



Published in final edited form as:

*Am J Obstet Gynecol.* 2010 February ; 202(2): 135.e1. doi:10.1016/j.ajog.2009.06.008.

## Pregnancy: A “teachable moment” for weight control and obesity prevention

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### Abstract

Excessive gestational weight gain has been shown to relate to high postpartum weight retention and the development of overweight and obesity later in life. Since many women are concerned about the health of their baby during pregnancy and are in frequent contact with their health care providers, pregnancy may be an especially powerful “teachable moment” for promoting healthy eating and physical activity behaviors among women. Initial research suggests that helping women gain the recommended amount during pregnancy through healthy eating and physical activity could make a major contribution to preventing postpartum weight retention. However, more randomized controlled trials with larger samples sizes are needed to identify the most effective and disseminable intervention. Providers have the potential to prevent high postpartum weight retention and future obesity by monitoring weight gain during pregnancy and giving appropriate advice about recommended amounts of gestational weight gain.

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Obesity is major health problem in the United States. National data indicate that 65.1% of Americans are considered overweight or obese (BMI  $\geq 25$ ).<sup>1</sup> The prevalence of obesity (body mass index [BMI]  $>30$  kg/m<sup>2</sup>) has increased more than 50% (from 14.5% to 33.6%) over the past two decades.<sup>2,3</sup> The known risks of morbidity associated with overweight include hypertension, cardiovascular disease, diabetes, and cancer. Weight gain during adult life is also associated with increased risk of heart disease and death.<sup>4,5</sup> Even modest amounts of weight gain dramatically increase the risk for the development of diabetes after 18 years of age.<sup>5-7</sup>

### The link between pregnancy and obesity

An important contributing factor to weight gain among young adult women is sustained weight retention after pregnancy. Although studies of the general population have reported average weight gains of only 0.4 to 3.8 kg more than aging,<sup>8-18</sup> there is marked variability in weight changes associated with pregnancy. Approximately 25% of women experience weight retention of 4.5 kg or more in association with pregnancy.<sup>15,19-21</sup> Moreover, weight changes at the time of pregnancy are strongly related to subsequent weight change. In two large prospective studies<sup>22,23</sup> weight gains during the pregnancy and weight changes during the year postpartum were both independently related to weight gain<sup>23</sup> or the development of overweight<sup>22</sup> at 10 and 15 years follow-ups, respectively. Linne<sup>24</sup> reported that 45.6% of normal weight individuals who gained excessive amounts of weight during pregnancy (average = 18.8 kg) shifted from normal weight to overweight at 15 years follow-up (Figure 1).

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Moreover, 43.8% of normal weight women who had retained significant amounts of weight at 12 months postpartum (M= 4.8 kg) became overweight at 15 years follow-up. Rooney et al.<sup>23</sup> reported that women who were back to their pre-pregnancy weight by 6 months postpartum gained only 2.4 kg over the next 10 years, whereas those who retained weight at postpartum gained 8.3 kg over the 10 year follow-up. Thus, high gestational weight gain and postpartum weight retention appear to set the stage for future weight gain and the development of obesity.

## Variables associated with high postpartum weight retention provide targets for intervention

The strongest predictor of 1-year postpartum weight retention is the amount of weight gained during pregnancy.<sup>21–23,25,26</sup> The IOM guidelines, published in 1990, recommend ranges of weight gain by pre-pregnancy BMI<sup>27</sup> (Table 1). These ranges were selected to optimize fetal growth and maternal/infant outcomes<sup>27</sup> and are currently under consideration for revision by the IOM in the context of today's obesity epidemic. Despite the wide adoption of the 1990 IOM guidelines, however, many women continue to gain more than the recommended amount. Recent data suggest that 37% of normal weight women and 64% of overweight women gain more than IOM recommendations.<sup>19,28</sup> Although there is a broad range of weight changes that are associated with healthy pregnancy outcomes,<sup>29</sup> weight gains that exceed the IOM recommended levels have been connected to gestational complications (hypertension, diabetes, and pre-eclampsia), complications in delivery (cesarean sections), babies that are large for gestational age (macrosomia),<sup>30–34</sup> and obesity in offspring by age 3.<sup>35,36</sup> Weight gains outside IOM recommendations are also associated with greater postpartum weight retention and an increased risk of future overweight.<sup>37–40</sup> Thus, in order to prevent postpartum weight retention, it is critical to try to prevent excessive weight gain during pregnancy.<sup>41</sup>

Behaviors during pregnancy have also been found to relate to the risk of excessive gestational weight gain<sup>42–46</sup> (Figure 2). Olson et al<sup>44</sup> evaluated multivariable biopsychosocial models of gestational weight gain in 622 healthy women. In the final adjusted model, women who reported eating “much more” food during mid-pregnancy were 2.35 times more likely than women who ate “a little more” food to gain too much weight in pregnancy. Moreover, women who were less physically active during pregnancy than before pregnancy were 1.7 times more likely to gain more than recommended than those who maintained or increased their physical activity. Other studies have reported similar findings and also shown additional relationships with excessive gestational weight gain and high fat intake,<sup>42</sup> low fiber intake,<sup>42</sup> and high intake of sweets.<sup>42</sup> These findings suggest that targeting healthy eating and modest physical activity during pregnancy may help improve maternal weight gain outcomes.

## At risk populations

Certain subgroups of women appear to be at greater risk of high gestational weight gain than others and may benefit from interventions to promote healthy weight gain during pregnancy. Many studies have found that pre-pregnancy weight is a significant predictor of weight changes during pregnancy. Although obese women gain less weight than normal weight women during pregnancy, women who are obese (BMI $\geq$ 30) prior to pregnancy appear more likely to exceed IOM weight gain guidelines (using the IOM overweight criterion of BMI > 26) compared with normal weight women.<sup>29,47,48</sup> The multiple risks associated with excess gestational weight gain may be compounded by risks associated with high pre-pregnancy BMI.<sup>49–52</sup> Compared with normal-weight females, obese pregnant women have an increased risk of early-trimester loss and recurrent miscarriage<sup>53</sup> as well as congenital anomalies, including neural tube defects, heart defects, and omphalocele.<sup>54–56</sup> Other complications include chronic hypertension, pregnancy-induced hypertension, pregestational diabetes, gestational diabetes, post-date delivery,<sup>57–61</sup> urinary tract infection,<sup>62</sup> asthma, obstructive sleep apnea, and gallbladder

disease<sup>59,63–65</sup> Numerous delivery, <sup>59</sup> operative, <sup>66</sup> and post-partum<sup>67–70</sup> complications are also associated with pre-pregnancy obesity. Moreover, maternal obesity has a significant impact on offspring risks, including higher rates of fetal macrosomia, still birth <sup>71,72</sup> and childhood obesity<sup>73</sup>.

Weight loss prior to conception is likely an effective way to decrease complications associated with pregnancy in obese women; however, limited research has been conducted in this area. Bariatric procedures prior to conception have been found to significantly reduce rates of pregnancy-induced hypertension and gestational diabetes,<sup>74</sup> chronic hypertension, pregestational diabetes, and large for gestational age infants.<sup>75</sup> However, bariatric surgery is a potential option for only a small subset of women who have a BMI > 35, comorbid conditions, history of failed nonsurgical interventions, acceptable operative risks, and motivation to adhere to long-term post-surgical dietary regimen <sup>76</sup>. Practitioners may consider advising effective non-surgical weight loss strategies prior to conception, including daily self-monitoring food intake, <sup>77–80</sup> daily self-weighing, <sup>78,81</sup> and consuming meal replacement products, typically for 2 meals a day initially, and then one meal a day long-term.<sup>82,83</sup> However, since physicians often cannot devote the time needed to help a patient with their weight loss efforts, it may be useful to refer patients to other programs that can provide more intensive assistance with weight loss prior to conception.<sup>84</sup> Ideally, efforts to promote pre-pregnancy weight control should be carried over during pregnancy to prevent excessive gestational weight gain.

Race may also affect pregnancy weight changes. African-American women consistently gain less weight than white women during pregnancy.<sup>19,26,40</sup> However, they are no different from white women in terms of falling above, at, or below IOM guidelines.<sup>40,47</sup> Age also affects weight gain during pregnancy; younger women gain more weight than older women, but this effect may be due to high weight gain during growth in adolescent women.<sup>85</sup> Primiparity is also associated with larger weight gains during pregnancy. Abrams and Parker<sup>85</sup> found that weight gains of women with parity of 0,1, or 2+ were 34.0, 33.2, and 31.5 lbs; and, in another study, 34% of primiparous women exceeded the IOM guidelines, while only 16% of multiparous women exceeded the guidelines.<sup>26</sup>

Smoking cessation is strongly recommended during pregnancy because, in part, of its association with low infant birth weight.<sup>86</sup> Studies comparing women who do not smoke with those who continue to smoke find that non-smokers tend to gain more weight than smokers.<sup>26</sup> Smoking during pregnancy has also been associated with increased risk of obesity in the offspring.<sup>87,88</sup> Low income has also been related to greater risk of exceeding weight gain guidelines.<sup>89,90</sup> Finally, genetic factors may contribute to the rate of gestational weight gain.<sup>91</sup>

## Pregnancy as a “teachable moment”

The label “teachable moment” has been used to describe naturally occurring life transitions or health events thought to motivate individuals to spontaneously adopt risk-reducing health behaviors; the concept of “teachable moments” has a strong foundation in widely accepted conceptual models of behavior.<sup>92,93</sup>

McBride et al.<sup>94</sup> recently proposed a model to describe characteristics of effective teachable moments using smoking cessation as an example. Teachable moments were characterized as times that (1) increase perceptions of personal risk and outcome expectancies, (2) prompt strong affective or emotional responses, and (3) redefine self-concept or social roles. McBride et al.<sup>94</sup> posited that the greater the degree to which a health event alone or in combination with a proximally timed intervention influences all three domains, the greater the likelihood the event will prompt behavioral change.

Using this model, pregnancy may be conceptualized as a powerful “teachable moment.” Pregnancy provides an immediate and personal experience with risk related to the mother’s and baby’s health and enhances the perceived value of healthy eating and exercise.<sup>95,96</sup> Moreover, the emotional responses surrounding pregnancy may also make it an opportune time to initiate change. Emotional responses are thought to influence an individual’s judgments about the significance and meaning of an event.<sup>93</sup> Pregnancy may prompt feelings of elation and fear about the well-being of the fetus, which may motivate women to change their eating and exercise habits.

Finally, consideration of the pregnancy’s impact on social role and self-concept is important in viewing it as a “teachable moment.” Clearly, pregnancy is a time when personal and social roles change as women become mothers in addition to their other roles. Primiparous women are adopting the maternal role for the first time, which carries expectations for major changes in lifestyle and self-image.<sup>97,98</sup> Women are also becoming a role model for their new child, which, again, may have implications for adopting healthy eating and exercise habits. Thus, intervening during pregnancy may capitalize on this natural period of redefinition that occurs among women (Figure 3).

### Weight gain prevention interventions during pregnancy

A handful of studies have evaluated interventions during pregnancy to promote weight gain within recommendations and prevent postpartum weight retention. Gray-Donald et al.<sup>99</sup> examined the effects of periodic dietary counseling on weight gain in a non-randomized study of the Cree population. The intervention was found to have only a minor impact; the authors noted that cultural factors, however, likely limited the intervention’s efficacy in the Cree population.<sup>99</sup> In another non-randomized study, Kinnunen et al.<sup>100</sup> examined the effects of an intervention that included four dietary counseling sessions with a public health nurse. Results indicated that more women in intervention clinics than control clinics made the dietary changes targeted by the intervention (higher intakes of vegetables, fruits, berries, and high fiber bread), but no significant group differences in magnitude of gestational weight gain were observed.

Studies that have included a focus on weight monitoring and more intensive counseling sessions have found significant effects on gestational gain. Olson et al.<sup>101</sup> conducted a study evaluating the effects of periodic weight monitoring, graphing, and education to prevent excessive weight gain during pregnancy in a sample of women from upstate New York. Results indicated that, in the low income women, 33% exceeded weight gain recommendations in the intervention groups compared with 52% in the historical control group. However, no effect was found among the higher income women. Claesson et al.<sup>102</sup> conducted a non-randomized evaluation of an intervention program in Sweden for obese women that included weekly 30 minute counseling sessions (focused on weight control and motivation and conducted by midwives) and weekly (1–2 times/week) aqua aerobic classes. Results indicated that the intervention succeeded in reducing magnitude of weight gain during pregnancy (7.5 vs. 9.8 kg, respectively) and 12-week postpartum weight retention (–3.3 vs. –.52 kg, respectively), independent of socioeconomic status.

Only two randomized-controlled trials have been conducted evaluating intervention effects on weight gain during pregnancy; both studies had sample sizes less than 120. Polley et al.<sup>103</sup> examined whether a behavioral intervention delivered during pregnancy could decrease the percentage of women who gained more than the IOM recommendations. Results indicated that the intervention was successful in decreasing the percentage of normal weight women who exceeded the IOM recommendations relative to no-treatment controls (33% vs. 58%, respectively); no effect was found in overweight but a trend in the opposite direction was observed. In another randomized trial of 50 obese women from Denmark, Wolff et al.<sup>104</sup>

examined the effects of 10, 1-hour dietary counseling sessions in reducing gestational weight gain. The intervention was found to significantly restrict gestational weight gain relative to controls (6.6 vs 13.3 kg).

These preliminary studies suggest that monitoring weight gain, quantity of food intake, and physical activity are appropriate behavioral targets and, combined with behavioral counseling, appear to curb excessive gestational weight gain and postpartum weight retention. However, larger randomized controlled trials are needed to adequately test the effects of behavioral intervention during pregnancy on the long-term weight retention and obesity.

### **Are there adverse effects of intervening during pregnancy?**

Available data suggest that prevention of excessive weight gain during pregnancy does not have adverse consequence on the developing fetus or mother. In Wolff et al.'s randomized trial,<sup>104</sup> the intervention did not have any detectable adverse effects on fetal growth, and fewer incidences of pregnancy and birth complications were observed in the intervention than in the control group. Similarly, Claesson et al.<sup>102</sup> found no significant differences between intervention and control groups regarding mode of delivery and neonatal outcomes. Neither Gray-Donald et al.,<sup>99</sup> Polley et al.,<sup>103</sup> nor Olson et al.<sup>105</sup> found any differences in birth weight between intervention and control groups. However, results of these studies require further investigation in larger randomized controlled trials.

Although there are certain contraindications to exercise during pregnancy (e.g., pregnancy-induced hypertension, incompetent cervix), research on moderate aerobic exercise does not appear to have a negative effect on the developing fetus.<sup>106-107</sup> Kulpa et al.<sup>106</sup> randomly assigned pregnant women to usual care or an exercise condition and found that the exercise intervention significantly reduced the amount of pregnancy weight gain (27 vs. 34 lb) with no adverse effects on gestational age, birth weight, Apgar scores, or obstetric complications. Based, in part, on these data, current recommendations by the American College of Obstetricians and Gynecologists are in line with the Centers for Disease Control and Prevention and American College of Sports Medicine recommendation for exercise: To accumulate 30 minutes or more of moderate exercise on most, if not all days of the week- in the absence of either medical or obstetric complications.<sup>108-109</sup>

### **Talking to patients about appropriate weight gain**

In light of the increasing rates of high postpartum weight retention and obesity, the IOM is currently re-examining its 1990 gestational weight gain recommendations.<sup>110</sup> Nonetheless, there is strong evidence that prenatal care providers are either not providing weight gain advice or not following existing IOM guidelines when they advise their patients. Approximately one third of women report receiving no weight gain advice from their prenatal care provider,<sup>111-112</sup> and, among those patients receiving advice, approximately one third report receiving advice inconsistent with the current IOM guidelines.<sup>111</sup> Stotland and colleagues<sup>111</sup> evaluated 1198 women and found that 50% of high BMI participants (BMI > 26) reported receiving advice to over-gain; by contrast, 35% of low-BMI participants (BMI < 19.8) report receiving advice to under-gain.<sup>111</sup> Similar findings have been reported elsewhere.<sup>33</sup> Reasons for lack of provider adherence to IOM guidelines include lack of awareness, familiarity, and agreement with guidelines.<sup>113-114</sup> Some providers may not be aware of the BMI specific weight gain guidelines and advise all women to gain within the same range.<sup>111</sup> Also, providers may reduce their weight gain goals for obese patients but overlook more moderate degrees of overweight.<sup>111</sup> In addition, weight gain during pregnancy is a sensitive topic for many patients, and providers may be reluctant to broach the issue.<sup>115</sup>

Nonetheless, in the absence of definitive empirical findings to guide practice, providing weight gain goals and graphing weight gain during pregnancy in relation to IOM recommendations would appear to be a step to at least reduce the likelihood of excess pregnancy weight gain. Providers' advice about gestational weight gain is strongly associated with actual weight gain outcomes.<sup>33,111,116</sup> Although there is a wide range of weight gain associated with healthy pregnancy outcomes,<sup>117</sup> patients who are exceeding recommendations may be advised to "check-in" with their health behaviors and modify any unhealthy eating and exercise habits.<sup>103</sup> Promoting physical activity and discouraging sugar-sweetened beverage intake and fast food consumption may also contribute to prevention of excessive gestational weight gain and promote healthy postpartum habits.<sup>37</sup> Weight gain graphs and educational materials to promote healthy gestational weight gain are available online from the study from the study by Olson and colleagues<sup>105</sup> (<http://www.nutritionworks.cornell.edu/features/index.cfm?Action=Course&CourseID=76>).

Advantages of intervening during pregnancy include capitalizing on pregnancy's potential as a "teachable moment" and implementing interventions in the context of usual prenatal care. However, translating research findings into clinical practice remains a challenge. 98-101.<sup>118</sup> In practice, financial barriers may prohibit patients from being able to afford, for example, the cost of a scale or transportation to attend clinic visits. Patient adherence to recommended strategies (e.g., weight graphing, physical activity), particularly among diverse patient populations during pregnancy, remains understudied. In clinical practice, a pregnant patient may be seen by multiple practitioners and at varying time intervals, making consistent goal-setting and follow-up with behavioral goals a challenge. Providing educational materials and behavioral counseling may also prove difficult within the time constraints of clinical practice. More research is needed to identify the most effective and disseminable intervention for promoting appropriate gestational weight gain within the context of our current healthcare system. Barriers to providing advice about appropriate weight gain also need to be addressed, including the role of patient adherence, financial barriers, limited physician time and lack of payment by health-insurance and managed-care plans.<sup>119,120</sup> To combat the rising obesity epidemic, multi-level interventions across the lifespan will need to be implemented.<sup>121</sup> By monitoring and giving appropriate advice about gestational weight gain, health care providers can influence weight gain during pregnancy and potentially reduce the incidence of overweight and obesity in women and children.

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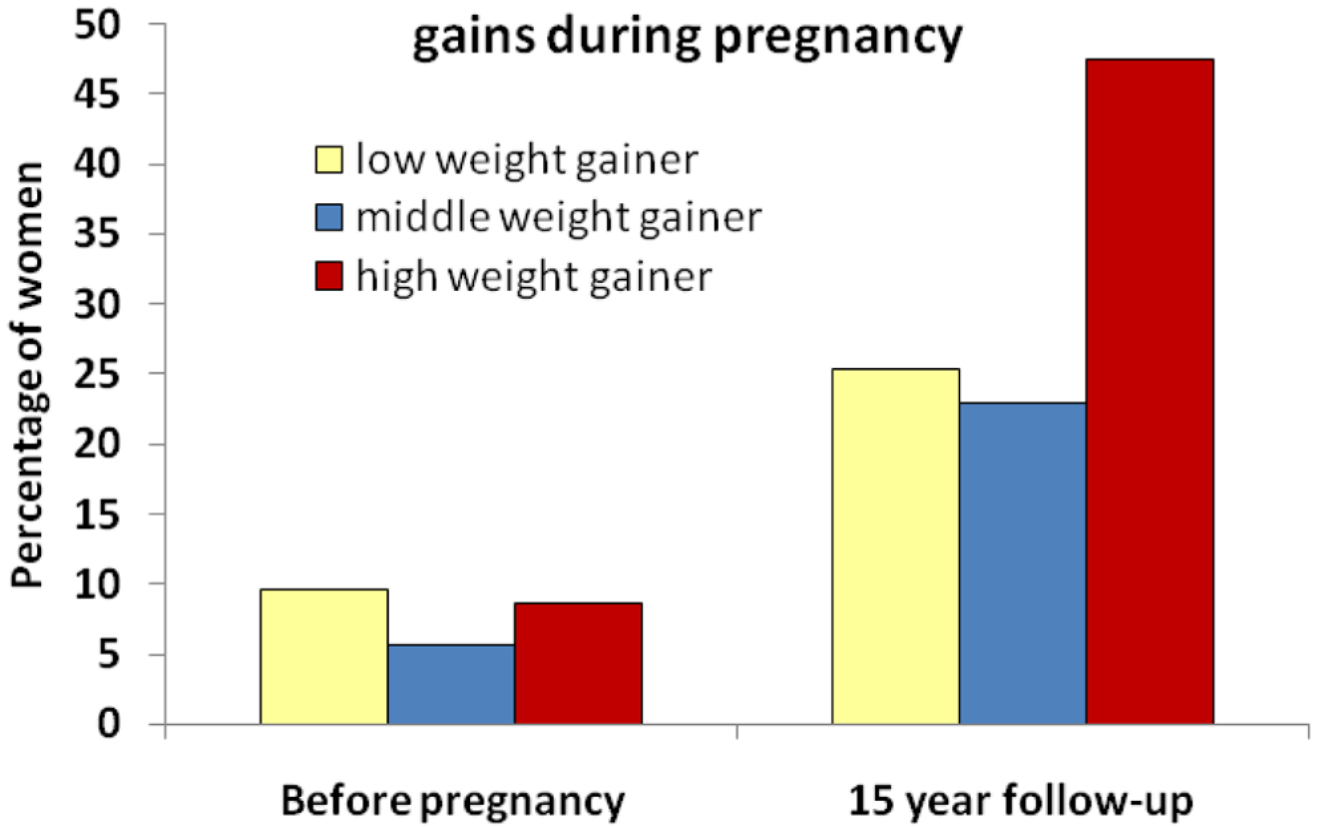
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## Prevalence of overweight and obesity among women who had low, middle, and high weight gains during pregnancy



**Figure 1.** Prevalence of overweight and obesity among women who had low, middle, and high weight gains during pregnancy. NOTE: Adapted from Linne et al, 2004<sup>22</sup> Low weight gainers gained an average of  $9.8 \pm 1.9$  kg; middle weight gainers gained  $14.0 \pm 0.9$  kg; and, high weight gainers gained  $18.8 \pm 2.3$  kg during pregnancy.



**Figure 2.**  
Variables related to excessive gestational weight gain

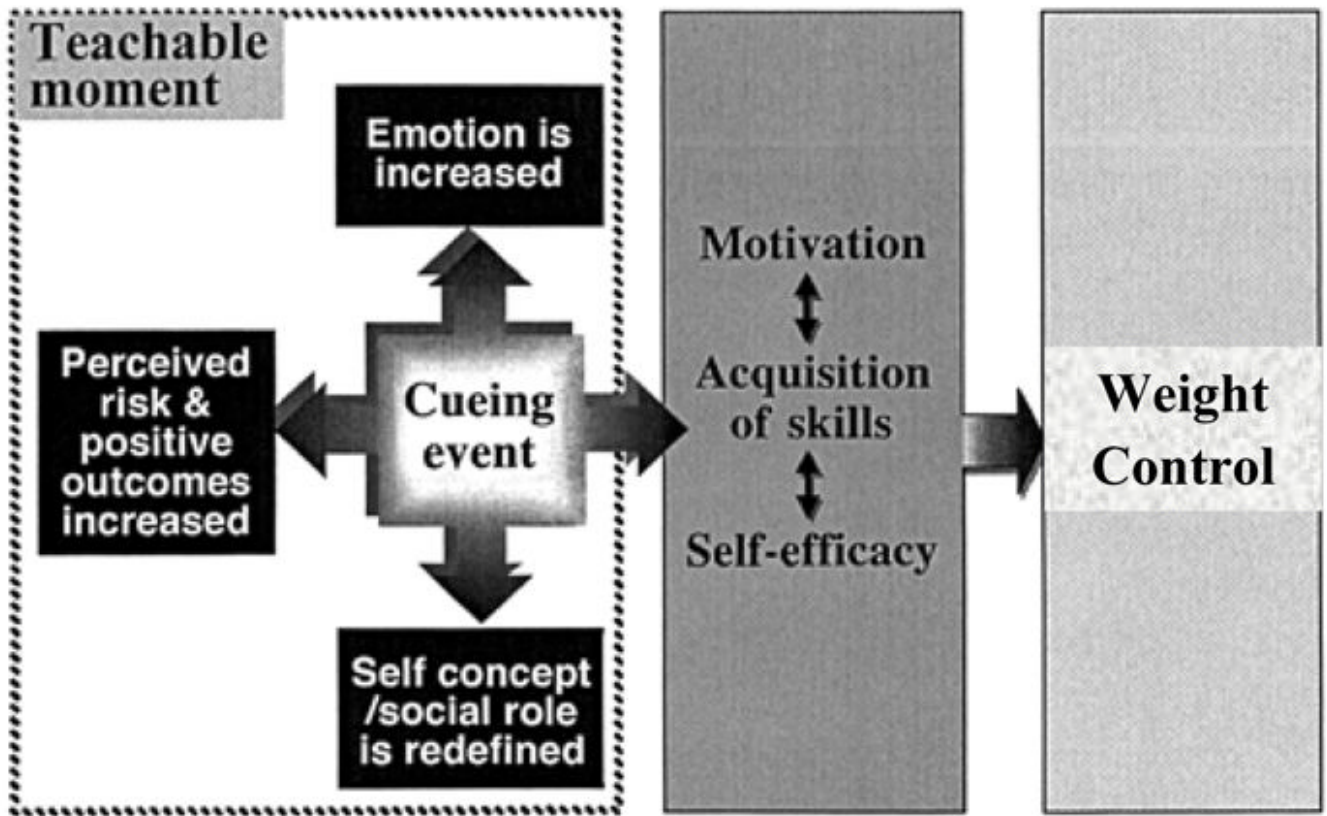


Figure 3. Pregnancy as a “teachable moment” for weight control. Reprinted and adapted with permission from McBride et al.<sup>122</sup>

**Table 1**

The 1990 IOM recommendations for total weight gain ranges for pregnant women

Recommended total gestational weight gain		
BMI category	kg	lb
< 19.8	12.5–18	28–40
19.8–26	11.5–16	25–35
26.0–29.0	7–11.5	15–25
> 29.0	≥ 6.8	≥ 15

Adapted from the 1990 Institute of Medicine report <sup>27</sup>