1_05_EAT SG1_06_PHY SG1_07_PHY

| 62 | *Decimal Age:* 8.19
Gender: Girl
Weight: 24.5 kg
Height: 127.5 cm
BMI: 15.07 kg/m^2
BMI Z-Score: -0.50
BMI Percentile: 30.85 | SG0_23_INT_F
SG0_41_EAT
SG0_42_EAT
SG0_43_EAT
SG0_44_EAT
SG0_45_EAT
SG0_46_EAT
SG0_47_EAT
SG0_48_EAT
SG0_49_PHY
SG0_50_PHY | SG0_23_INT_F   SG0_05_DEV
SG0_41_EAT
SG0_42_EAT
SG0_43_EAT
SG0_44_EAT
SG0_45_EAT
SG0_46_EAT
SG0_47_EAT
SG0_48_EAT
SG0_49_PHY
SG0_50_PHY |
| 63 | *Decimal Age:* 8.81
Gender: Girl
Weight: 47.2 kg
Height: 130.5 cm
BMI: 27.72 kg/m^2
BMI Z-Score: 2.76
BMI Percentile: 99.98 | SG0_02_GEN
SG1_01_EAT
SG1_02_EAT
SG1_03_EAT
SG1_04_EAT
SG1_05_EAT
SG1_06_PHY
SG1_07_PHY | SG0_02_GEN
SG1_01_EAT
SG1_02_EAT
SG1_03_EAT
SG1_04_EAT
SG1_05_EAT
SG1_06_PHY
SG1_07_PHY |

64	*Decimal Age:* 15 *Gender:* Girl *Weight:* 61.01 kg *Height:* 158.5 cm *BMI:* 24.30 kg/m^2 *BMI Z-Score:* 1.18 *BMI Percentile:* 88.10	SG0_03_GEN SG0_41_EAT SG0_42_EAT SG0_43_EAT SG0_44_EAT SG0_45_EAT SG0_46_EAT SG0_47_EAT SG0_48_EAT SG0_49_PHY	SG0_50_PHY	SG0_03_GEN SG0_41_EAT SG0_42_EAT SG0_43_EAT SG0_44_EAT SG0_45_EAT SG0_46_EAT SG0_47_EAT SG0_48_EAT SG0_49_PHY	SG0_50_PHY
65	*Decimal Age:* 11.13 *Gender:* Girl *Weight:* 56 kg *Height:* 148.7 cm *BMI:* 23.33 kg/m^2 *BMI Z-Score:* 1.95 *BMI Percentile:* 97.44	SG0_02_GEN SG1_01_EAT SG1_02_EAT SG1_03_EAT SG1_04_EAT SG1_05_EAT SG1_06_PHY SG1_07_PHY		SG0_02_GEN SG1_01_EAT SG1_02_EAT SG1_03_EAT SG1_04_EAT SG1_05_EAT SG1_06_PHY SG1_07_PHY	
66	*Decimal Age:* 9.61 *Gender:* Girl *Weight:* 50.65 kg *Height:* 155.5 cm *BMI:* 20.95 kg/m^2 *BMI Z-Score:* 1.36 *BMI Percentile:* 91.31	SG0_03_GEN SG0_41_EAT SG0_42_EAT SG0_43_EAT SG0_44_EAT SG0_45_EAT SG0_46_EAT SG0_47_EAT SG0_48_EAT SG0_49_PHY SG0_50_PHY		SG0_03_GEN SG0_41_EAT SG0_42_EAT SG0_43_EAT SG0_44_EAT SG0_45_EAT SG0_46_EAT SG0_47_EAT SG0_48_EAT SG0_49_PHY SG0_50_PHY	

67	*Decimal Age:* 7.44 *Gender:* Girl *Weight:* 36.55 kg *Height:* 133 cm *BMI:* 20.66 kg/m^2 *BMI Z-Score:* 1.82 *BMI Percentile:* 96.40	SG0_02_GEN SG1_01_EAT SG1_02_EAT SG1_03_EAT SG1_04_EAT SG1_05_EAT SG1_06_PHY SG1_07_PHY	SG0_02_GEN SG1_01_EAT SG1_02_EAT SG1_03_EAT SG1_04_EAT SG1_05_EAT SG1_06_PHY SG1_07_PHY
68	*Decimal Age:* 11.06 *Gender:* Boy *Weight:* 62.8 kg *Height:* 160.3 cm *BMI:* 24.44 kg/m^2 *BMI Z-Score:* 1.62 *BMI Percentile:* 94.70	SG0_02_GEN SG1_01_EAT SG1_02_EAT SG1_03_EAT SG1_04_EAT SG1_05_EAT SG1_06_PHY SG1_07_PHY	SG0_02_GEN SG1_01_EAT SG1_02_EAT SG1_03_EAT SG1_04_EAT SG1_05_EAT SG1_06_PHY SG1_07_PHY
69	*Decimal Age:* 13.47 *Gender:* Boy *Weight:* 48.9 kg *Height:* 151 cm *BMI:* 21.45 kg/m^2 *BMI Z-Score:* 0.38 *BMI Percentile:* 64.80	SG0_41_EAT SG0_42_EAT SG0_43_EAT SG0_44_EAT SG0_45_EAT SG0_46_EAT SG0_47_EAT SG0_48_EAT SG0_49_PHY SG0_50_PHY	SG0_41_EAT SG0_05_DEV SG0_42_EAT SG0_43_EAT SG0_44_EAT SG0_45_EAT SG0_46_EAT SG0_47_EAT SG0_48_EAT SG0_49_PHY SG0_50_PHY

70	**Decimal Age:** 8.08 **Gender:** Girl **Weight:** 40.4 kg **Height:** 128 cm **BMI:** 24.78 kg/m^2 **BMI Z-Score:** 2.47 **BMI Percentile:** 99.0	SG0_02_GEN SG1_01_EAT SG1_02_EAT SG1_03_EAT SG1_04_EAT SG1_05_EAT SG1_06_PHY SG1_07_PHY		SG0_02_GEN SG1_01_EAT SG1_02_EAT SG1_03_EAT SG1_04_EAT SG1_05_EAT SG1_06_PHY SG1_07_PHY	
71	**Decimal Age:** 8.75 **Gender:** Girl **Weight:** 41.8 kg **Height:** 133 cm **BMI:** 23.75 kg/m^2 **BMI Z-Score:** 2.15 **BMI Percentile:** 98.0	SG0_02_GEN SG1_01_EAT SG1_02_EAT SG1_03_EAT SG1_04_EAT SG1_05_EAT SG1_06_PHY	SG1_07_PHY	SG0_02_GEN SG1_01_EAT SG1_02_EAT SG1_03_EAT SG1_04_EAT SG1_05_EAT SG1_06_PHY	SG1_07_PHY
72	**Decimal Age:** 11.41 **Gender:** Girl **Weight:** 56.45 kg **Height:** 153 cm **BMI:** 24.11 kg/m^2 **BMI Z-Score:** 1.64 **BMI Percentile:** 94.95	SG0_02_GEN SG1_01_EAT SG1_02_EAT SG1_03_EAT SG1_04_EAT SG1_05_EAT SG1_06_PHY SG1_07_PHY		SG0_02_GEN SG1_01_EAT SG1_02_EAT SG1_03_EAT SG1_04_EAT SG1_05_EAT SG1_06_PHY SG1_07_PHY	

73	*Decimal Age:* 6.59 *Gender:* Girl *Weight:* 35.2 kg *Height:* 119 cm *BMI:* 24.86 kg/m^2 *BMI Z-Score:* 2.77 *BMI Percentile:* 99.72	SG0_02_GEN SG1_01_EAT SG1_02_EAT SG1_03_EAT SG1_04_EAT SG1_05_EAT SG1_06_PHY SG1_07_PHY	SG0_02_GEN SG1_01_EAT SG1_02_EAT SG1_03_EAT SG1_04_EAT SG1_05_EAT SG1_06_PHY SG1_07_PHY
74	*Decimal Age:* 9.56 *Gender:* Boy *Weight:* 53.25 kg *Height:* 143 cm *BMI:* 26.04 kg/m^2 *BMI Z-Score:* 2.48 *BMI Percentile:* 99.34	SG0_02_GEN SG1_01_EAT SG1_02_EAT SG1_03_EAT SG1_04_EAT SG1_05_EAT SG1_06_PHY SG1_07_PHY	SG0_02_GEN SG1_01_EAT SG1_02_EAT SG1_03_EAT SG1_04_EAT SG1_05_EAT SG1_06_PHY SG1_07_PHY
75	*Decimal Age:* 17.61 *Gender:* Girl *Weight:* 94.0 kg *Height:* 171.5 cm *BMI:* 31.96 kg/m^2 *BMI Z-Score:* 2.94 *BMI Percentile:* 99.84	SG0_02_GEN SG1_01_EAT SG1_02_EAT SG1_03_EAT SG1_04_EAT SG1_05_EAT SG1_06_PHY SG1_07_PHY	SG0_02_GEN SG1_01_EAT SG1_02_EAT SG1_03_EAT SG1_04_EAT SG1_05_EAT SG1_06_PHY SG1_07_PHY

76	Decimal Age: 13.91 Gender: Boy Weight: 102.15 kg Height: 174 cm BMI: 33.80 kg/m^2 BMI Z-Score: 2.76 BMI Percentile: 99.65	SG0_02_GEN SG1_01_EAT SG1_02_EAT SG1_03_EAT SG1_04_EAT SG1_05_EAT SG1_06_PHY SG1_07_PHY	SG0_02_GEN SG1_01_EAT SG1_02_EAT SG1_03_EAT SG1_04_EAT SG1_05_EAT SG1_06_PHY SG1_07_PHY
77	Decimal Age: 5.66 Gender: Girl Weight: 38 kg Height: 99.99 BMI: 24.83 kg/m^2 BMI Z-Score: 3.11 BMI Percentile: 99.80	SG0_02_GEN SG1_01_EAT SG1_02_EAT SG1_03_EAT SG1_04_EAT SG1_05_EAT SG1_06_PHY SG1_07_PHY	SG0_02_GEN SG1_01_EAT SG1_02_EAT SG1_03_EAT SG1_04_EAT SG1_05_EAT SG1_06_PHY SG1_07_PHY
78	Decimal Age: 9.76 Gender: Boy Weight: 51.3 kg Height: 139.5 cm BMI: 26.36 kg/m^2 BMI Z-Score: 2.40 BMI Percentile: 98.18	SG0_02_GEN SG1_01_EAT SG1_02_EAT SG1_03_EAT SG1_04_EAT SG1_05_EAT SG1_06_PHY SG1_07_PHY	SG0_02_GEN SG1_01_EAT SG1_02_EAT SG1_03_EAT SG1_04_EAT SG1_05_EAT SG1_06_PHY SG1_07_PHY
79	Decimal Age: 7.92 Gender: Boy Weight: 46.1 kg Height: 139 cm BMI: 23.86 kg/m^2	SG0_02_GEN SG1_01_EAT SG1_02_EAT SG1_03_EAT SG1_04_EAT	SG0_02_GEN SG1_01_EAT SG1_02_EAT SG1_03_EAT SG1_04_EAT

	BMI Z-Score: 2.62 *BMI Percentile:* 99.0	SG1_05_EAT SG1_06_PHY SG1_07_PHY	SG1_05_EAT SG1_06_PHY SG1_07_PHY
80	*Decimal Age:* 7.63 *Gender:* Girl *Weight:* 26.45 kg *Height:* 129 cm *BMI:* 15.89 kg/m^2 *BMI Z-Score:* 0.05 *BMI Percentile:* 51.99	SG0_22_INT_F SG0_41_EAT SG0_42_EAT SG0_43_EAT SG0_44_EAT SG0_45_EAT SG0_46_EAT SG0_47_EAT SG0_48_EAT SG0_49_PHY SG0_50_PHY	SG0_22_INT_F SG0_05_DEV SG0_41_EAT SG0_42_EAT SG0_43_EAT SG0_44_EAT SG0_45_EAT SG0_46_EAT SG0_47_EAT SG0_48_EAT SG0_49_PHY SG0_50_PHY