

## THE DURATION OF LABOR: MEAN, MEDIAN, AND MODE

TRENT BUSBY, M.D., BALTIMORE, MD.

(From the Department of Obstetrics, Johns Hopkins University and Hospital)

THE figures cited in textbooks, and ordinarily taught, for the duration of labor are eighteen hours in primigravidas and twelve hours in multiparas (Stander, DeLee-Greenhill, Beck). These are mean or average values, calculated simply by adding up the total hours occupied by all labors in a large series and dividing by the number of labors. Although mean or average figures are often valuable, it is well known to statisticians that they may sometimes be very misleading in that, under certain circumstances, they may not yield typical and truly representative values. Let us consider, as an extreme example, a community of 300 families, made up of a hamlet of 290 families, surrounded by 10 country estates each occupied by a millionaire. If the incomes of the families in the hamlet ranged from \$1200 to \$2600, as shown in Table I, and those of the wealthy group were \$50,000 each, the mean or average income would be \$3230—obviously a figure which is not at all representative of a typical family in the community. While this is an exaggerated and artificial example, it helps to recall that extreme values, which lie far outside the usual run, may so distort the mean or average of a series of observations as to render it quite meaningless.

TABLE I. CRUDE EXAMPLE SHOWING HOW A FEW EXTREME VALUES IN ANY SERIES TEND TO DISTORT AVERAGE OR MEAN FIGURES

NUMBER OF FAMILIES	INCOME OF EACH FAMILY	TOTAL INCOME
50	\$1,200	\$60,000
100	1,500	150,000
80	1,600	128,000
20	1,800	36,000
10	2,100	21,000
20	2,400	48,000
10	2,600	26,000
10	50,000	500,000
300		\$969,000

Average income—\$3230; Median income—\$1550; Modal income—\$1500

When, in any series of variate magnitudes, a few of the values lie far outside the range of most of the values, the median and mode of the series may be more representative and informative figures than the mean or average. The median for any series of observations, it will be recalled, is the center value above and below which fall exactly half the individual values. It is particularly useful as a measure of central tendency in a series in which it is desired to suppress the influence of extreme or unusual values. By the mode of any series is

meant the value which shows the greatest frequency of occurrence, it being assumed that seriation provides a reasonably smooth frequency distribution. In the above example, the median may be taken as \$1550, while the mode is obviously \$1500. Clearly, either of these figures is much more representative of the income of the typical family in the community mentioned than is the mean of \$3230.

It is the purpose of this paper to report figures on the mean, medial, and modal duration of labor in 15,533 consecutive cases of parturition which occurred at the Johns Hopkins Hospital between Jan. 1, 1937 and Dec. 31, 1945. In this series, there were 758 cases in which either the duration of labor was unknown, or cesarean section was performed. These were discarded, leaving 14,775 cases which were grouped according to race and parity as follows:

	<i>White</i>	<i>Negro</i>	<i>Total</i>
Primiparas	4243	3278	7,521
Multiparas	4227	3027	7,254
	<u>8470</u>	<u>6305</u>	<u>14,775</u>

The criterion used for the onset of labor was regular, painful uterine contractions observed by the patient. This entails, of course, a certain source of error, but in the main such errors would tend to counterbalance each other. In the present analysis only the total duration of labor will be considered.

The calculated mean or average durations of labor for the above groups are as follows:

	<i>White</i>	<i>Negro</i>
Primiparas	13.04 hours	15.15 hours
Multiparas	8.15 hours	10.27 hours

Fig. 1 shows the frequency distribution curve of 4243 labors in white primiparas together with the perpendiculars indicating the mean, median, and modal durations of labor for this group. It will be seen that the curve is not the symmetrical type of normal frequency distribution, but is skewed to the right by reason of a small number of extremely long labors; in other words, by a few values which lie far outside the range of most of the values. Actually the limit of this curve would be 118 hours—the longest white primiparous labor in this series. The median duration of labor for this group was found to be 10.59 hours—almost  $2\frac{1}{2}$  hours less than the mean. The mode was 7 hours, slightly more than half the mean.

Fig. 2 shows the rates at which labor progressed in the four groups. It will be noted that about 65 per cent of white primiparas had labors of less than 13.04 hours (mean or average for this group) and that about the same percentage of multiparas had been delivered after less than their respective averages. These curves define the median durations of labor for the four groups as follows:

	<i>White</i>	<i>Negro</i>
Primiparas	10.59 hours	12.37 hours
Multiparas	6.21 hours	7.31 hours

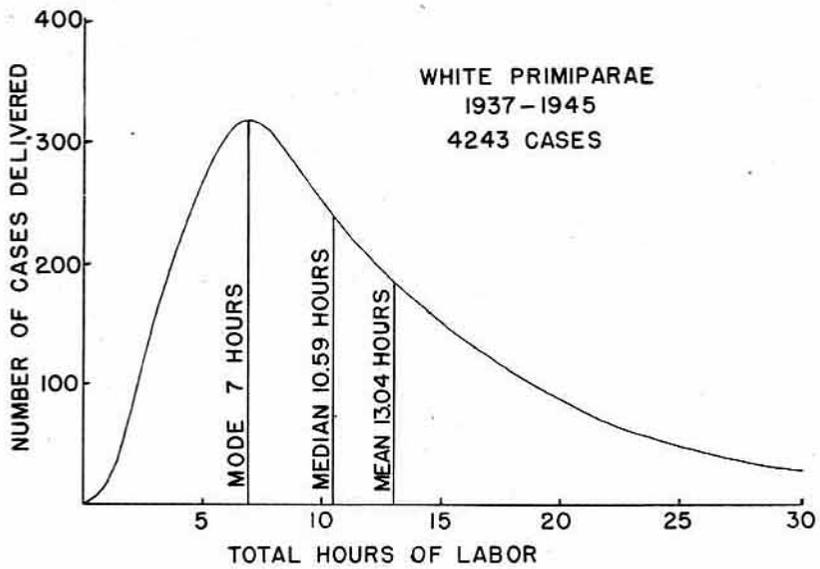


Fig. 1.

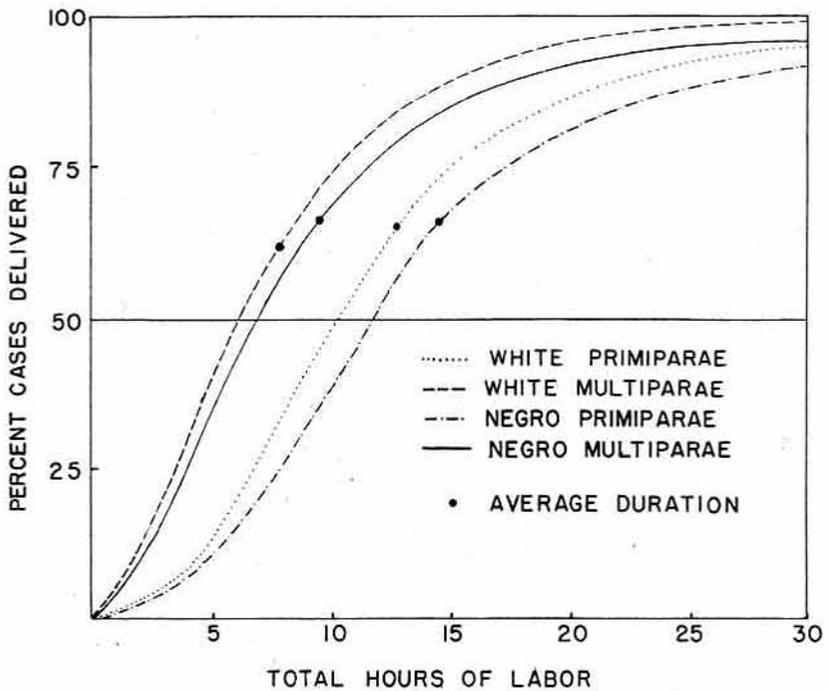


Fig. 2.

The frequency distribution curves for the four groups are shown in Fig. 3. The data on which these curves are based are given in Table II. The peaks of these curves define the modal durations of labor as follows:

	White	Negro
Primiparas	7 hours	7 hours
Multiparas	4 hours	4.5 hours

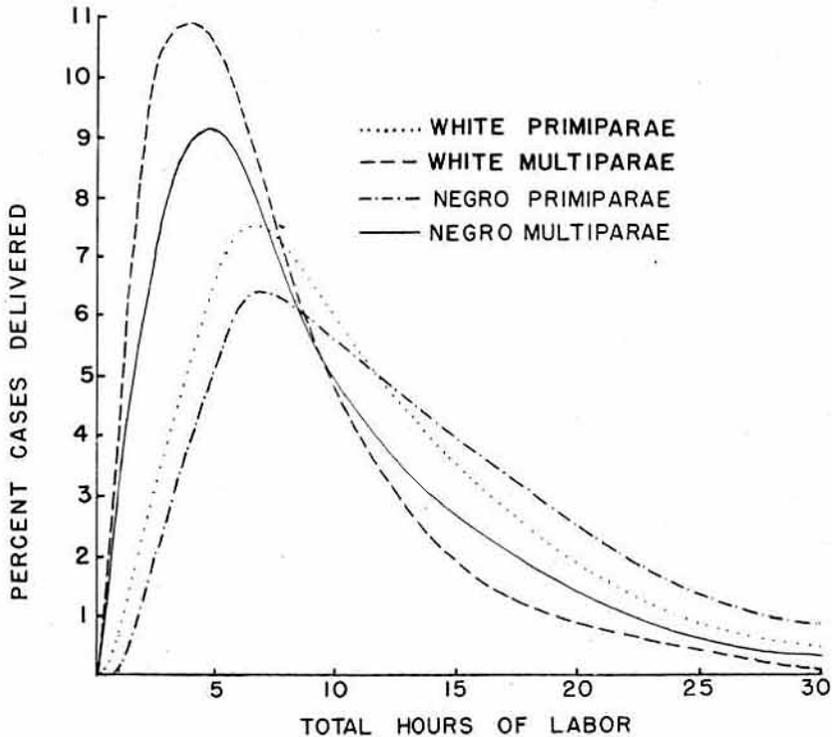


Fig. 3.

TABLE II. FREQUENCY DISTRIBUTION OF 14,775 CASES ACCORDING TO DURATION OF LABOR, RACE, AND PARITY

HOURS OF LABOR	WHITE PRIMIPARAS	WHITE MULTIPARAS	NEGRO PRIMIPARAS	NEGRO MULTIPARAS
0-3	216	949	150	545
4-6	735	1274	447	793
7-9	903	824	559	560
10-12	700	493	505	318
13-15	504	236	418	227
16-18	391	169	338	199
19-21	242	96	236	111
22-24	165	64	169	83
25-27	112	47	107	57
28-30	67	20	84	29
31 and over*	208	55	265	105

\*The longest labor for white primiparas was 118 hours, for white multiparas 87 hours, negro primiparas 136 hours and negro multiparas 131 hours.

It should be noted that the peaks for the Negro women do not represent as high a per cent of the total group as those for the white, but the curves are more skewed to the right. This explains the significant difference both in the mean and median durations of labor between white and negro, although the modes are essentially the same—this difference being attributable to the greater number of abnormal and prolonged labors in negroes.

With the mean, median, and modal durations of labor thus established for this series, the question arises as to which of these indices is the most descriptive and useful. If complete appreciation of a variate series is to be had, it is necessary, in the opinion of statisticians, to know the characteristics of the entire distribution, but if reliance is placed on one centering constant alone, and the material is definitely skew, the median is usually the most informative value. Applied to the duration of labor, these statements, together with the findings in the present study, indicate the desirability of laying more stress on the median duration of labor than has been done in the past. Certainly, if 65 per cent of labors terminate in less than the average time, the latter index taken alone is misleading. The main desiderata here would seem to be chiefly those figures which are most descriptive of the *typical* duration of labor in primigravidas and in multiparas, and there can be no question that the medians give a much truer picture in this regard than do the means or averages.

It is interesting, nevertheless, to compare the average values calculated in this series with the accepted values of 18 hours in primigravidas and 12 hours in multiparas, and more particularly with the averages found by Peckham in a series of 13,658 consecutive deliveries from Jan. 1, 1907 to Dec. 13, 1929 in the Johns Hopkins Hospital (Table III). These figures would tend to indicate that modern improvements in obstetrical technique and prenatal care have reduced significantly the average duration of labor. To explain fully this difference from the statistical data at hand would be impossible, but certain factors immediately come to mind which probably tend toward shortening the average duration of labor. Before 1935, the incidence of forceps deliveries in this clinic was less than 13 per cent. Recently, the popular use of elective low forceps for the delivery of primigravidas has raised this figure to 38 per cent. In the past decade, the cautious use of pituitrin stimulation in cases of uterine inertia has eliminated many very long labors from this series. These labors of exceedingly long duration would unduly increase the average duration as pointed out above. In the past few years, there has been much stress laid on the importance of diet in prenatal care. High protein diets, supplemented with vitamins and minerals, and low in salt content, may shorten the average duration of labor. These observations tend to explain to a certain degree the decrease noted in the average duration of labor as shown in Table III.

TABLE III. COMPARISON OF THE MEAN DURATION OF LABOR CALCULATED AT THE JOHNS HOPKINS HOSPITAL

	WHITE PRIMIPARAS	WHITE MULTIPARAS	NEGRO PRIMIPARAS	NEGRO MULTIPARAS
Jan. 1, 1907 to Dec. 13, 1929 (Peckham)	16.57 hours	10.91 hours	17.66 hours	12.49 hours
Jan. 1, 1937 to Dec. 31, 1945	13.04 hours	8.15 hours	15.15 hours	10.27 hours

### Conclusions

1. Previous calculations of the average duration of labor are misleading because of the incidence of prolonged labors, which distorts the frequency distribution of the cases delivered and of hours labor.

2. The median and modal durations of labor are presented as being more statistically significant than the mean or average, and certainly more in keeping with the experience of obstetricians.

3. In white primiparas, the mean was found to be 13.04 hours, the median 10.59 hours, and the mode 7 hours; in white multiparas, the mean was 8.15 hours, the median 6.21 hours, and mode 4 hours. In negro primiparas, the mean was calculated as 15.15 hours, the median 12.37 hours, and the mode 7 hours; while in negro multiparas, the corresponding findings were 10.27, 7.31, and 4.5 hours.

4. The average duration of labor is longer in negro than in white patients because of the greater incidence of prolonged labors in the former.

5. Recent improvements in obstetrical technique and prenatal care have significantly shortened the average duration of labor.

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