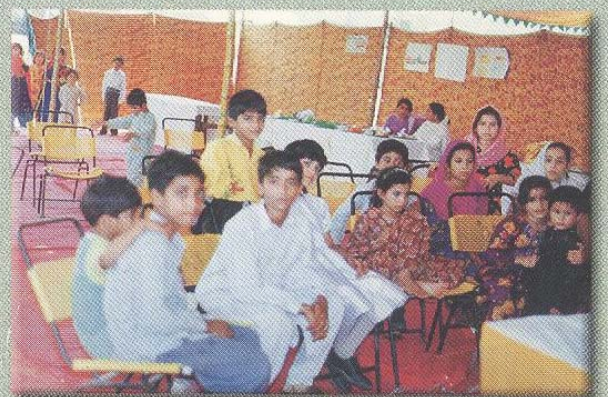
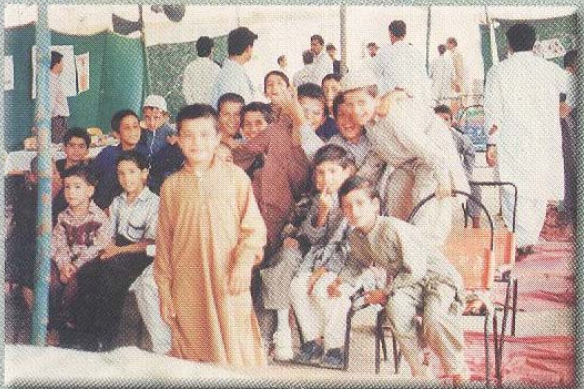
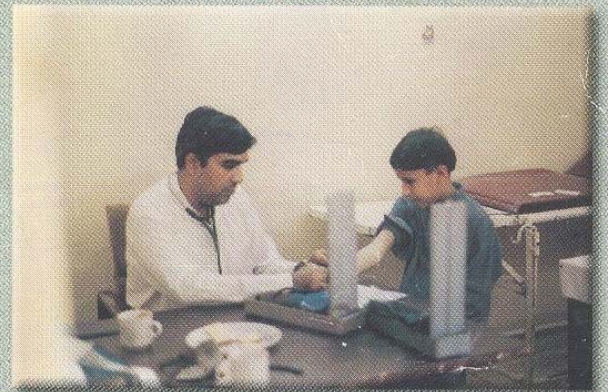
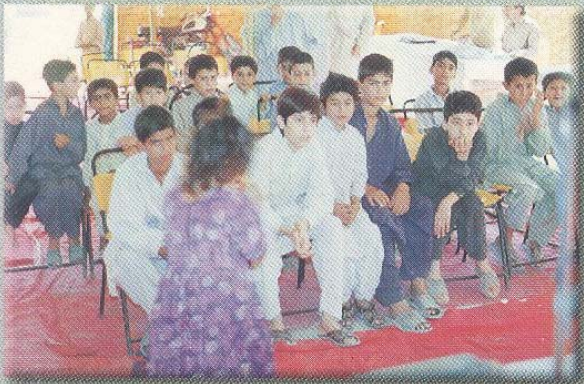
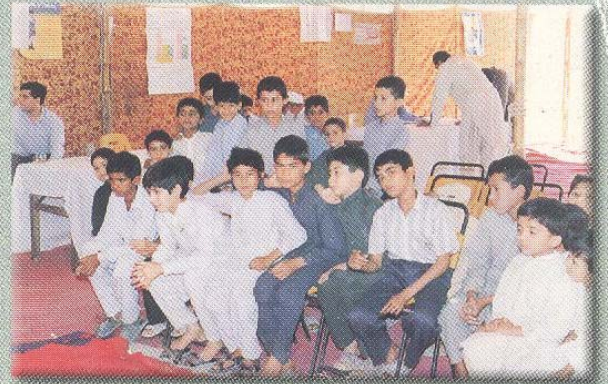
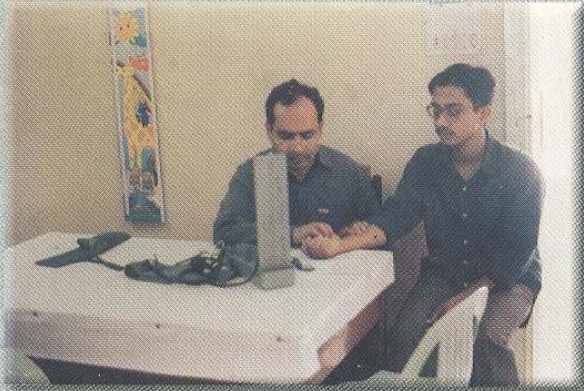


Pakistan Hypertension League

Guidelines for the Detection, Control and Management of Hypertension (high blood pressure) in Pakistani children.



Guide lines for the detection control and management of high blood pressure in Pakistani children

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Introduction

Hypertension in children, adolescents is defined as that level of systolic diastolic or both diastolic and systolic blood pressure that exceeds 95th percentiles of the population at three separate determinations .The level of blood pressure that is harmful and leads to target organs damage such as kidney, heart ,brain and peripheral vessels including coronary arteries has by general consensus has been set at >- than 140/90 mmHg .This cut of point has been determined by long term studies in adults. In children such studies are not available so that statistical method of percentiles has been adopted .Normal blood pressure has been defined by the Task Force of NIHBL USA as less than 90th percentile which are height weighted and specific for sex, and weight and high normal between 90th -95th percentile , high blood pressure for sex and age and hypertension as blood pressure exceeding 95th percentile. Severe hypertension is that level which exceeds 99th percentile. Recently in JCN 8 report it has been suggested that in children and adolescents a systolic or diastolic blood pressure exceeding 120/80 mmHg requires life style

modification ..Hypertension is a genetic disease and powered by environmental factors .In children obesity has emerged as a single most important environmental factor .The studies have shown that children in high blood pressure and those exceeding 95th percentile track their high percentiles and become hypertensive adults .The autopsy data of long term studies have shown development of atherosclerotic lesions in young children and adolescents who have risk factors for coronary heart disease including hypertension . It is thus important to detect children with blood pressure in high percentiles and treat them so that they do not become hypertensive adults .USA and Europe have developed percentile graphs which are age, height and gender specific, for their populations .

It is known that the hypertension prevalence is racially related so that African have higher prevalence than Caucasians .Hypertension is estimated at 3 percent in Pakistan National health survey children population. We have shown that diastolic blood pressure in Pakistani children is higher than USA or Europe. Consequently we have developed percentile blood pressure graphs and tables for sex, age specific and height weighted .. The percentile graphs were made using 5057 5-17 year children of PHS data and 999 children of Metroville health study .

The flowing graphs and tables available for Pakistani population

1. The systolic blood pressure(SBP) percentile profile of children age 2-17 years is shown in Table 1 for boy and girls respectively .The percentiles of diastolic blood pressure (DBP) are shown in Table 2
2. Cut of points of height percentiles for boys and girls are shown in Table 3.
3. Height weighted SBP and DBP 90th and 95th percentiles for 5-17 year old boys and girls are shown in Table 4
4. SBP and DBP profile of 2-17 year old boys and girls is presented in graphic form fig 1 2 3 4 .
5. Height and weight percentiles for 2-17 year old boys and girls in graphic form are presented in fig 5 -8

Prevalence hypertension in children

The prevalence of 2-3 percent is reported for Caucasians children in the developed countries. Using the USA Task force percentiles hypertension SBP and DBP or both in 2-17 year Pakistani children of Pakistan National Health survey (PNHS) children population, the prevalence was 6 percent.

Technique of measuring blood pressure

The blood pressure in children is measured in sitting position and supine position in infants.

Relax the child by talking and explaining what you are going to do.

Selection of appropriate cuff

Measure the upper arm circumference between olecranon process at the elbow and acromion at the shoulder and at its mid-point measure the circumference of the arm and by using this measurement select appropriate cuff from the Table 5

General rule is to select a cuff which should cover 2/3 third of the arm. Generally infant small child and adolescent cuffs are required Infants and newly born babies require special cuffs. Obese older children may require thigh cuff.

Use mercury manometer when possible otherwise all devices need calibration off and on.

Digital devices are convenient for home use and Doppler devices may be required for newborn or infants or situations where pulses are weak for auscultation as in infants and when coarctation of aorta is

1. Wrap the cuff snugly around the right arm above the brachial fossa present and inflate the cuff till brachial artery is not palpable. This is the obliteration pressure.

- 2 Stethoscope is placed in the brachial fossa and cuff inflated 20 mmHg above the obliteration pressure

3 Arm should be at heart level in sitting position.

4 the cuff is gradually deflated 2 mmHg at a time till 2 consecutive Korotkoff sound are audible, this is taken as systolic blood pressure(SBP)

5 The cuff is gradually deflated further till sounds become muffled note this is K4 diastolic pressure

6 Continue deflation till sounds become inaudible, this is the diastolic pressure, K5 point which is agreed to recorded as diastolic blood pressure (DBP)

7 If Korotkoff sounds remain audible till zero point the K4 is taken as DBP.

8. Two readings of blood pressure are taken .if variation between is more than 2 mmHg then a third reading is taken

9 Raise the arm after each reading for at least two minute interval be taken between readings.

10 When pulses are not palpable , present flush pressure (mean pressure) is determined. Required in coarctation of aorta for leg pressure and in infants and newborn.

The cuff is wrapped across the arm or leg which is elevated and blood milked from proximally from distal direction keep the milking pressure proximally and inflate the cuff keeping the pressure on the limb constant .The leg or arm is the set flat on

the bed .The cuff is deflated slowly till flush appears in the distal part of the limb .This pressure is noted and represents the mean blood pressure.

12 Ambulatory blood pressure device use in children is being used for excluding white coat hypertension and exploring the night day pressure and correlations with target organ damage. Its role is yet to be established

Types of hypertension

There are 2 types

When a cause known it is termed secondary hypertension

When a cause not known, often with family history and obesity is called essential or primary hypertension

Secondary hypertension in children in Pakistan is mostly due to kidney diseases, such as hydronephrosis and acute or chronic nephritis. Chronic pyelonephritis hypoplastic kidney, and renal arterial stenosis, in infant's coarctation of the aorta and renal vein thrombosis are also implicated .Other causes are listed in the table 6

Table 6 A

Renal disease

Glomerulonephritis, poly cystic disease, unilateral renal vein stenosis, parenchymal disease, Henoch-Schonlein purpura, reflex uropathy, hemolytic uremic syndrome and nephritic syndromes.

Coactation of aorta

Mineralocorticoid excess

Hyperthyroidism

Paeochromocytoma

Neurofibromatosis

Wilms tumor

Umbilical vein catheterization

Table 6 B

Investigations

In Pakistan renal disease is the most common form of secondary hypertension.

Urine analyses casts' hematuria proteinuria and inflammatory cells should be done,

Blood urea, serum creatinine, and serum electrolytes

Abdominal scan for renal artery stenosis

Endocrine causes are sought when clinically indicates

Catecholamine estimation in urine and VMA test when indicated

ECG, chest x-ray, and echocardiography for LV hypertrophy

Renal radiography such as isotope renogram. Voiding cryptogram, and Doppler study or MRI for renal arterial stenosis when indicated renal arterial angiography rennin levels and aldosterone estimations as required

Clinical examination

In addition to the routine clinical examination special attention is paid to the following

Family history of hypertension

Over weight and obesity

Fudoscopy in severe hypertension

Feel for femoral pulses

Examine chest and abdomen for bruit

Treatment

Non Physiological : Life style modifications

The following have been shown to reduce blood pressure

1. Weight reduction to the optimal .It is recommended to use weight and height graphs and charts to diagnose obesity and optimal weight .If obesity is diagnosed consult a dietician.

2 .Salt reduction in the diet is shown to reduce blood pressure it is recommended to remove all added salt to the diet and gradually reduce salt content in cooking till minimum till recommended daily amount. Roti should be cooked with

minimal quantity enough to facilitate cooking. The recommended salt consumption in children is 1.2 g daily and 1.5 g in older children and adolescents.

3. Increase physical activity .Recommended that school games be encouraged for all children, Mohalla clubs should be encouraged where along with cultural activities Picnics sports can be undertaken. Shopping trips on weekends, picnics to the parks where family could play games with children .Evening walks in Parks in the vicinity should be encouraged.

4 .Smoking by parents should be eliminated, Teen agers should be educated in the harm of smoking.

5 .Healthy diet is recommended, reduce total fat in the cooking reduce saturated oils in the cooking boil vegetables and grill the meat and fish and chicken if feasible. Substitute unsaturated vegetable oil such as soya and corn oil, for Ghee which is saturated fat.

Healthy foods are

Dalls (lentils), cereals vegetables, fruits, Chicken and fish, Brown bread and whole grain Roti to increase fiber in the diet.

Red meat three times week, rice and roti can be substituted with each other during the week parathas should be eaten on special occasions .

Dairy products and cookies of and on

The diet should be of quantity to maintains the optimum weight

Pharmacological Therapy

The medicine for controlling hypertension with non-pharmacologic extension should be started with great caution .Severe hypertension acute or chronic requires drugs and life style changes.

Mild hypertension should be treated with life style modifications

Drugs used for chronic hypertension

Principal of use

All possible causes of hypertension should be exclude, if cause is found it be treated and medicines stopped if possible after the removal of cause .Drugs are used and their discontinuation should be considered after sustained control if possible

Life style modification should be concomitant with drug therapy

If heart failure is present use ACE inhibitors such as captopril
Captopril and Enalapril

Diuretics oral or intravenous

ACE inhibitors are used well tolerated in children cough and potassium disturbance are infrequent complication

Contraindicated in Pregnancy. If renal artery stenosis is present can cause severe elevation of blood urea and creatinine

Beta blockers and calcium channel inhibitors are used in adults our experience with calcium channel inhibitors is limited in children

Vasodilators are useful in acute as well as chronic hypertension

Hydralazine is useful in controlling hypertension in acute glomerulonephritis Table 7-9.

Algorithm for management is shown in Fig 9

Table 7

Anti hypertensive therapy for hypertensive emergencies

Drugs	Dose
Nifedipine	0.25-0.5 mg /Kg sublingual prn
Sodium Nitropusside (Nipride)	0.5-1 ug/min IV to Max 8ug/Kg/min
Labetalol	0.2 -1mg/Kg/dose IV over 1-2 min Till 1 mg/kg till response

Esmolol	500-600 ug/Kg IV over 1-2 min till 200ug /kg to max of 1000ug/kg/min
Hydralazine	0.2-0.4 mg/Kg per dose at 2- 4 hourly if required
Furosemide(Lasix)	1-2 mg /Kg at 2-4 hourly interval

Table8

Anti-hypertensive drugs for persistent hypertension

Drug	Dose
Beta Blockers	
Atenolol	1-8 mg/Kg /dq6-12
Propranolol	1-8 mg /Kg d q 8 hourly
Metoprolol	1-2 mg/Kg d bid(max 6mg/kg)
Carvidiolol 0.35 mg /Kg bid (Max 25 mg)	0.05-0.1 mg/kg/dose bid to maintenance dose of
Calcium Channel Blockers	
Diltiazem	1-3mg/Kg 8 H (Max 120-249mg d
Verapamil	1mg/Kg/d (40-80mg /d)
Amlodipine	0.05-0.2mg/Kg d (2.5-10mg/ d)

Table 9

Diuretics	
Spiromide	1-2 mg/kg as Lasix
Spironolactone	1-2mg/Kg D
Amiloride	0.4-0.63mg/Kg/qd
Angiotensin Converting Enzymes (ACE)	
Captopril	
Children	1-6 mg /Kg d
Neonates	0.03-2mg/Kg d q8-12hrly
Enalpril	0.08mg/Kg/ up to 5 mg d q 12-24 hrly
Enalaprilat	0.05-1.0 mg/Kg/dose upto 1.25mg/dose
Angiotensin receptor blockers (ARB)	
Losartan	0.7 mg/Kg/d up to 50mg/d

The most commonly used drugs in children are

Captopril

Diuretics

Hydralazine

Beta Blockers and carvedilol

All ARB And ACE inhibitors are contraindicated in Pregnancy should be avoided in adolescents.

Repeated checks on serum creatinine urea and serum potassium levels are required

Enalaprilat IV may cause prolonged hypotension and renal failure in neonates

Fig 9

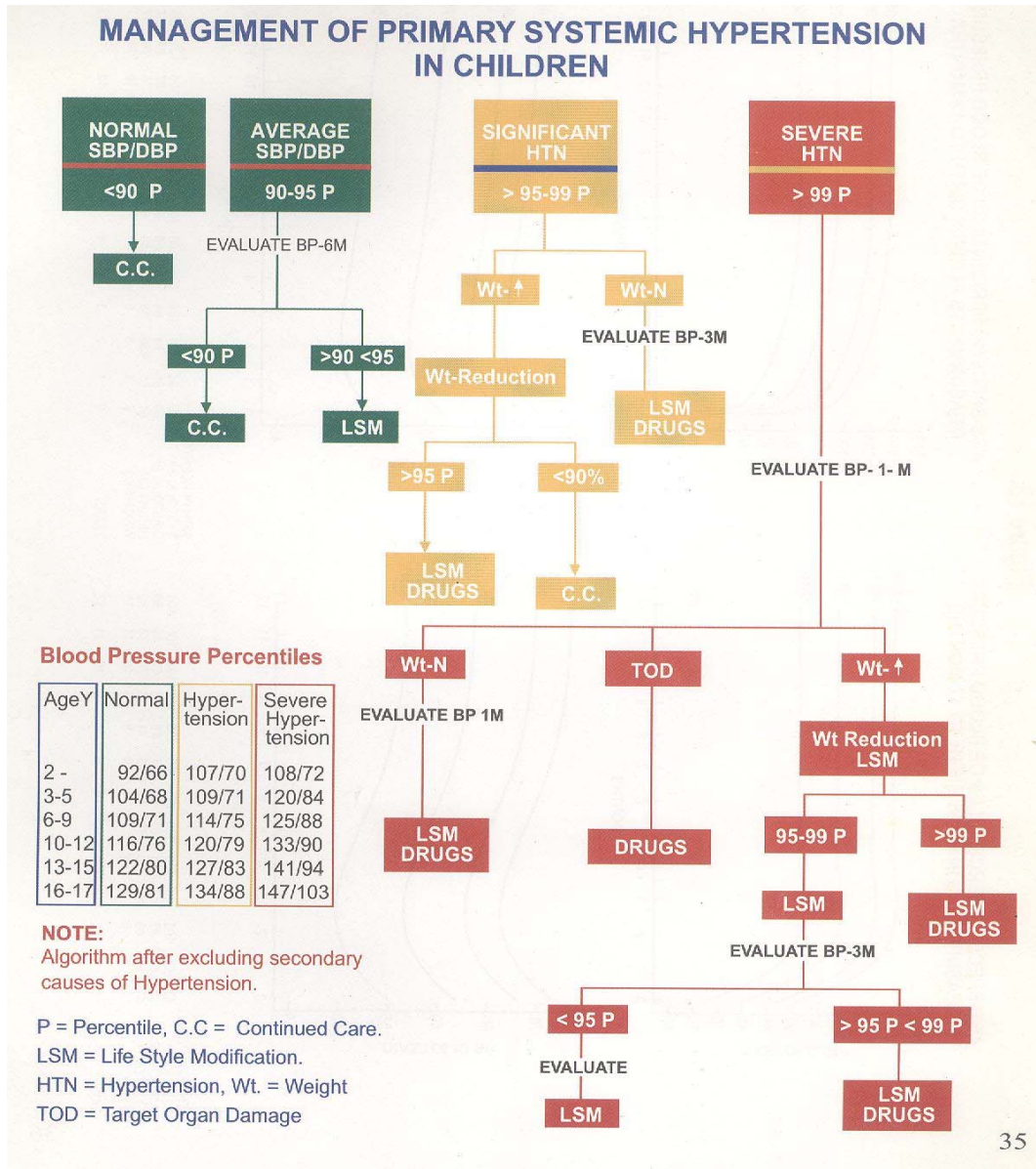


Figure 4.

Regression Percentile for DBP, girls (Age 2 - 4 for MHS only, Age 5 - 17 for both PMRC and MHS)

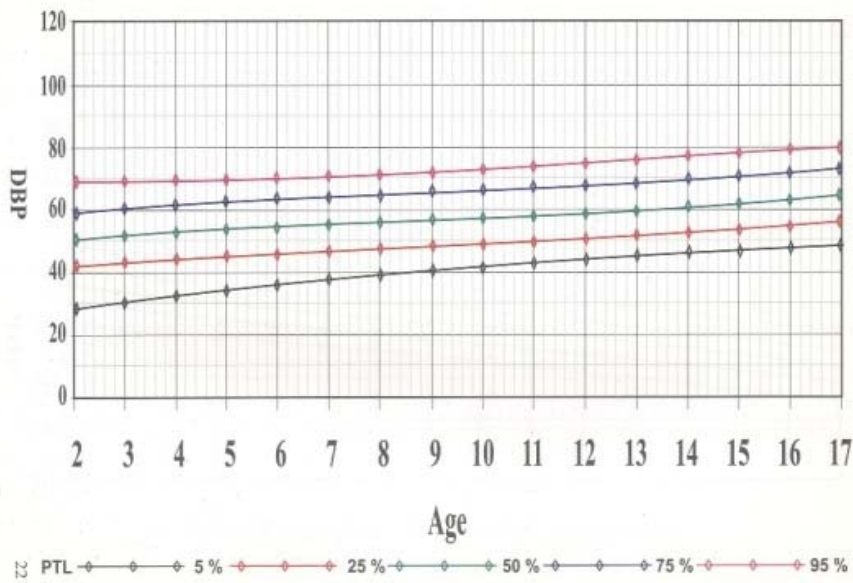


Figure 3.

Regression Percentile for SBP, girls (Age 2 - 4 for MHS only, Age 5 - 17 for both PMRC and MHS)

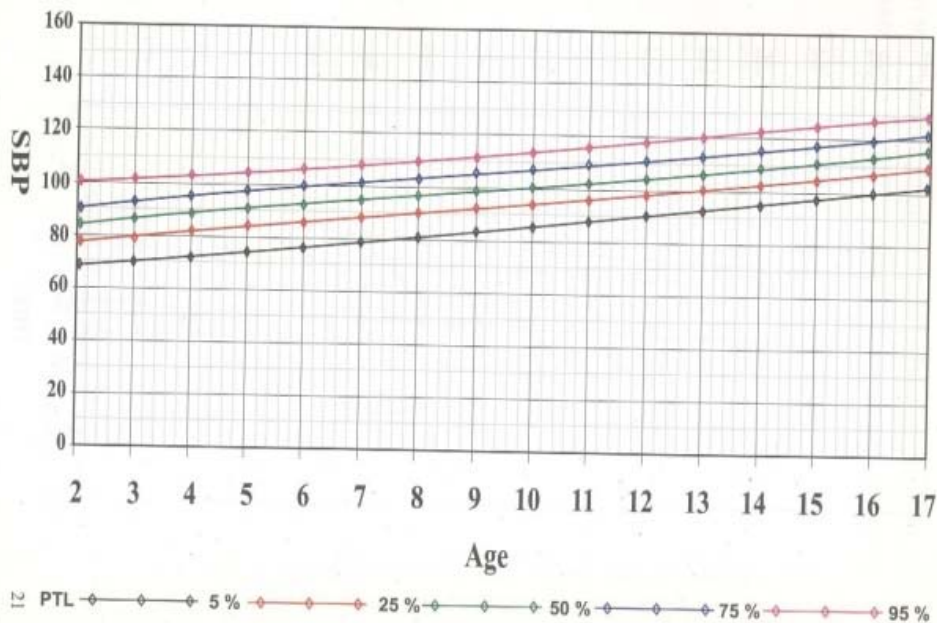


Figure 1.

Regression Percentile for SBP, boys (Age 2 - 4 for MHS only, Age 5 - 17 for both PMRC and MHS)

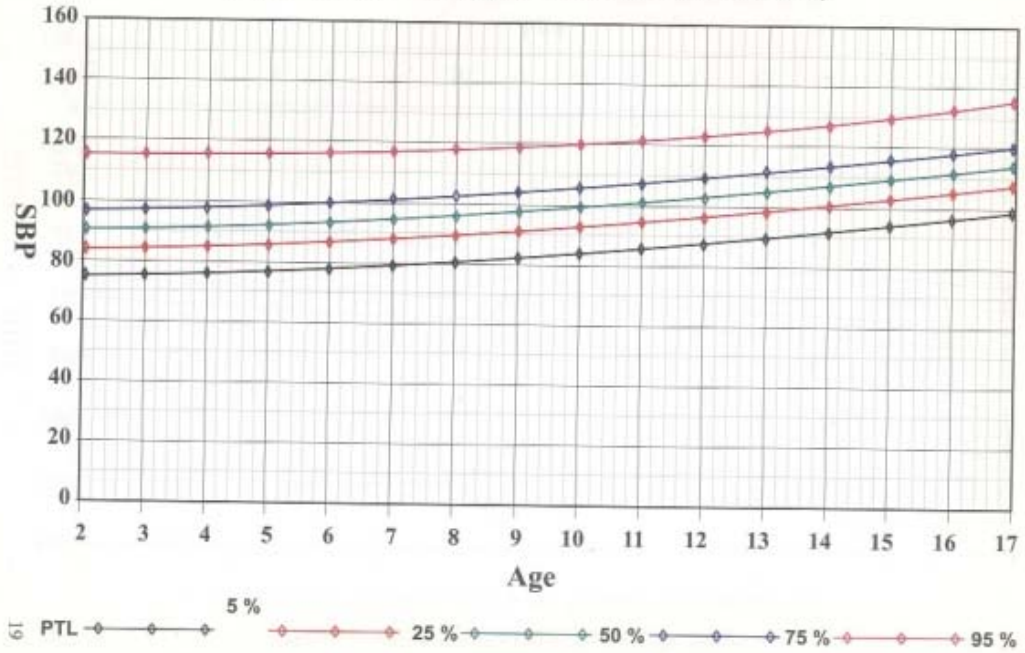


Figure 2.

Regression Percentile for DBP, boys (Age 2 - 4 for MHS only, Age 5 - 17 for both PMRC and MHS)

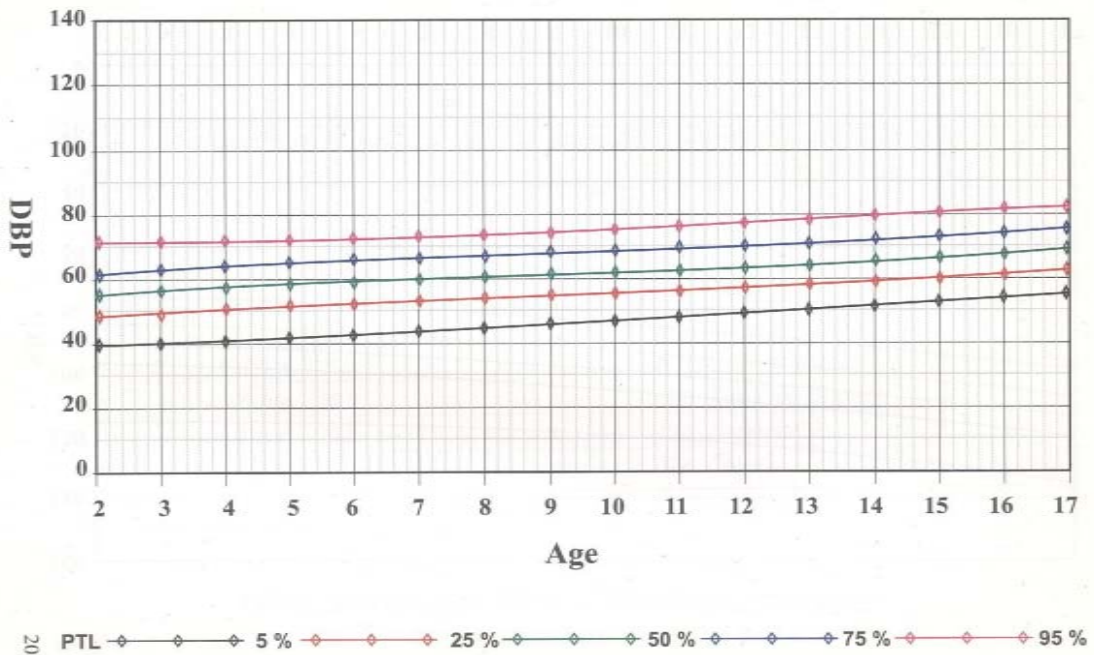


Fig 6

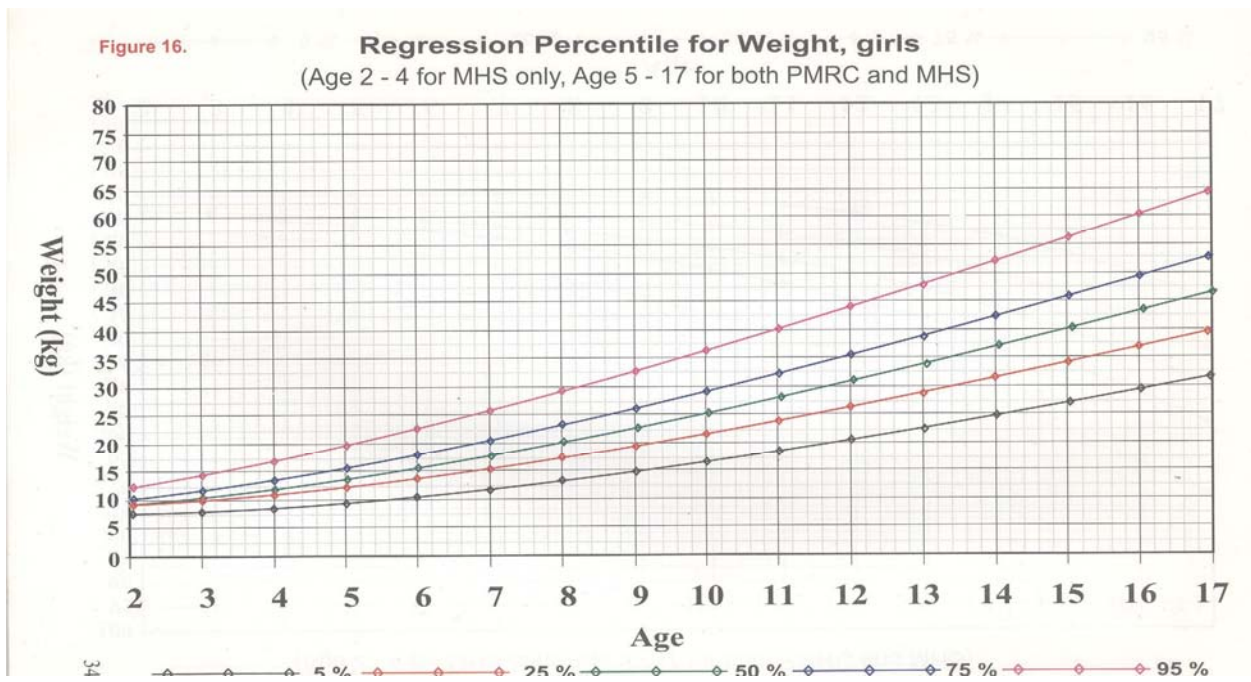
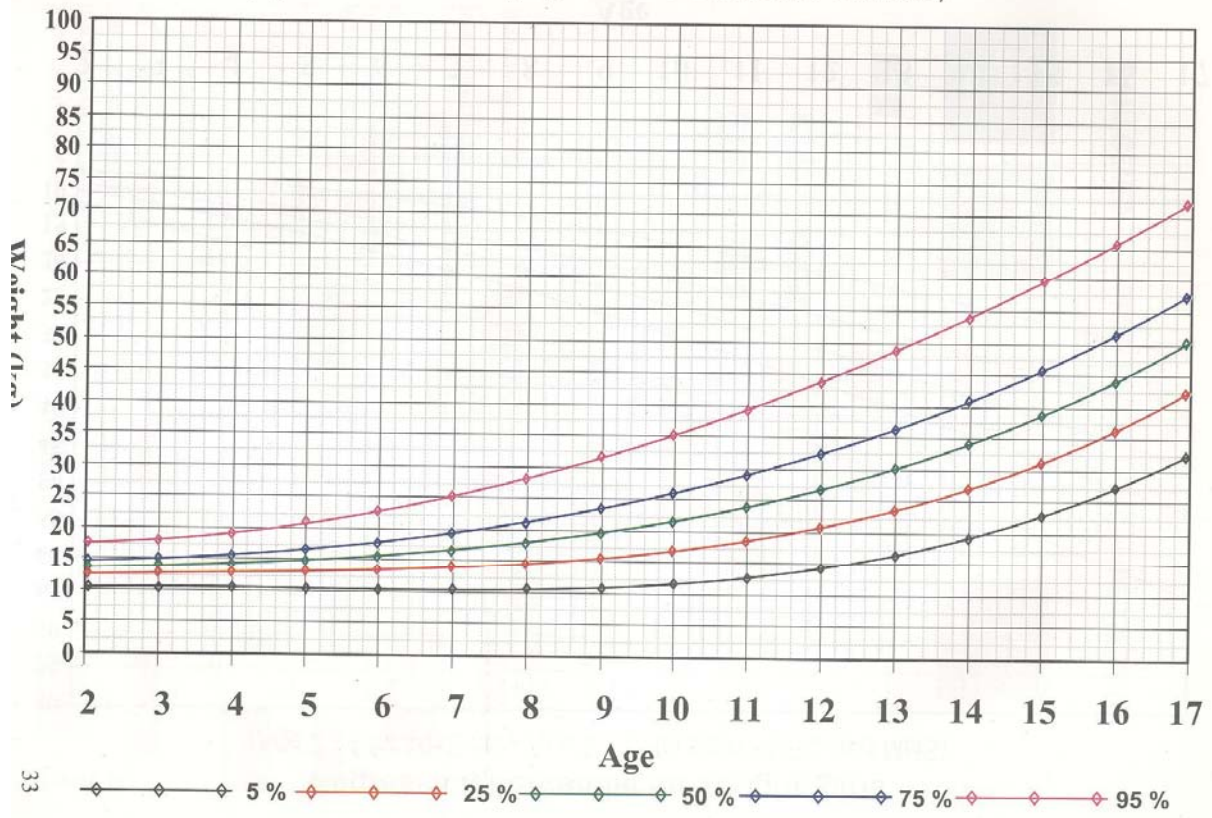


Fig 5



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Fig 7

Figure 13.

Regression Percentile for Height, boys
(Age 2 - 4 for MHS only, Age 5 - 17 for both PMRC and MHS)

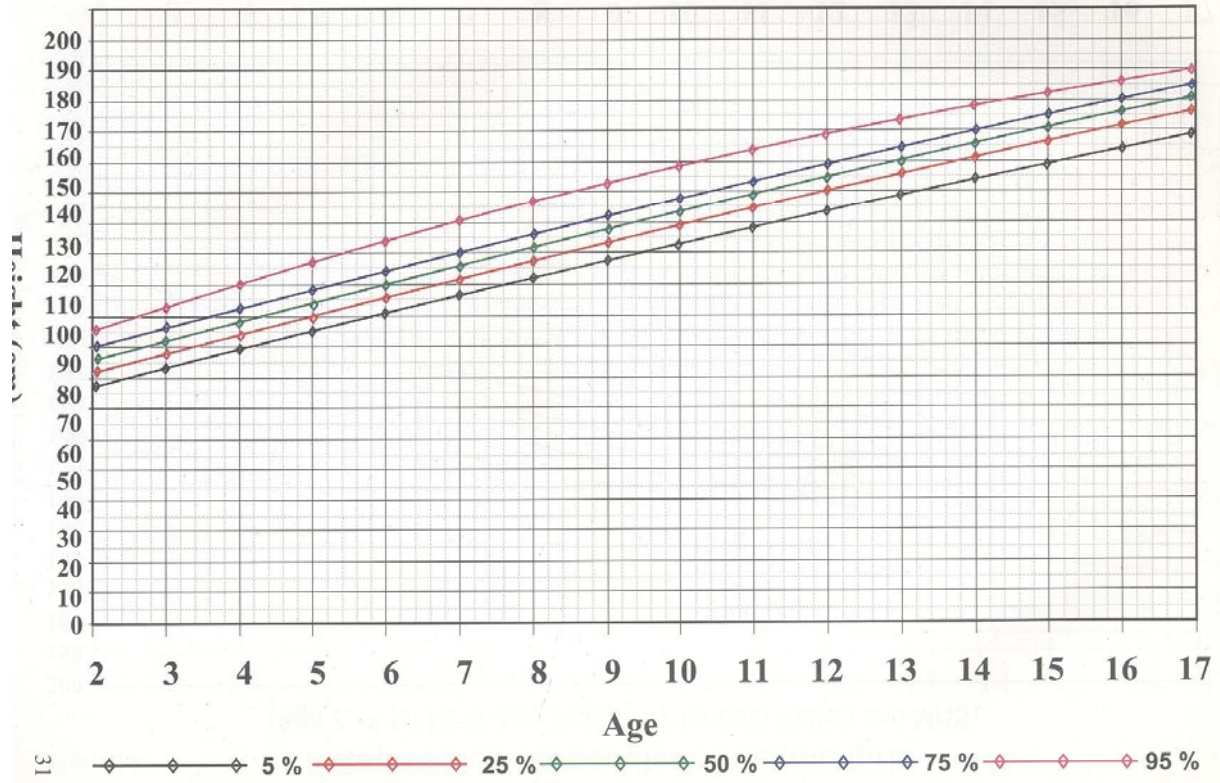


Fig 8

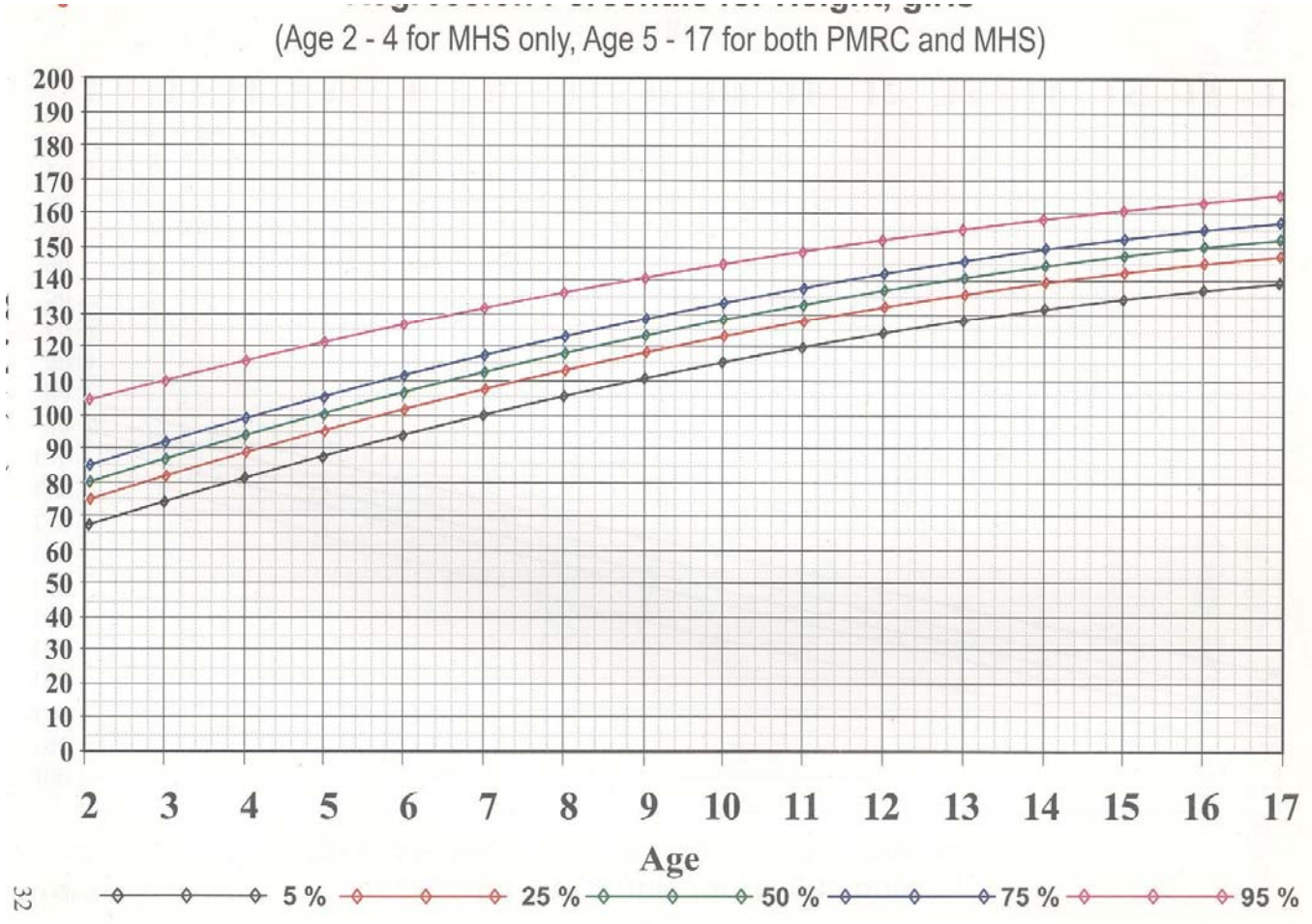


Table 5

Arm Circumference (cm)		Cuff Size (cm*)
Upto	5.9	2.5 ("newborn") ⁹
6.0 to	15.9	6.5 ("infant")
16.0 to	22.5	9.0 ("child" or "pediatric")
22.6 to	30.0	12.0 ("adult" or "regular")
30.1 to	37.5	15.0 ("large arm")
37.6 to	43.7	17.5 ("thigh")

Adapted from reference (3)

Table 4: Blood Pressure Percentiles for Pakistan Children (MHS and National Health Survey-PMRC Data)
Blood Pressure Levels (mmHg) for the 90th, 95th and 99th Percentiles of Blood Pressure for Children Age 5 to 17 by Percentile of Height (Note: Height percentile cut-points are based on Pakistan PMRC and MHS data)

Boys						Girls									
Age	BP %	SBP *****Height***** % iles			DBP *****Height***** % iles			Age	BP %	SBP *****Height***** % iles			DBP *****Height***** % iles		
		25 th	50 th	90 th	25 th	50 th	90 th			25 th	50 th	90 th	25 th	50 th	90 th
5	90 th	103	103	111	70	70	72	5	90 th	93	101	105	62	68	68
	95 th	108	110	117	72	73	73		95 th	99	105	110	66	71	72
	99 th	112	119	127	78	76	80		99 th	110	111	113	80	74	77
6	90 th	106	110	110	70	74	73	6	90 th	100	107	108	64	67	68
	95 th	112	118	112	71	77	78		95 th	100	109	110	66	69	71
	99 th	125	122	123	75	81	80		99 th	111	118	119	67	77	86
7	90 th	107	111	111	71	76	76	7	90 th	101	104	110	68	70	70
	95 th	113	112	116	74	77	79		95 th	109	108	110	70	73	80
	99 th	116	117	125	75	80	92		99 th	113	110	130	82	80	85
8	90 th	110	112	115	73	77	76	8	90 th	108	110	110	68	70	74
	95 th	113	120	118	76	79	79		95 th	110	116	117	70	74	76
	99 th	117	124	122	79	90	83		99 th	115	121	119	74	86	83
9	90 th	110	115	114	73	76	80	9	90 th	106	110	114	70	71	72
	95 th	112	117	117	75	78	83		95 th	110	111	120	74	75	74
	99 th	120	123	124	83	89	86		99 th	117	120	123	78	82	85
10	90 th	114	114	119	75	80	80	10	90 th	110	110	120	70	74	72
	95 th	118	118	120	77	80	80		95 th	110	118	122	75	77	76
	99 th	119	124	130	83	83	82		99 th	111	124	126	78	81	82
11	90 th	113	113	118	78	81	78	11	90 th	110	110	120	73	70	71
	95 th	115	119	120	80	83	82		95 th	115	115	127	75	74	74
	99 th	120	124	137	84	88	95		99 th	120	121	140	84	86	75
12	90 th	114	116	120	77	79	80	12	90 th	113	115	122	72	72	74
	95 th	117	120	121	80	82	83		95 th	116	120	126	75	75	75
	99 th	120	122	141	91	86	88		99 th	123	135	135	89	78	89
13	90 th	115	118	125	79	79	81	13	90 th	119	120	126	74	74	74
	95 th	120	120	127	81	80	85		95 th	123	122	129	76	75	76
	99 th	130	138	134	87	83	90		99 th	128	134	130	80	80	81
14	90 th	115	129	129	79	82	81	14	90 th	121	123	127	75	77	77
	95 th	120	130	130	80	83	85		95 th	125	130	129	81	80	79
	99 th	132	140	134	87	87	88		99 th	128	143	132	83	80	81
15	90 th	122	125	127	84	91	84	15	90 th	124	122	129	80	82	81
	95 th	131	130	130	88	92	90		95 th	128	127	130	80	82	84
	99 th	140	136	131	100	98	95		99 th	130	131	140	86	88	90
16	90 th	129	130	128	85	89	86	16	90 th	130	128	125	80	82	80
	95 th	130	131	138	87	90	89		95 th	135	130	130	83	84	81
	99 th	134	151	148	94	100	97		99 th	150	131	131	99	91	90
17	90 th	130	128	130	88	88	89	17	90 th	123	129	122	80	85	82
	95 th	140	130	132	95	90	90		95 th	125	130	130	80	85	82
	99 th	146	140	140	111	92	96		99 th	130	142	145	90	90	95

Ns and Mean Height for Children Age 5 to 17 by Percentiles of Height

Note: Height percentile cut-points are based on Pakistan PMRC and MHS data)

Boys

Girls

Boys Height Percentiles							Girls Height Percentiles						
Age	25 th		50 th		90 th		Age	25 th		50 th		90 th	
	N	Mean Height	N	Mean Height	N	Mean Height		N	Mean Height	N	Mean Height	N	Mean Height
5	106	98.26	123	106.55	67	115.53	5	90	96.61	103	105.78	59	118.09
6	107	105.84	116	112.87	78	121.87	6	86	102.86	105	111.56	61	120.57
7	102	110.90	106	119.17	73	128.12	7	104	110.26	106	118.60	65	126.62
8	126	116.41	126	124.50	72	134.17	8	121	115.37	115	124.41	76	133.82
9	94	120.08	89	129.43	60	137.97	9	85	121.09	99	129.70	56	140.41
10	100	126.31	105	134.24	66	143.68	10	88	124.67	90	134.93	63	145.34
11	83	129.92	90	139.10	54	150.66	11	75	130.17	63	139.46	58	148.88
12	91	134.49	106	144.13	60	156.44	12	79	135.06	85	144.97	59	153.61
13	73	140.88	63	151.39	50	163.88	13	60	142.96	62	151.85	40	158.23
14	81	146.61	75	159.55	57	169.39	14	56	145.98	57	152.65	45	159.62
15	63	153.20	57	165.10	39	172.79	15	59	148.35	56	154.65	45	161.46
16	65	156.15	71	166.10	55	175.52	16	72	149.25	63	155.02	43	151.34
17	74	162.89	42	170.17	26	176.91	17	45	147.22	38	154.74	37	162.13

Table 2. Diastolic Blood Pressure Means, Standard Deviations, and Percentiles for Pakistan Children (MHS and PMRC Data) by Age and Gender (Age 2-4 for MHS only, Age 5-17 for both PRMC and MHS)

Boys

Age	N	Mean	SD	Percentiles for DBP						
				5th	25th	50th	75th	90th	95th	99th
2	12	43.67	8.34	30	39	41	52	56	57	57
3	25	54.52	10.76	40	49	56	62	71	71	72
4	47	56.24	8.28	43	51	57	62	68	70	71
5	296	59.35	8.96	43	53	60	65	71	73	80
6	301	61.52	8.58	47	57	62	67	72	75	80
7	281	62.83	8.82	48	58	63	69	74	77	82
8	324	65.11	8.38	52	60	65	70	76	78	90
9	243	65.73	8.36	52	60	65	72	76	79	84
10	271	65.74	9.19	49	60	66	72	78	80	83
11	227	67.76	8.98	52	62	67	74	80	82	88
12	257	68.20	8.46	53	62	69	74	78	82	86
13	186	68.42	9.12	51	63	70	74	80	82	87
14	213	69.57	8.34	55	65	70	76	80	82	87
15	159	74.59	9.03	59	68	75	81	85	91	98
16	191	74.93	9.80	56	70	75	82	86	89	91
17	110	76.95	9.03	65	70	75	83	88	90	102

Girls

Age	N	Mean	SD	Percentiles for DBP						
				5th	25th	50th	75th	90th	95th	99th
2	23	44.83	9.85	25	40	44	51	57	59	60
3	24	51.17	10.50	36	40	53	61	63	64	70
4	27	50.15	11.18	32	41	51	58	61	62	81
5	252	53.55	9.37	40	47	53	60	66	70	76
6	252	54.18	9.48	38	49	54	61	66	69	77
7	275	56.57	10.52	40	50	56	64	70	73	85
8	312	58.34	9.83	41	51	59	66	70	74	82
9	240	59.48	8.92	45	54	60	65	72	74	78
10	241	60.94	8.58	49	55	61	67	72	75	80
11	196	62.43	8.05	49	58	63	68	72	74	84
12	223	62.21	8.54	48	56	63	68	72	75	78
13	162	64.33	7.94	50	60	65	70	74	76	80
14	158	65.79	8.17	50	60	66	70	77	80	82
15	160	70.39	8.18	59	66	70	76	81	82	90
16	178	71.69	8.93	58	67	71	79	80	84	94
17	120	71.69	10.62	54	68	72	80	80	85	90

Table 1. Systolic Blood Pressure Means, Standard Deviations, and Percentiles for Pakistan Children (MHS and PMRC Data) by Age and Gender (Age 2-4 for MHS, Age 5-17 for both MHS and PRMC)

Boys

Age	N	Mean	SD	Percentiles for SBP						
				5th	25th	50th	75th	90th	95th	99th
2	12	82.33	8.73	61	79	83	89	91	93	93
3	25	89.36	11.74	72	81	90	98	102	105	118
4	47	91.66	10.51	79	82	91	97	106	112	122
5	296	93.81	9.40	80	88	93	110	105	110	122
6	301	97.08	9.92	80	91	97	103	110	113	123
7	281	97.82	8.82	84	91	97	103	110	113	118
8	324	99.27	9.62	84	92	100	105	112	116	121
9	243	100.45	9.27	86	94	100	107	112	116	122
10	271	101.93	9.73	88	94	102	109	114	118	124
11	227	102.40	9.70	86	95	102	109	114	119	124
12	257	104.19	9.59	90	98	104	111	117	120	122
13	186	106.31	10.30	90	101	107	112	119	124	134
14	213	109.26	11.16	90	101	109	117	126	130	132
15	159	111.97	10.34	97	106	111	119	126	131	139
16	191	113.18	11.98	94	104	113	120	130	131	148
17	110	115.51	11.13	100	108	114	122	130	137	143

Girls

Age	N	Mean	SD	Percentiles for SBP						
				5th	25th	50th	75th	90th	95th	99th
2	23	82.87	7.85	70	78	82	90	92	92	95
3	24	88.42	8.34	76	83	90	94	97	99	108
4	27	86.94	10.84	66	80	87	93	100	105	114
5	252	88.96	9.47	72	83	90	94	101	105	112
6	252	91.27	9.65	78	85	90	97	104	109	118
7	275	92.88	9.56	80	87	91	100	106	110	117
8	312	95.92	10.20	80	90	96	102	110	112	120
9	240	97.87	9.50	82	91	98	105	110	114	120
10	241	99.18	10.65	81	91	100	107	112	118	125
11	196	102.15	10.14	85	95	102	110	114	120	130
12	223	102.84	11.33	84	95	103	110	116	122	131
13	162	106.40	11.03	90	100	105	115	120	125	133
14	158	108.82	11.38	90	100	109	117	123	128	133
15	160	110.45	11.30	91	102	110	120	126	130	135
16	178	112.41	11.43	95	105	110	120	129	131	143
17	120	112.25	10.61	95	105	110	120	124	130	142