# VARIATION IN THE LENGTH OF LABOR

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OBSTETRIC literature is replete with articles dealing with prolonged labor. Beyond discussing such cases as brow and shoulder presentation, most of these articles are concerned with uterine inertia, primary or secondary. There is also a smaller number of contributions describing the pathologic possibilities of short labors. A rather careful search has not revealed any considerable contribution to the study of labors, the lengths of which might be said to be within normal limits.

The following discussion is the result of a statistical study of some 1250 consecutive labors in the University of Virginia Hospital. Abnormally long labors were excluded, because their small number was not statistically significant. The elimination of these few abnormally long labors does not in any way impair the accuracy of the results as averages are not considered. The study covered such items as age and parity of the mother, height and weight of the mother, length of gestation, length of conjugata vera, and height and weight of the child.

Each of these factors was studied for its effect on the length of the first stage, on the length of the second stage, and on the total duration of labor. Two methods of analysis were employed:

1. Pearson's coefficient of correlation. (For description of the use and interpretation of this coefficient, see AMERICAN JOURNAL OF OBSTETRICS AND GYNECOLOGY, April, 1929, pages 278-282 and in *Transactions American Association of Obstetricians, Gynecologists, and Abdominal Surgeons*, 1928, pp. 136-140.)

2. Regression lines plotted on coordinate paper. The coefficients of correlation were fairly striking, and they are herewith presented for purposes of comparison with any later or more complete studies.

TABLE I (A). FIRST STAGE OF LABOR

| | | |
|---|---|---|
| Age of mother | −.088 | ±.022 |
| Parity of mother | −.280 | ±.016 |
| Height of mother | −.045 | ±.026 |
| Weight of mother | −.019 | ±.026 |
| Length of gestation | +.021 | ±.026 |
| Conjugata vera | +.095 | ±.023 |
| Height of child | −.045 | ±.023 |
| Weight of child | −.049 | ±.021 |

TABLE I (B). SECOND STAGE OF LABOR

| | | |
|---|---|---|
| Age of mother | −.133 | ±.026 |
| Parity of mother | −.366 | ±.014 |
| Height of mother | −.030 | ±.023 |
| Weight of mother | +.056 | ±.019 |
| Length of gestation | −.027 | ±.030 |
| Conjugata vera | −.063 | ±.026 |
| Height of child | +.085 | ±.024 |
| Weight of child | +.018 | ±.021 |

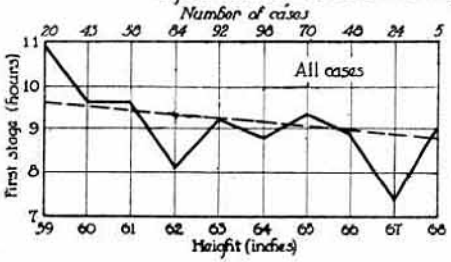
From the data in Table I it is quite evident that none of the factors save age and parity of the mother have any effect on the length of either the first or the second stage of labor. The coefficients are consistently small and in many instances no larger than their probable errors. Age of the mother would seem to be inversely proportional to the length of both the first and second stages and this is, of course, actually true, when we consider all cases. If primiparous and multiparous labors be analyzed separately we have:

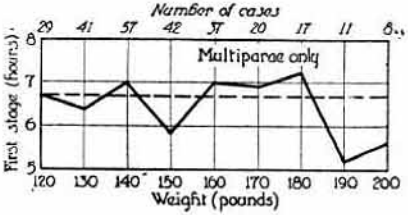
| | | |
|---|---|---|
| Primiparae—Age of mother; First stage | +.016 | ±.038 |
| Primiparae—Age of mother; Second stage | −.031 | ±.038 |
| Multiparae—Age of mother; First stage | −.070 | ±.032 |
| Multiparae—Age of mother; Second stage | −.030 | ±.032 |

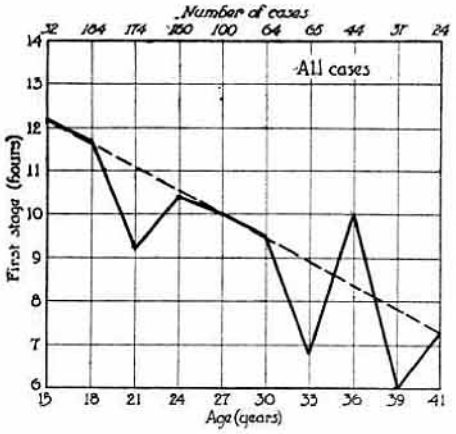
Age thus loses its significance and apparently has no effect on the duration of either the first or second stage. Parity alone then has a high (negative) coefficient and clearly affects the length of labor. The decrease is almost entirely confined to the space between primiparae and secundiparae as will be seen in Fig. 1.

Beginning with secundiparae there is no further decrease in the first stage of labor with succeeding pregnancies. The irregularity in the

Fig. 1a. Clinical Factors Affecting the Duration of Labor



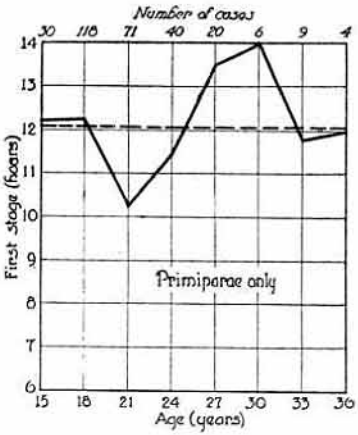
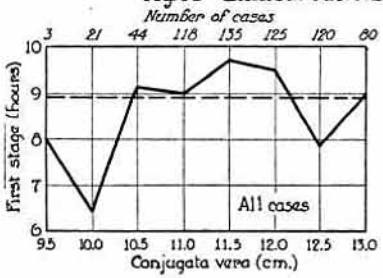
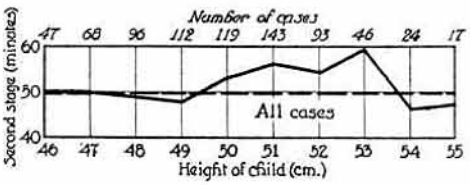
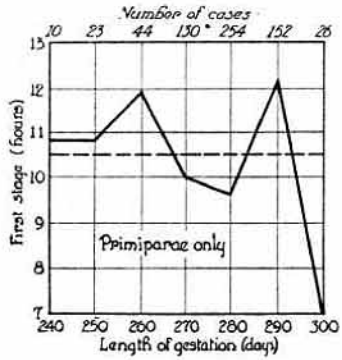
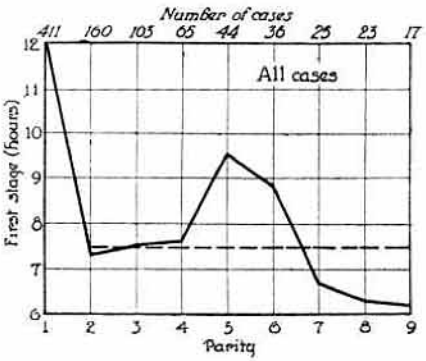




Fig. 1b Clinical Factors Affecting the Duration of Labor



curve (Fig. 1 *b*) is not significant. There would seem to be some further shortening of the second stage after the sixth labor although, for practical purposes, one may doubt the significance of so small a change.

The effect of age of the mother is clearly demonstrated by the curves in Fig. 1 (*a*). The apparent inverse relation to age (all cases) is lost when primiparae alone are considered. (Multiparae alone also show a horizontal line.)

All other curves may be regarded as horizontal lines and the conclusion that none of these factors affect the length of either the first or the second stage of labor would seem justified.*

The shorter second stage of labor in multiparae might be explained on the basis of decreased resistance of the cervix, vaginal walls, and pelvic floor. In fact, one might hazard the guess that the *duration of both the first and the second stages of labor is the product of the character of the labor pains on the one hand and the resistance of the soft parts on the other.*

## SUMMARY

1. The almost completely negative results of this study would seem to controvert certain beliefs; e.g., the long labor of the fat woman, the long labor of the elderly primipara, and the long labor of the woman with a small pelvis (9.5 or 10.00 cm. conjugata vera) or a large baby.

2. We believe that further studies of the variation in the length of labor will be hereby simplified.

*Coefficients of correlation were computed for primiparous labors, for multiparous labors, and for strictly normal labors, weighing each of the eight factors (age, parity, height and weight of the mother, height and weight of the child, conjugata vera, and length of pregnancy) against both the first and second stages. Curves were plotted covering all of these various relationships. All these coefficents are essentially zero, and the curves are horizontal lines. It seemed, therefore, that publication of them was unnecessary.

DR. L. A. CALKINS, University, Va., read a paper entitled **Factors Affecting the Length of Labor.** (For original article see page 294, February issue.)

DISCUSSION

DR. A. M. MENDENHALL, INDIANAPOLIS, IND.—Dr. Calkins' very brief paper represents a tremendous amount of work. I knew nothing about coefficient of correlation, but sought to enlighten myself about it. I at first approached the mathematicians but they did not give me very much help. I then studied it in connection with psychology, particularly in connection with the work of statisticians. Now it is rather difficult to harmonize their conclusions with our preconceived ideas. It is exceedingly difficult for me to believe those figures. I have no doubt whatever that they are correct, but whatever the method of approach in obtaining such facts as contained in Dr. Calkins' conclusions, I am led to think that there is something wrong. I have the impression that the elderly primiparas have longer labors than the younger primiparas. I cannot accept his statement regarding this until further investigation has been made. I cannot help but feel that the fat woman has a longer labor than the woman of ordinary build. We have perhaps drifted into the habit of expecting a fat woman to have longer labors although we know that there is an occasional woman who has an atypical pelvis, but the fat woman usually has a small outlet and there is consequently a longer labor.

Then, too, it is hard for me to change my preconceived ideas that a large baby does prolong labor. I also still believe that a small pelvis does very definitely prolong labor.

Dr. Calkins brought out the fact that in handling this coefficient, the element of probable error must not be greater than a third or fourth of the coefficient or its reliability is very much doubted. Furthermore, I found one authority, Rugg, who maintains that the coefficient grows in reliability in exact proportion to the number of patients studied, as Dr. Calkins admits. I hope that I may have cases that are easily available in my records in Indianapolis so that I may have them studied by Dr. Calkins' method because if they prove what he has apparently proved by his statistics, it will be a very marked revelation to me. This authority, and I am quoting entirely, having no knowledge myself, says that the coefficient must be 0.3 or 0.6 for reliability. This same authority says there are other authorities who maintain that the coefficient does not need to be greater than 0.2 in order to be reliable, and that there is a personal element of the investigator that must enter into all this because there are certain hypotheses which are assumed.

DR. R. T. LA VAKE, MINNEAPOLIS, MINN.—I am so familiar with Dr. Calkins' mathematical accuracy that I feel confident if he says that stout women do not have longer labors because of their stoutness, nor elderly women because of their age, that, as far as it is possible to determine such facts from this series of 1200 cases, he is correct.

Any observations and figures intended to aid in prognosticating the probable length of a labor are of great value, both from the standpoint of the effective apportionment and conservation of our time and energy and from the standpoint of the formulation of tentative plans for the proper handling of each individual case.

Under normal conditions in reference to the size, presentation and position of the passenger, we would likely agree that the first factor of importance in prognosticating the probable length of a first labor is the pelvis and its measurements. In this regard, after getting all the measurements and satisfying myself that delivery is possible from the measurements of the true pelvis, I check back over

the external oblique measurements and have found them to be the most suggestive in relation to the computation of the probable length of labor. The average is 22½ cm., suggesting an average length of labor; 21 cm. and below a justominor pelvis suggesting a long labor; and 24 cm. and above a justomajor pelvis suggesting a very short labor.

Another and possibly the most important factor, although one seldom mentioned, is the hereditary stamina that often permits a little woman to dilate the birth canal and push a comparatively large baby through a relatively small pelvis in a short time, whereas the lack of this stamina may make it difficult for a large woman to dilate the birth canal and push a comparatively small baby through a relatively large pelvis. Nowhere in medicine will a family history give one more suggestive data. If a woman's mother delivered quickly and with ease, that woman, even with a comparatively small pelvis, is likely to deliver quickly and with ease. The correctness and importance of this observation I have seen proved many times where the hereditary element was the deciding factor in determining upon a test of labor in the face of strong opposition on the part of those advocating an elective cesarean.

A factor of great practical importance in the apparent length of labor is the amount of effacement of the cervical canal and dilatation of the external os that takes place before labor pains begin. Experimentally, daily rectal examinations in the last weeks of pregnancy will show one that many women come to their first pain in labor with the cervical canal nearly effaced, and a few with the external os nearly completely dilated. This effacement and dilatation may take many days for its accomplishment. Many very rapid labors are the results of this factor. The short duration of the pain element makes them seem short. These facts are very important because they point to the proper way of handling those less fortunate women who have distressing pain from the very beginning of effacement and dilatation, namely; making them as comfortable as possible with sedatives, etc., and giving them the same chance to dilate naturally, though it may take many days. Failure to wait for dilatation accounts, every day, for many tragedies due to meddlesome operative interference upon the sole indication of pain.

DR. IRVING W. POTTER, BUFFALO, N. Y.—I have very decided opinions about labor and its attending causes, based on considerable experience. I am not inclined to think that the woman who has had eight or ten children, has a longer stage of labor usually than the primipara. Another point that has not been mentioned and about which we hear very little, is the height of the symphysis. It has as much to do with the length of the labor as anything else.

DR. GRANDISON ROYSTON, ST. LOUIS, MO.—The point made by Dr. LaVake in regard to the dilatation of the cervix is very important. I believe Dr. Calkins eliminated cases of inertia. Uterine contractions of less than forty seconds duration accomplish but little. The force exerted by the uterine contractions, the resistance offered by the cervix, and the presentation of the fetus are all important factors in the duration of labor, although I believe that in the primiparous patient the resistance offered by the soft parts is the most important thing with normal presentation. I believe that occipitoposterior positions are more frequent than occipitoanterior positions. Most of our figures given in the textbooks are from examinations in the later stages of labor.

I have found that the short, fat woman usually has a longer labor, but certainly I feel that the condition of the cervix is the one most important single factor. When we hear of a woman being in labor for several days, she may have had contractions that length of time, but the changes that take place in the cervix as a result of these contractions constitute the only proof we have that she is actually in labor. The increased Braxton-Hicks sign should not be confused with true labor pains.

DR. CALKINS (closing).—This study was based on 1250 cases only. I am sorry that there were not more available. It is true that the accuracy of a study of this kind grows with the increasing number of cases and that it is highly desirable to have a minimum of 4000 for an analysis such as this. With a larger series the probable errors are much smaller and the reliability of the coefficients is thereby increased. The size of the coefficient itself is not a factor as to its reliability. In fact, there are very few instances in biologic variables where one will get a coefficient as high as 0.3 to 0.6. The real test of a coefficient is its relation to its probable error. If the coefficient is four times its probable error there is not more than one chance in a thousand of its being incorrect.

Dr. LaVake spoke of determining the probable duration of labor beforehand. That was my sole idea in introducing this study and I am convinced, as a result of this work, that one cannot estimate accurately the length of labor from the relation of the size of the baby to the size of the pelvis, from the age or stature of the mother, or from the stage of pregnancy. The only information of value in estimating the length of labor, is the length, thickness, and the consistency of the cervix. Of course, we know little about what the labor pains will be like, except as Dr. LaVake has pointed out, that heredity may give us some idea. With a multipara, of course, the character of pains in previous labors is of great value.

Dr. Potter spoke of the long labors in the seventh and eighth pregnancies. Frequent childbearing does tend to produce weak and ineffective labor pains in this group of patients. The general average is not different, however, from the second, third, or fourth labors.

Dr. Royston referred to the prolonged labor with occipitoposterior position. I purposely avoided the question of presenatation because the study was already too long, without adding this additional variable.