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# Report of a Special Panel on Desired Prenatal Weight Gains for Underweight and Normal Weight Women

## MEMBERS OF THE SPECIAL PANEL

The authors and their affiliations are identified in an accompanying box. They were panel members of a special study group formed to identify what levels of weight gain by women during pregnancy would be likely to improve infant outcomes, while not risking women's health. The contents of the report represent a consensus of the panel members and do not necessarily reflect the views of advisory group members, liaison representatives, or the organizations with which panel members are affiliated.

The panel was convened in support of a prenatal weight gain intervention project conducted by the University of Minnesota School of Public Health in cooperation with the Minnesota Department of Health, and codirected by Dr. Carolyn McKay, Minnesota Department of Health, and Dr. Judith Brown, University of Minnesota. The panel activities were supported as part of a research project funded by the Health Resources and Services Administration, Public Health Service, under grant MCJ 276008-2, awarded by the Bureau of Maternal and Child Health and Resources Development.

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### Synopsis.....

*A major challenge facing the health care system is to improve the distribution of infant birth*

*weights. Prenatal weight gain and prepregnancy weight status are two of the major factors that influence infant birth weight. These are independently and linearly related to birth weight. It is believed by many that the distribution of infant birth weights may be improved by implementing prenatal weight gain goals that optimize the relationship between prepregnancy weight status and infant birth weight.*

*The panel considered prenatal weight gains for underweight and normal weight women that correspond to the delivery of infants with birth weights within a desired range. The panel identified (a) the desired range of birth weights as 3,500 to 3,999 grams; (b) for underweight women starting pregnancy, a prenatal weight gain of 30 to 35 pounds (lb), plus the prepregnancy weight deficit for the height of the woman; and (c) for normal weight women starting pregnancy, a gain of 30 to 35 lb.*

*The report summarizes the scientific rationales for the conclusions, as well as the results of deliberations on potential risks to maternal health of the suggested weight gains.*

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**A** MAJOR CHALLENGE facing the health care system is that of improving the distribution of infant birth weights. One approach to improving infant birth weight distribution is to develop and implement recommendations for pregnant women's weight gains that correspond to the birth of optimally sized infants.

Of the facts known to influence birth weight, prenatal weight gain is of practical interest because it can be modified during the course of prenatal care. Prenatal weight gain is of particular interest because it accounts for the largest proportion of variation in birth weight of term infants (1-7).

The second strongest independent effect on birth weight is generally thought to be the weight status of the woman before pregnancy (1-7). The relationship between prenatal weight gain and infant birth weight appears to be due to the correspondence between prenatal weight gain, plasma volume expansion, and maternal fat stores (6, 8-10). Be-

cause of the apparent direct effects on birth weight of prenatal weight gain and prepregnancy weight status, and the strong association between infant birth weight and health, there is strong evidence that infant birth weight and health may be improved by implementing prenatal weight gain goals that optimize the relationship between prepregnancy weight status and infant birth weight (2, 10, 11).

The hypothesis is being tested among a group of women who started pregnancy at normal weight or underweight. The prenatal weight gain intervention study is supported by a grant from the Health Resources and Services Administration's Bureau of Maternal and Child Health and Resources Development. Before beginning the intervention, however, a consensus of expert opinion was sought concerning which levels of weight gain during pregnancy were likely to improve infant outcomes while not jeopardizing maternal health. The current recom-

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mentation of a gain of 22 to 27 lb is based primarily on maternal considerations. Different recommendations would be likely to result if gains were based primarily on infant outcomes (12).

We report the conclusions of the panel on desired infant outcomes, as well as underweight and normal weight women's prenatal weight gains associated with those outcomes. We summarize the scientific rationales for the conclusions and highlight the results of deliberations on risks to maternal health related to prenatal weight gain. Three technical advisers and seven representatives from professional associations, public health organizations, and other relevant groups participated in the discussions. The panel members convened at the University of Minnesota on April 4 and 5, 1988.

The final report was approved by each panel member for release in October 1988.

## Defining Desired Infant Outcome

Infant birth weight emerged as the primary measure of desired infant outcome based on three major considerations: (a) the strong relationships between birth weight and infant morbidity and mortality, (b) the direct and positive relationship between prenatal weight gain and birth weight, and (c) the lack of reference data on other, and perhaps more sensitive, indicators of infant health.

A desired range of infant birth weights was identified based on birth weight-specific perinatal mortality data. Perinatal mortality rates docu-

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mented in the National Infant Mortality Surveillance (NIMS) Project (13), as well as results from California (14) and Kansas (15), show that perinatal mortality rates consistently are lowest among infants whose birth weight is 3,500 to 3,999 grams (g) (7 lb, 12 ounces [oz] to 8 lb, 13 oz). The next lowest perinatal mortality rate is among infants weighing 4,000 to 4,499g (8 lb, 14 oz to 9 lb, 14 oz). Perinatal mortality rates in these reports were lower for infants weighing 3,500 to 4,499 (7 lb, 12 oz to 9 lb, 14 oz) than for infants weighing 3,000 to 3,499 (6 lb, 10 oz to 7 lb, 11 oz), the range with the mean birth weight of infants born in this country.

The panel members agreed that the prenatal weight gains identified should be those associated with birth weights of 3,500 to 3,999 g. This range of birth weights appears to represent health advantages to infants as well as reduced risk to maternal health. The members acknowledged that while the birth weight range identified represents that associated with lowest perinatal mortality rates overall, desired birth weights may vary somewhat by ethnic background.

### **Defining Desired Weight Gains**

The panel members considered prenatal weight gains associated with the delivery of 3,500 to 3,999 g infants among women starting pregnancy who are underweight or normal weight. Relatively wide standard deviations surround mean prenatal weight gains within categories of birth weight. The panel members concluded that prenatal weight gain goals should be given as ranges for each prepregnancy weight status group. In this way the goals will reflect the variation of maternal weight gains that correspond to a level or range of birth weight.

Using these criteria, panel members unanimously concluded that a prenatal weight gain range of 30 to 35 lb (with a mean of 33 lb) is appropriate and desirable for women starting pregnancy at normal weight. A gain of 30 to 35 lb (with a mean of 33 lb), plus the deficit in prepregnancy weight, was identified as the weight gain goal for underweight women. The panel noted that weight gain during

pregnancy should be generated by a well-balanced and adequate diet.

### **Risks to Maternal Health**

The panel members considered whether the identified weight gain goals, which were based on desired infant outcome, would put women at increased risks of complications during labor and delivery, as well as maternal obesity.

Selma Taffel, panel member, presented data to the panel from the National Center for Health Statistic's 1980 National Natality Study that showed an increase in cesarean section deliveries associated with weight gains during pregnancy of more than 46 lbs. Shepard and coworkers (16) recently reported an increase in cesarean section rates with prenatal weight gains of more than about 45 lb in normal weight women. Although relatively high weight gains among healthy women do not appear to adversely affect neonatal outcomes, the results suggest that prenatal weight gains of more than 45 lb in normal weight women should be avoided.

On the question of maternal obesity, although research results do not support a simple *yes* or *no* answer, there are relevant data concerning weight gain and loss after pregnancy. Two summaries of studies relate prenatal weight gain to weight loss after pregnancy (12, 17). They indicate that 20- to 24-lb weight gains during pregnancy result, on average, in a return to prepregnancy weight by 6 weeks postpartum.

Stander and Pastore (18) examined postpartum weight loss among healthy women who started pregnancy at normal weight and gained an average of 30.7 lb. They reported an average loss among primiparous women of 26 lb and among multiparous women of 27 lb by 6 weeks postpartum. Among a group of 48 healthy women who gained an average of 37.5 lb during pregnancy, Plass and Yoakam (19) reported an average weight loss of 20 lb after delivery and an additional 17.5 lb subsequently (the time interval associated with the 17.5 lb loss was not specified).

Billewicz and Thomson (20, 21) examined weight changes among women by parity and age. The average prenatal weight gain among women studied was estimated to be 27.5 lb. Nulliparous women were found to gain an average of 8 lb between the ages of 20 and 35 years. The same average amount of weight gain was noted for women who had one pregnancy. Women having four or more pregnancies during this age span weighed 2 lb more on

average than women with one or no prior pregnancy. Greene and coworkers (22) recently reported similar results. Using a sample of 7,116 women enrolled in the Collaborative Perinatal Study of the National Institute of Neurological and Communicative Disorders and Stroke, they reported that the 50th percentile of weight gain between the first and second study pregnancies was 2 lb.

An important result of studies examining prenatal weight gain and weight loss after pregnancy is the considerable variation in weight change after pregnancy among individual women. King (23) reported detailed information on differences in postpartum weight change among 226 private patients. Two-thirds of the women in the study gained from 16 to 33 lb during pregnancy. After 3 months, the differences between postpartum and prepregnancy weight ranged from minus 4 to plus 8 lb. Of the 47 women who gained 22 lb during pregnancy, 4 were 2 lb heavier after 3 months and 3 were 10 lb lighter than before pregnancy. Some women gained more weight after delivery than they gained during pregnancy. The simple correlation between prenatal weight gain and net gain at 3 months was weak ( $R = 0.12$ ).

Previous study results do not indicate a strong association between prenatal weight gain and subsequent maternal obesity. The need for well-designed studies on prenatal weight gain and weight status after pregnancy was expressed by panel members. Studies should control for the effects on postpartum weight changes of maternal activity level and caloric intake, breast feeding, infant size, and the duration of pregnancy. In addition, there is a need to identify the characteristics of women who are at risk of gaining weight excessively during or after pregnancy.

The prenatal weight gain goals and birth weight ranges identified by the panel have not been associated with increased rates of clinical problems during pregnancy, subsequent maternal obesity, or adverse neonatal outcomes in healthy women entering pregnancy at normal weight or underweight (13, 16, 24-26). Panel members concluded that any potential risks to maternal health associated with the weight gain goals would be minor in comparison with the potential benefits to infant health.

## Related Areas

**Identifying prepregnancy weight status.** The 1959 version of the Metropolitan Life Insurance Company's height and weight tables (27) was selected as an appropriate reference for assessing prepregnancy

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weight status in clinical settings. The tables are widely used in research and clinical situations. Many of the research reports the panel considered in identifying weight gain goals used the tables in assessing prepregnancy weight status. The panel members concluded that women whose weight for height is 90 through 110 percent of the midpoint value within a height category in the tables should be considered normal weight; those whose weight is below 90 percent of the midpoint value should be considered underweight.

The weight deficit of underweight women is defined as the difference between actual weight and the calculated weight-for-height at the level of 90 percent of the midpoint within a category of height. For example, if a woman starts pregnancy weighing 105 lb, and the midpoint weight for a woman of her height in the tables is 120.5 lb, the weight deficit is determined by subtracting her current weight from a value representing 90 percent of the midpoint weight (0.9 times 120.5 lb equals 108.5, minus 105 equals 3.5 lb). The result is then added to 30 and to 35 lb. In this case, the weight gain goal ranges from 33.5 to 38.5 lb.

**Recommendations for overweight women.** The panel concluded that available information indicates that a prenatal weight gain goal for overweight women would be less than that for normal weight women. However, it is difficult to identify a specific weight gain range for overweight women based on infant birth weight because of the weaker relationship between weight gain and birth weight in overweight women than in underweight and normal weight women (1, 2, 4-7).

**Goals for adolescent pregnancies.** On the basis of available data, weight gains recommended for adults in this report were judged to be appropriate for adolescents as well.

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