



کراچی یونیورسٹی

University of Karachi
THE NGDS PILOT PROJECT
The Sibling Growth Pilot Project



SF-GROWTH-AND-IMAGING LABORATORY

ADDITIONAL FILE 2

GROWTH-AND-OBESITY VECTOR-ROADMAPS GENERATED USING ENHANCED ANTHROPOMETRIC INSTRUMENTS: THE FOURTH-GENERATION SOLUTION OF CHILDHOOD OBESITY

Syed Arif Kamal, Ashfaq Ali Naz, Saba Musafar and Shakeel Ahmed Ansari*

<http://www.ngds-ku.org/Presentations/Vector.pdf>

This is the format of the report generated using vector model. Text in BLUE is not part of report handed out to parents of L. G. (header and footer on this page as well as pages 5-9)

GROWTH-AND-OBESITY VECTOR-ROADMAPS OF G. FAMILY

SGPP Case Number: SGPP-KHI-20131021-02 • Date of Report (year-month-day): 2015-08-29

Father's Name: W/H • Mother's Name: W/H • e-mail: W/H • Paper Mail: W/H

Telephone: W/H • Best time to Call: 11 am on Saturday

Table 1_{VECTOR}. Adult-mid-parental (Target) and army-cutoff heights

Father's Height: † 167.16 cm • Mother's Height: † 160.16 cm

Adult-Mid-Parental (Target) and Army-Cutoff Heights	Boy †		Girl †	
	Target	Army-Cutoff	Target	Army-Cutoff
Height (cm)	170.16	162.56	157.16	157.48
Height (ft-in)	5 ft 6.99 in	5 ft 4.00 in	5 ft 1.87 in	5 ft 2.00 in
Percentile	18.95	2.72	18.14	19.36

cm: centimeter(s) • ft: foot (feet) • in: inch(es) • kg: kilogram(s) • lb: pound(s) • oz: ounce(s)

MP: Mid-Parental • NA: Not Available • NM: Not Measured • W/H: Withheld to protect privacy

EC I: Energy-Channelization I (Tallness + Wasting) • EC II: Energy-Channelization II (Stunting + Obesity)

EC III: Energy-Channelization III (Puberty-Induced Energy-Channelization) • AM: Acute Malnutrition

ON: Over-Nutrition (Tallness + Obesity) • UN: Under-Nutrition (Stunting + Wasting)

- The mother, accompanied by father, could come and discuss strategies for long-term-health protection of their child(ren), on:
Tuesday, September 1, 2015 at 1730h
- For explanation of dress and behavior codes see *Manual for Anthropometric Measurements*:
http://www.ngds-ku.org/ngds_folder/M02.pdf
- Optimal mass (weight) is the recommended mass based on current height of the incumbent.
- WASTED (OBESE) means student has lesser (excess) weight-for-height (do not confuse with everyday meaning of wasted). Detailed guidelines to help maintain optimal weight-for-height are placed at:
<http://www.ngds-ku.org/BLA/Weight.pdf>
- If the data are divided into 100 equal parts, each part represents percentile and gives ranking in the sample chosen to collect data.
- Estimated-adult height is based on percentile of current height. Adult-mid-parental (Target) height is obtained by adding 6.5 cm to (for boys)/ subtracting 6.5 cm from (for girls) average of parents' heights (in cm).
- Some helpful suggestions to increase heights of girls, who are considered short-for-age, are available at the link:
<http://www.ngds-ku.org/BLA/Height.pdf>
- All diet-based interventions to maintain appropriate weight-for-height and proper height-for-age would be nullified, if children were suffering from vitamin-D deficiency (VDD). The following link lists some indications as well as remedial measures to spot and overcome VDD:
<http://www.ngds-ku.org/BLA/VDD.pdf>
- Cumulative-Scoliosis-Risk Weightage (CSRW) above 5.5, 6.5 or 7.5 after the first, the second or the third checkup, respectively, needs careful observation and follow up. CSRW is determined on the basis of the following criteria:
http://www.ngds-ku.org/BLA/Scoliosis_Risk.pdf
- Guidelines to guard against curvatures of spinal column are placed at:
<http://www.ngds-ku.org/Articles/A14.pdf>
- This 'Growth-and-Obesity Vector-Roadmap' is generated according to the procedures given in:
<http://www.ngds-ku.org/Presentations/Vector.pdf>
- Next checkup of your family is scheduled on:
Saturday, March 26, 2016 at 0937h
- Many thanks for your support and understanding of the work done by the NGDS Team.

Prof. Dr. Syed Arif Kamal
Professor and Project Director
e-mail: sakamal@uok.edu.pk

*Head, Anthromathematics Group, Project Director, the NGDS Pilot Project and Director, SF-Growth-and-Imaging Laboratory, University of Karachi.

Table 2_{VECTOR}a. Month-wise-height and -mass (-weight) management for L. G. (SGPP-KHI-20131021-02/01) based on the vector model

Gender: Female † • Date of Birth: August 15, 2007 • School: W/H • GR Number: W/H • Sport: Gymnastics

Target Date	Height Target		Mass (Weight) Target	
	cm	ft-in	kg	lb-oz
September 22, 2015	144.05	4 ft 8.71 in	28.88	63 lb 10.98 oz
October 22, 2015	144.58	4 ft 8.92 in	29.31	64 lb 10.14 oz
November 22, 2015	145.12	4 ft 9.13 in	30.31	66 lb 13.23 oz
December 22, 2015	145.66	4 ft 9.35 in	31.28	68 lb 15.58 oz
January 22, 2016	146.18	4 ft 9.55 in	32.21	71 lb 0.35 oz
February 22, 2016	146.72	4 ft 9.76 in	33.05	72 lb 13.88 oz

Table 2_{VECTOR}b. Lifestyle adjustment, diet and exercise plans for L. G. to achieve month-wise targets

	Height Management	Mass (Weight) Management
Lifestyle Adjustment	Recommended daily dose of vitamin D (600 IU) through 10-15 minute guarded-graduated sun-exposure (early morning or late afternoon) with the child minimally dressed (leaving head, arms, legs and spinal column exposed, last one from external auditory meatus to hip joint; eyes protected through UV-cutoff glasses); 8-hour, night-time, sound sleep dressed in pajama shorts only (3-minute, slow-stroke back massage to improve quality and quantity of sleep); maximum 2-hour screen time (one hour computer/video games — computer monitor at eye level; one hour TV/DVD) — light exercises during TV/DVD watching; for 5 minutes each after waking up, at the end of every hour and before going to bed — bending on sides, focusing eyes far away and moving eyeballs, moving fingers and wrists after computer work and writing, stretching, touching toes without flexing knees, exercising neck muscles (left, right, up, down)	
Diet Plans	3 relaxed and balanced meals, 10-12 glasses of water daily — absolutely NO carbonated drinks To gain height, diet plan should include calcium-, protein- and fiber-rich diet (milk, fresh fruit, chicken and fish)	To put on mass (weight), diet plan should include milk, potato items (baked or boiled, but not fried) and protein-rich diet
Exercise Plans	Guarded-graduated exercises preceded by warm-up and followed by cool-down routines To pick up height, child should perform light-stretching exercises (bar hanging, mild-stretching, summersault, cartwheel)	To increase mass (weight), heavy exercises performed for shorter duration, consistently

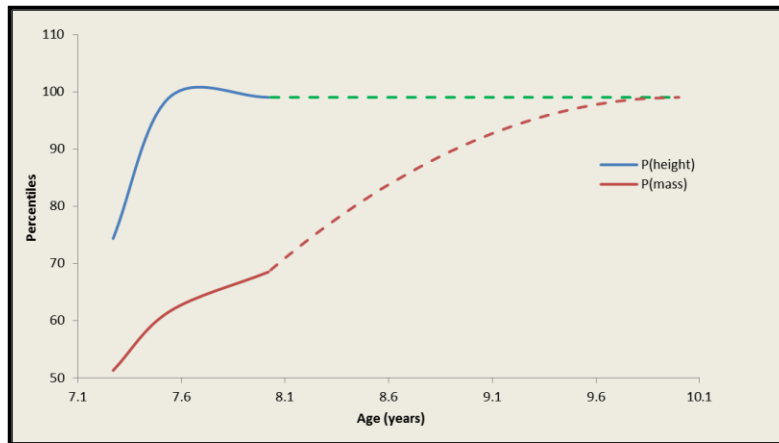





Figure 1_{VECTOR}. Time evolution of L. G.’s height and mass percentiles for her four checkups in the age range 7.27-8.61 years (navigational trajectory: solid curve), including the desired course-of-action (guidance trajectory: green-dashed line) and recommended intervention (control action: none for height-percentile curve and maroon-dashed for mass-percentile curve)

Table 2_{VECTORC}. Growth-and-Obesity Vector-Roadmap of L. G.

Checkup	1 st	2 nd	3 rd
Photograph			
Scanned Signatures	<i>LG</i>	<i>LG</i>	<i>LG</i>
Class and Section	II-B	II-B	III-B
Date of Checkup (<i>year-month-day</i>)	2014-11-22	2015-02-28	2015-08-22
Age (<i>year-month-day</i>)	07-03-07	07-05-23	08-00-07
Age (<i>decimal years</i>)	7.27	7.54	8.02
Dress Code	0/0.5	0/0.5	0/0.5
Behavior Code	0	0	0
Height, <i>h</i> (cm)	126.96	139.92	143.51
Height (<i>ft-in</i>)	4 ft 1.98 in	4 ft 7.09 in	4 ft 8.50 in
Percentile-of-Height, <i>P</i> (<i>h</i>)	74.37	99.01	99.06
Estimated-Adult Height (cm)	167.59	180.04	180.44
Estimated-Adult Height (<i>ft-in</i>)	5 ft 5.98 in	5 ft 10.88 in	5 ft 11.04 in
CA-MP (Current-Age-Mid-Parental) Height (cm)	118.00	119.59	122.25
Δ Height w. r. t. CA-MP Height (cm)	+8.96	+20.33	+21.26
Algebraic Status (pertaining-to-height), <i>STATUS_±</i> (<i>h</i>)	+7.59%	+17.00%	+17.39%
Qualitative Status (pertaining-to-height)	1st-Deg Tall	2nd-Deg Tall	2nd-Deg Tall
CA-AC (Current-Age-Army-Cutoff) Height (cm)	118.26	119.86	122.53
Δ Height w. r. t. CA-AC Height (cm)	+8.70	+20.06	+20.98
Reference Height (cm)	126.96	139.92	143.51
Percentile-of-Reference-Height	74.37	99.01	99.06
Gross Mass (kg)	23.66	25.69	28.21
Clothing Correction (kg)	0	0	0
Net Mass, μ (kg)	23.66	25.69	28.21
Net Weight (<i>lb-oz</i>)	52 lb 2.72 oz	56 lb 10.34 oz	62 lb 3.25 oz
Percentile-of-Net-Mass, <i>P</i> (μ)	51.31	61.58	68.54
Estimated-Adult Mass (kg)	58.62	61.76	63.88
Estimated-Adult Weight (<i>lb-oz</i>)	129 lb 4.04 oz	136 lb 2.73 oz	140 lb 13.64 oz
Optimal Mass (kg)	26.37	39.12	42.61
Δ Mass-for-Height (kg)	-2.71	-13.43	-14.40
Algebraic Status (pertaining-to-mass), <i>STATUS_±</i> (μ)	-10.28%	-34.33%	-33.80%
Qualitative Status (pertaining-to-mass)	2nd-Deg Wasted	4th-Deg Wasted	4th-Deg Wasted
Cumulative-Scoliosis-Risk Weightage (CSRW)	8.50	9.00	9.00
Estimated-Adult BMI (<i>kg/m²</i>)	20.87	19.05	19.62
Nutritional Status	EC I	EC I	EC I
<i>P</i> (<i>h</i>) + <i>P</i> (μ)	125.68	160.60	167.59
Build	Medium	Big	Big

Need to take care of the checked items for L. G.:

- ⊗ 1. Optimal-weight management advised — note (*d*) on page-1 footer
- 2. Your child seems not to gain height, optimally — note (*g*) on page-1 footer
- ⊗ 3. Guard against your child acquiring scoliosis — notes (*i, j*) on page-1 footer
- 4. Signs of anemia observed; your child may have vitamin-D deficiency — note (*h*) on page-1 footer

Table 3_{VECTORa}. Month-wise-mass (-weight) management for parents

Father's Date of Birth: † July15, 1971 • Mother's Date of Birth: † January 2, 1979

Target Date	Father †		Mother †	
	kg	lb-oz	kg	lb-oz
December 22, 2014	63.39	139 lb 12.40 oz	70.39	155 lb 3.36 oz
January 22, 2015	64.12	141 lb 6.15 oz	69.62	153 lb 8.19 oz
February 22, 2015	64.85	142 lb 15.91 oz	68.85	151 lb 13.03 oz
March 22, 2015	65.58	144 lb 9.66 oz	68.08	150 lb 1.86 oz
April 22, 2015	66.32	146 lb 3.77 oz	67.32	148 lb 7.05 oz
May 22, 2015	67.06	147 lb 13.88 oz	66.56	146 lb 12.24 oz

Table 3_{VECTORb}. Lifestyle adjustment, diet and exercise plans for parents to achieve month-wise targets

	Father †	Mother †
Lifestyle Adjustment	Active and carefree lifestyle, lesser screen time, outdoor activities combined with light reading and social interactions, 6-hour night-time sound sleep	
Diet Plans	3 relaxed and balanced meals, 10-12 glasses of water daily — absolutely NO carbonated drinks To put on mass (weight), diet plan should include milk, potato items (baked or boiled, but not fried) and protein-rich diet	To shed off mass (weight), diet plan should include salad, yogurt and skimmed milk
Exercise Plans	Guarded-graduated exercises preceded by warm-up and followed by cool-down routines To put on mass (weight), father should perform heavy exercises for shorter duration, consistently	To shed off mass (weight), mother should perform light exercises longer duration, consistently

Table 3_{VECTORc}. Obesity Roadmaps of parents

	Father †	Mother †
Date of Checkup (year-month-day)	2014-11-22	2014-11-22
Age (year-month-day)	43-04-07	35-10-20
Age (decimal year)	43.36	35.89
Dress Code	1.5/2	2/2
Height, h (cm)	167.16	160.16
Height (ft-in)	5 ft 5.81 in	5 ft 3.06 in
Gross Mass (kg)	62.96	71.46
Clothing Correction (kg)	0.30	0.30
Net Mass, μ (kg)	62.66	71.16
Net Weight (lb-oz)	138 lb 2.64 oz	156 lb 14.52 oz
Optimal Mass (kg)	67.06	66.56
Δ Mass-for-Height (kg)	-4.40	+4.60
Algebraic Status (pertaining-to-mass), $STATUS_{\pm}(\mu)$	-6.56%	+6.91%
Qualitative Status (pertaining-to-mass)	1st-Deg Wasted	1st-Deg Obese
Body-Mass Index, BMI (kg/m ²)	22.42	27.74
$P(h) + P(\mu)$	31.45	118.16
Build	Small	Medium

COLOR-CODING FOR VARIOUS TABLES

Table 4_{VECTORa}. Row separation in 1_{VECTOR}, 2_{VECTORa} and 3_{VECTORa}

White	Hue	170 255	Red
	Sat	000 255	Green
	Lum	255 255	Blue
Grey	Hue	170 230	Red
	Sat	000 230	Green
	Lum	230 230	Blue

Table 4_{VECTORb}. Row separation in Tables 2_{VECTORb} and 3_{VECTORb}

Lifestyle Adjustment	Hue	021 255	Red
	Sat	255 204	Green
	Lum	204 153	Blue
Diet Plan	Hue	234 255	Red
	Sat	255 153	Green
	Lum	204 204	Blue
Exercise Plan	Hue	127 204	Red
	Sat	255 255	Green
	Lum	230 255	Blue

Table 4_{VECTORc}. Row separation in Tables 2_{VECTORc} and 3_{VECTORc}

Vital Statistics			
Light	Hue	042 255	Red
	Sat	255 255	Green
	Lum	204 153	Blue
Dark	Hue	042 255	Red
	Sat	255 255	Green
	Lum	169 083	Blue
Height Data			
Light	Hue	149 189	Red
	Sat	255 222	Green
	Lum	222 255	Blue
Dark	Hue	149 153	Red
	Sat	255 204	Green
	Lum	204 255	Blue
Mass Data			
Light	Hue	234 255	Red
	Sat	255 153	Green
	Lum	204 204	Blue
Dark	Hue	234 255	Red
	Sat	255 117	Green
	Lum	186 186	Blue
Combined Data			
Light	Hue	085 204	Red
	Sat	255 255	Green
	Lum	230 204	Blue
Dark	Hue	085 129	Red
	Sat	255 255	Green
	Lum	192 129	Blue

Table 5_{VECTOR}*a*. Status (pertaining-to-height) — qualitative and algebraic

4th-Degree Stunted	Hue Sat Lum	000 255 255 000 128 000	Red Green Blue	$STATUS_{\pm}(h) < -30$
3rd-Degree Stunted	Hue Sat Lum	019 227 233 108 119 010	Red Green Blue	$-30\% \leq STATUS_{\pm}(h) < -20\%$
2nd-Degree Stunted	Hue Sat Lum	032 255 255 192 128 000	Red Green Blue	$-20\% \leq STATUS_{\pm}(h) < -10\%$
1st-Degree Stunted	Hue Sat Lum	042 255 255 255 128 000	Red Green Blue	$-10\% \leq STATUS_{\pm}(h) < -1\%$
Normal	Hue Sat Lum	104 000 255 176 088 080	Red Green Blue	$-1\% \leq STATUS_{\pm}(h) < +1\%$
1st-Degree Tall	Hue Sat Lum	042 255 255 255 128 000	Red Green Blue	$+1\% \leq STATUS_{\pm}(h) < +10\%$
2nd-Degree Tall	Hue Sat Lum	032 255 255 192 128 000	Red Green Blue	$+10\% \leq STATUS_{\pm}(h) < +20\%$
3rd-Degree Tall	Hue Sat Lum	019 227 233 108 119 010	Red Green Blue	$+20\% \leq STATUS_{\pm}(h) < +30\%$
4th-Degree Tall	Hue Sat Lum	000 255 255 000 128 000	Red Green Blue	$STATUS_{\pm}(h) \geq +30\%$

Table 5_{VECTOR}*b*. Status (pertaining-to-mass) — qualitative and algebraic

4th-Degree Wasted	Hue Sat Lum	000 255 255 000 128 000	Red Green Blue	$STATUS_{\pm}(\mu) < -30$
3rd-Degree Wasted	Hue Sat Lum	019 227 233 108 119 010	Red Green Blue	$-30\% \leq STATUS_{\pm}(\mu) < -20\%$
2nd-Degree Wasted	Hue Sat Lum	032 255 255 192 128 000	Red Green Blue	$-20\% \leq STATUS_{\pm}(\mu) < -10\%$
1st-Degree Wasted	Hue Sat Lum	042 255 255 255 128 000	Red Green Blue	$-10\% \leq STATUS_{\pm}(\mu) < -1\%$
Normal	Hue Sat Lum	104 000 255 176 088 080	Red Green Blue	$-1\% \leq STATUS_{\pm}(\mu) < +1\%$
1st-Degree Obese	Hue Sat Lum	104 000 255 176 088 080	Red Green Blue	$+1\% \leq STATUS_{\pm}(\mu) < +10\%$
2nd-Degree Obese	Hue Sat Lum	032 255 255 192 128 000	Red Green Blue	$+10\% \leq STATUS_{\pm}(\mu) < +20\%$
3rd-Degree Obese	Hue Sat Lum	019 227 233 108 119 010	Red Green Blue	$+20\% \leq STATUS_{\pm}(\mu) < +30\%$
4th-Degree Obese	Hue Sat Lum	000 255 255 000 128 000	Red Green Blue	$STATUS_{\pm}(\mu) \geq +30\%$



Figure 2_{VECTORa}. Coördinate-plane representation of nutritional status — acute malnutrition is the limiting situation of under-nutrition; energy-channelization III (puberty-induced energy-channelization) is the limiting case of over-nutrition

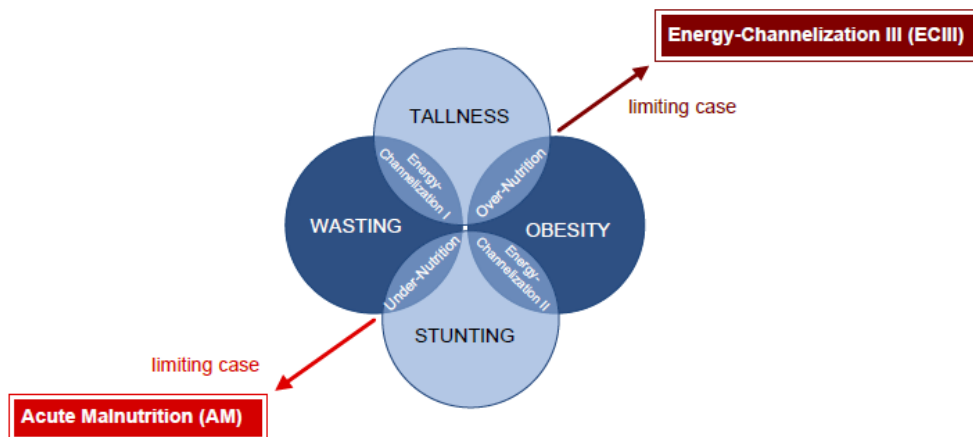


Figure 2_{VECTORb}. Venn-diagrammatic representation of nutritional status

Table 6_{VECTOR}a. Month-wise height and mass management

Old Model: http://www.ngds-ku.org/Presentations/Vector/Additional_File_1.pdf

Hue	000 128	Red
Sat	255 000	Green
Lum	064 000	Blue

Table 6_{VECTOR}b. Estimated-adult height

<: Lesser than Army-Cutoff Height • >: In Excess of Army-Cutoff Height
Army-Cutoff Height for the Pakistani Youth: 5 feet 4 inches for males and 5 feet 2 inches for females

<	Hue	000 255	Red
	Sat	255 000	Green
	Lum	128 000	Blue
>	Hue	106 051	Red
	Sat	128 153	Green
	Lum	102 102	Blue

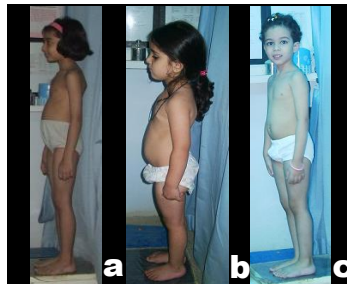
Table 6_{VECTOR}c. Severity of acute malnutrition (where present)

Example: <http://www.ngds-ku.org/Papers/J40.pdf>

Hue	000 255	Red
Sat	255 000	Green
Lum	128 000	Blue

Table 6_{VECTOR}d. Classification of build

Small	Hue	000 255	Red
	Sat	255 000	Green
	Lum	128 000	Blue
Medium	Hue	104 000	Red
	Sat	255 176	Green
	Lum	088 080	Blue
Big	Hue	042 255	Red
	Sat	255 255	Green
	Lum	128 000	Blue



Figures 3_{VECTOR}a-c. From left to right, examples of children of different builds — (a) small, (b) medium and (c) big

DESIRED TRAJECTORIES FOR HEIGHT AND MASS PERCENTILES

Table 7_{VECTOR}a. Percentile of height, h , as a function of age, A

$$P(h, A) = 99.05807563$$

Table 7_{VECTOR}b. Percentile of mass, μ , as a function of age, A

$$P(\mu, A) = 99.05807563 - 7.77898542 (A - 10)^2$$

Table 7_{VECTOR}c. Percentiles of height and mass on the dates, for which recommendations are generated

Date of Last (Third) Checkup: August 22, 2015 • *Decimal Age, A_0* [¶] = 8.019178082 years
 P_{ref} [¶] = 99.05807563 • $P(h, A_0)$ [¶] = 99.05807563 • $P(\mu, A_0)$ [¶] = 68.53601694

<i>Dates of Recommendation</i>	<i>Decimal Age, A_i (years)</i>	<i>$P(h, A_i)$</i>	<i>$P(\mu, A_i)$</i>
September 22, 2015	8.104109589	99.05807563	71.09728693
October 22, 2015	8.186301370	99.05807563	73.46908193
November 22, 2015	8.271232877	99.05807563	75.80952158
December 22, 2015	8.356164384	99.05807563	78.03773598
January 22, 2016	8.438191481	99.05807563	80.08321773
February 22, 2016	8.522890935	99.05807563	82.08548704

[¶] A_0 is the reference age, when control action is initiated; $P(h, A_0)$ represents percentile of height at the most-recent checkup, taken as reference; $P(\mu, A_0)$ represents percentile of mass at the most-recent checkup, taken as reference; P_{ref} is the reference percentile obtained by selecting maximum value of percentile of current height, $P(h, A_0)$, percentile of army-cutoff height, P_{AC} , and percentile of mid-parental height, P_{MP} .

Web address of the main document:

GROWTH-AND-OBESITY VECTOR-ROADMAPS GENERATED USING ENHANCED ANTHROPOMETRIC INSTRUMENTS THE FOURTH-GENERATION SOLUTION OF CHILDHOOD OBESITY

<http://www.ngds-ku.org/Presentations/Vector.pdf>

Web address of this document:

Additional File 2: GROWTH-AND-OBESITY VECTOR-ROADMAPS OF G. FAMILY

http://www.ngds-ku.org/Presentations/Vector/Additional_File_2.pdf