HEIGHTS AND WEIGHTS OF NEW YORK CITY CHILDREN 14 TO 16 YEARS OF AGE: A STUDY OF MEASUREMENTS OF BOYS AND GIRLS GRANTED EMPLOYMENT CERTIFICATES

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Trieste

Heights and Weights of New York City Children 14 to 16 Years of Age*

A STUDY OF MEASUREMENTS OF BOYS AND GIRLS GRANTED EMPLOYMENT CERTIFICATES

The New York State Labor Law provides that no child between the ages of 14 and 16 shall be employed in a factory or in a mercantile or other specified establishment, unless he or she is in possession of an employment certificate. As a condition for granting this certificate, the law requires that the child shall have completed the work prescribed for the first six years of the elementary schools, and that in the opinion of the issuing officer the child shall have reached the normal development for his age. He must be in sound health, as determined by a thorough medical examination, and must be physically able to perform the work he intends to do. As the law in no way controls the nature of the work which the child may be called upon to do, except by prohibiting his employment in dangerous trades, it can readily be seen that the only construction of this law which will adequately protect the child is to determine his physical fitness for any work in which he may lawfully engage. This investigation has concerned itself in part with the determination of certain norms of physical development which may serve as a guide to those upon whom devolves the duty of issuing employment certificates.

Height and weight are obviously important factors in the examination to determine physical fitness, but emphatically so in the decision of the medical officer as to the normal development of each applicant. Hence, the chief object of this investi-

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gation is to establish the normal height and weight of children between the ages of 14 and 16. The normal measurements for a given age can be arrived at only by a statistical study of a considerable number of cases. For this purpose, the Board of Health of New York City, at the request of the writers, turned over to them the records of the 10,043 children who had received certificates during the nine months beginning July 13, 1914, and ending April 12, 1915.

To be sure, a number of investigations have been made on the heights and weights of children. The subject received its impulse from the well-known anthropometric researches of Quetelet. In England, notable studies were made by Galton, Roberts, Greenwood and others. An early investigation of the subject in this country was made by Bowditch in 1877 in the city of Boston. Subsequent studies were made by Peckham in Milwaukee, Porter in St. Louis, Boas in Worcester, Oakland and Toronto, and by a number of other investigators. But these studies concerned themselves with children at school, while our data deal with children who are on the point of leaving school to go to work. Moreover, the number of children between the age limits of 14 and 16 covered in the other investigations was in every case comparatively small. Thus, Bowditch's data included only 2,678 children, and the investigations carried on in the other five cities combined were based on an aggregate of 5,514 children 14 to 16 years of age. Our study is based on a much larger number of observations, namely, on 10,043 children, and is, therefore, more representative for children at these ages.

The records of the Health Department were transcribed on cards, and the following information was abstracted in each case: sex, color, birthplace of child, birthplace of father, mother-tongue, age, height, weight, grade in school, and various other items pertaining to the condition of the applicant's health. The foregoing items were tabulated, either singly or in combination, to give the data of this investigation. We shall first dispose of a few preliminary items such as sex, age, and school grade of the children, and shall then proceed with the consideration of their height and weight.

Sex

Of the 10,043 children, 5,393, or 53.7%, were boys, and 4,650, or 46.3%, were girls. The preponderance of boys over

girls is found during each of the four half-years, as is shown in Table 1 below.

Age

Ages are stated in years and months, a fraction of a month being counted as a full month. For example, a child of age 14 years and 2 days at the time of examination, was put into the age-group 14 and 1 month. There were thus 24 age-groups of 1 month each, starting at age 14 years and 1 month, and ending at age 15 years and 12 months. These were rearranged into quarter, half and full year age-groups.

The children were distributed by half-year age-periods as follows:

TABLE 1

Number and Percentage of New York Boys and Girls, Ages 14 to 16, Granted Employment Certificates

Classified by Half-year Age-periods

AGE-PERIOD	BOYS		GIRLS	
	Number	Per cent. of Total	Number	Per cent. of Total
14 -16	5,393	100.0	4,650	100.0
14 -14½	2,002	37.1	1,624	34.9
14½-15	1,403	26.0	1,203	25.9
15 -15½	1,263	23.4	1,141	24.5
15½-16	725	13.4	682	14.7

The first half-year period contains the largest proportion of children. Each of the succeeding half-years shows a regularly diminishing number. It is perhaps noteworthy that the excess at the first age-period is more marked in boys than in girls, 37.1% of all the former being in the first half-year, as against 34.9% of the latter. In the second half-year the proportion of boys and of girls is about equal, 26.0% of the former and 25.9% of the latter. In the third and fourth half-years the ratio of girls to the total of their sex is higher than the corresponding figure for boys, compensating, of course, for the reverse relationship obtaining during the first year. Age 15 to 15½ includes 23.4% of the boys and 24.5% of the girls, and age 15½ to 16 embraces 13.4% of the boys and 14.7% of the girls.

School Grade

Table 2 gives the distribution of the boys and girls by school grade for the two-year period.

TABLE 2

Number and Percentage of Boys and Girls, Ages 14 to 16

Classified by School Grade

SCHOOL GRADE	BOYS		GIRLS	
	Number	Per cent. of Total	Number	Per cent. of Total
All grades	5,393	100.0	4,650	100.0
7A	1,924	35.7	1,607	34.6
7B	629	11.7	586	12.6
8A	416	7.7	394	8.5
8B	467	8.7	297	6.4
Graduates	1,647	30.5	1,461	31.4
High School	287	5.3	287	6.2
Vocational	5	.1	1	
Unknown	18	.3	17	.4

In view of the requirements of the law demanding the completion of the sixth grade, it is not surprising to find that the children in Grade 7A contributed the largest number, 35.7% of the boys and 34.6% of the girls. The graduates formed 30.5% of the boys and 31.4% of the girls. These two groups together contributed approximately 66% for each sex. Only a small number of high school children are represented, namely, 5.3% of the boys and 6.2% of the girls. The remainder are distributed among the other school grades.

The above considerations show clearly the effect of the present law on the composition of the children who apply for work papers. The largest groups as to age were those in the first half-year period. From the distribution by grade, we find similarly that the minimum grade, 7A, contributed the largest number of children. In fact, 2,002 boys, distributed over the various grades, waited until they were just old enough, before applying for employment certificates. In addition, 1,924 boys who were eligible as to age were obliged to wait until they had reached the minimum grade. These two groups have 731 boys in common, that is, boys who have just satisfied the minimum requirements, both as to age and grade, before applying for certificates. Deducting these 731, who are common to the two groups, we obtain 3,195 out of a total of 5,393, or 59.2% of the boys who, lacking either in age or in school grade requirement, waited until they were just eligible under the law to apply for employment certificates. The corresponding figure for the girls is 56.2%. Whatever the cause of this condition may be, it is quite obvious that these children took advantage of the

privileges which were accorded them, under the law exempting them from school attendance, at their first opportunity.

Height

Heights given in the Health Department records are for children in shoes, to the nearest quarter-inch. Comparative tests made by the examiners showed that the shoes gave an error in the net heights of from $\frac{3}{4}$ to 1 inch for boys, and from $1\frac{1}{2}$ to 2 inches for girls. In the following tabulations, heights are given in one-inch units, each including all values to the next unit; thus, 61 inches includes $61\frac{1}{4}$, $61\frac{1}{2}$ and $61\frac{3}{4}$ inches.

The following table gives the distribution of the boys and girls for the two-year period, by heights in inches:

TABLE 3

Number and Percentage of Boys and Girls, Ages 14 to 16, at Each Inch of Height

Also Average Heights, Standard Deviations and Quartile Heights.

HEIGHT (Inches)	BOYS		GIRLS	
	Number	Per cent.	Number	Per cent.
54 and under	22	.4	18	.4
55	71	1.3	17	.4
56	129	2.4	76	1.6
57	250	4.6	152	3.3
58	384	7.1	357	7.7
59	470	8.7	542	11.7
60	641	11.9	822	17.7
61	650	12.1	781	16.8
62	666	12.3	694	14.9
63	605	11.2	512	11.0
64	527	9.8	322	6.9
65	389	7.2	180	3.9
66	263	5.0	107	2.3
67	155	2.9	47	1.0
68	76	1.4	14	.3
69 and over	90	1.7	9	.2
Total	5,393	100.0	4,650	100.0

	BOYS (Inches)	GIRLS (Inches)
Average height	61.99	61.35
Standard deviation (σ)	3.08±.020	2.38±.017
First quartile	59.91	59.88
Second quartile (Median)	61.99	61.31
Third quartile	64.17	62.93

The height class "54 and under" includes heights ranging down to 49 inches for boys, and down to 50 inches for girls; "69 and over" includes heights ranging up to 72 inches for boys and up to 71 inches for girls. The number of children at

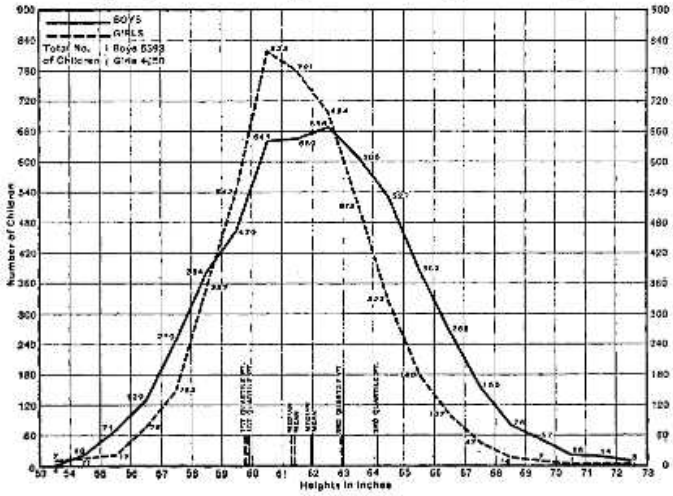
the extremes is small, as might be expected. The distribution follows quite closely the curve of error. It is fairly symmetrical, and the largest numbers cluster around the average. The mean and the median for boys are identical, both being 61.99 inches; in the case of girls, also, the figures agree quite closely, the mean being 61.35 inches, and the median only .04 inch less.

The distribution of heights between the first and third quartile points indicates that half of all the boys are found between the limits 59.91 and 64.17 inches, a range of 4.26 inches. Half of the girls, however, extend over a range of only 3.05 inches—between 59.88 and 62.93 inches. These figures show a greater variability in the height of boys as compared with that of girls. This is borne out further by the fact that the standard deviation, which is the measure of variability, is 3.08 inches for boys, and 2.38 inches for girls.

These facts are illustrated in Graph A, which portrays the distribution of the heights of the boys and girls for the two-

GRAPH A

Number of Boys and Girls, Ages 14 to 16, at Each Inch of Height; Also at Average, Median and Quartile Heights



year period. The solid line represents the boys, and the broken line the girls. The lesser variability of the girls is evident from the greater concentration of the cases about the mean. It is also interesting to note that the position of the first quartile point, that is, the height below which 25% of the cases are found, is almost identical for the two sexes; it is 59.91 inches for the boys, and 59.88 inches for the girls. On the other hand, the third quartile points, or the heights below which 75% of the cases are included, are more widely separated, being 64.17 inches for boys, and 62.93 inches for girls.

As has already been pointed out, the boys are taller than the girls, the averages being 61.99 and 61.35 inches respectively, or a difference of .64 inch. The actual difference between the average heights is even greater, because of the fact that the girls wear higher heels. Accurate figures are not available, but it is safe to say that an additional half-inch may be added to the above figure (.64 inch) to give the net difference in the average heights of the two sexes. This difference is somewhat greater than that found by other observers. The data of Bowditch,* for example, give a net difference of .47 inch in favor of the boys for the two-year period, and those of Boas† give a difference of only .10 inch.

These sex comparisons are much more significant, however, when made for each of the two years, and not for the two years combined; for the height relations of the two sexes present important differences in the individual years. This leads us to a discussion of gain in height of boys and girls during the two years covered in our investigation. It must be emphasized that our study is an extensive and not an intensive one. Our data do not cover individual children, each studied at various stages of development. Each child, at whatever age, was under observation only once.

The following table gives the average heights for each of the eight quarter-year periods for the boys and girls:

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*H. P. Bowditch, "The Growth of Children" (8th Annual Report of the State Board of Health of Massachusetts), Boston, 1877.

†Franz Boas, "The Growth of Toronto Children" (Report of the Commissioner of Education for 1896–7), Washington, 1898.

Boas and Wissler, "Statistics of Growth" based on a study of school children in Worcester, Mass. (Report of the Commissioner of Education for 1904), Washington, 1905.

Franz Boas, "Changes in Bodily Form of Descendants of Immigrants" (Vol. 38. Reports of the Immigration Commission), Washington, 1911.