

Overcoming Barriers to Physical Activity During Pregnancy and the Postpartum Period: The Potential Impact of Social Support

Christopher P. Connolly, Deborah L. Feltz, and James M. Pivarnik

Pregnant and postpartum women have reported a number of barriers that prevent them from being sufficiently physically active. Overcoming these barriers is critical to ensure the health benefits of physical activity to both mother and fetus. The primary focus of this review centers on the potential impact social support may have in overcoming each of the primary barriers to physical activity experienced during pregnancy and the postpartum period. A reasonable body of research exists regarding the relationships between social support and these barriers; however, few investigations have specifically attempted to mitigate the effects of these barriers via social support interventions. Within this review, the enabling influence of social support as it pertains to pregnant and postpartum women's physical activity is discussed. Recommendations are suggested for the application of social support in future research investigations involving physical activity during pregnancy and postpartum.

Keywords: pregnant women, exercise behavior

Pregnancy is a unique and often challenging time for most women, sometimes accompanied by physical discomfort and emotional strain not previously experienced. Multiple anthropometric and physiologic changes commonly occur during pregnancy, including an increase in weight, abdominal mass, joint laxity, and lumbar lordosis (Bullock, Jull, & Bullock, 1987; Danforth, 1967; Hartmann & Bung, 1999), as well as increases in resting blood volume, stroke volume, cardiac output, heart rate, mean arterial pressure, and oxygen consumption (Clark et al., 1989; Pivarnik, 1996; Pivarnik et al., 1993). As gestation progresses, the psychological state of pregnant women may vary in an episodic or transient manner. Although some women feel strength and fulfillment during pregnancy, other psychological changes manifest themselves in the form of increased anxiety, stress, fatigue, apathy, and or decreased self-worth, motivation, hopefulness, body image satisfaction, and perceived self-control (Lancaster et al., 2010).

Physical activity during pregnancy provides a myriad of benefits to both mother and baby and may have a protective effect against adverse outcomes during pregnancy and at delivery. Physical activity, both prepregnancy and throughout gestation, is associated with decreased risk of the pregnancy-related conditions such as gestational diabetes and preeclampsia (Dempsey et al., 2004; Oken et al., 2006; Rudra, Sorensen, Luthy, & Williams, 2008; Saftlas, Logsdan-Sackett, Wang, Woolson, & Bracken,

2004; Sorensen et al., 2003; Zhang, Solomon, Manson, & Hu, 2006). Activity during pregnancy has also been shown to promote healthy weight gain during pregnancy (Giroux, Inglis, Lander, Gerrie, & Mottola, 2006; Haakstad, Voldner, Henriksen, & Bo, 2007; Stuebe, Oken, & Gillman, 2009), which helps reduce the risk of adverse outcomes to the maternal-fetal unit at delivery and beyond. Researchers have also shown that physical activity during pregnancy provides substantial psychological benefits including reduced levels of depressive symptoms and anxiety as well as increased body image satisfaction and self-esteem (Daley, Macarthur, & Winter, 2007; Galper, Trivedi, Barlow, Dunn, & Kampert, 2006; Poudevigne & O'Connor, 2006). Maternal physical activity has been shown to be inversely associated with negative birth outcomes including, labor duration (Clapp, 1990; Melzer et al., 2010), preterm delivery (Hegaard et al., 2008; Juhl et al., 2008), and operative delivery (Melzer et al., 2010). In addition, the majority of evidence indicates that physical activity during pregnancy leads to healthy decreases in birth weight within the recommended range (Hegaard, Pedersen, Nielsen, & Damm, 2007; Mudd et al., 2012; Owe, Nystad, & Bo, 2009). Infants and toddlers of women who regularly engage in some form of physical activity during pregnancy appear to show enhanced neurodevelopment and subcutaneous fat profiles compared with those whose mothers did not exercise throughout gestation (Clapp, 1996; Clapp, Simonian, Lopez, Appleby-Wineberg, & Harcar-Sevcik, 1998).

It is clear that changes occur in total physical activity, intensity of activity, and energy expenditure throughout gestation (Evenson & Wen, 2010; Pereira et al., 2007;

Connolly (corresponding author: connol57@msu.edu), Feltz, and Pivarnik are with the Dept of Kinesiology, Michigan State University, East Lansing, MI.

Rousham, Clarke, & Gross, 2006), with a prominent decrease occurring from the second to the third trimesters (Downs, LeMasurier, & DiNallo, 2009; Pereira et al., 2007; Rousham et al., 2006; Stein, Rivera, & Pivarnik, 2003). Regardless, current recommendations from the 2008 Physical Activity Guidelines for Americans suggest at least 150 min of moderate-intensity aerobic activity for healthy pregnant women who are not highly active and even greater amounts and intensity for those who are highly active (United States Department of Health and Human Services [DHHS], 2008). Evenson and Wen (2010) recently found that only 14% of pregnant women achieved the minimal recommended amount of moderate-intensity activity. Moreover, it is suggested that only 48–61% of women are moderately active during pregnancy (Ning et al., 2003; J. Zhang & Savitz, 1996). Pereira et al. (2007) found that the prevalence of insufficient physical activity in the postpartum period was almost double that of prepregnancy.

Women's suboptimal physical activity levels suggest that a number of barriers impede pregnant and postpartum women from being sufficiently active. Social support appears to be a crucial element in enabling women to overcome many of these barriers. This paper is a literature review pertaining to the multidimensional concept of social support, common physical activity barriers experienced by pregnant and postpartum women, and the influence of social support in enabling pregnant and postpartum women to overcome these barriers and participate in sufficient physical activity.

Barriers to Physical Activity During Pregnancy and Postpartum

Physical and psychological changes that occur during pregnancy and postpartum elicit unique challenges that may be difficult for women to manage. These include a transformation in physical appearance, the possibility of adjustments in interpersonal relationships, physical and emotional discomfort, and the impending new role of motherhood. The combination of such factors constitutes pregnancy and the postpartum period as remarkable, but life-altering events. Thus, it is plausible that a woman's thoughts, feelings, and behaviors throughout this experience may be distinctive (Gjerdengen, Froberg, & Fontaine, 1991).

With respect to physical activity, a number of factors emerge during pregnancy and postpartum which impede women from being sufficiently physically active. Evenson, Moos, Carrier, & Siega-Riz (2009) examined perceived barriers to physical activity among 1,535 pregnant women and discovered that fatigue, physical discomfort, fear of harming the baby, and a lack of time as the most common reasons for not participating in physical activity. Such findings are confirmed by other survey-based investigations (Duncombe et al. 2009; Cramp & Bray, 2009; Da Costa & Ireland, 2013). In addition to these primary barriers, a host of qualitative investigations have

identified additional barriers to physical activity during pregnancy, including childcare responsibilities, dissatisfaction with body size, lack of access to workout facilities, low levels of self-confidence and motivation, and lack of informational support (Cioffi et al. 2010; Evenson, Moos et al., 2009; Hegaard, Kjaergaard, Damm, Petersson, & Dykes, 2010; Krans & Chang, 2011; Marshall, Bland, & Melton, 2013; Symons Downs & Hausenblas, 2004; Weir et al. 2010). For postpartum women, the most commonly reported barriers to physical activity are clearly lack of time, child care, and fatigue or lack of energy (Evenson, Aytur et al., 2009).

The Role of Social Support

Social support is generally considered to be an act by one individual that aides another in carrying out a certain task or goal successfully. Some investigators assessing the relationship between social support and health behaviors have considered social support to be a unidimensional construct, while others have considered a more multidimensional approach, this being the most current consensus (Rees, Hardy, & Evans, 2007; Richman, Rosenfeld, & Hardy, 1993). Although there is little agreement concerning the operational breakdown of elements that define social support and how these components should be assessed, most experts agree that the complexity of this concept extends far beyond a generic definition (Cohen, 1988). Basic and general assessments of social support within the physical activity domain are common; however, the lack of specificity within some of these assessments may partially explain inconsistencies in the scientific literature.

Regardless, investigators have undertaken the task of determining the extent to which various types and amounts of social support predict health behaviors among specific populations. Although proposed theoretical frameworks that govern this line research have been notably understudied, four broad categories of social support have recently emerged and are gaining acceptance in the literature: emotional social support, informational social support, tangible social support, and esteem social support (Rees & Hardy, 2000). Emotional support consists primarily of providing affection, care, and security toward the individual, while esteem support typically is considered to be the strengthening of the individual's confidence through appraisal. Informational support primarily encompasses the exchange of advice, counsel, or guidance from the provider to the recipient. Lastly, tangible support involves the providing of assistance in the form of time or resources (e.g., providing a gym membership or helping with house chores).

Social support has been shown repeatedly to be positively associated with physical activity (Sherwood & Jeffery, 2000; Treiber et al., 1991). Carron et al. (1996) examined the impact of social influences on physical activity behavior via meta-analysis and found moderate to large effect sizes for social support from family and

important others with exercise attitudes and behavior. A comprehensive body of literature specifically suggests the crucial importance of social support in facilitating women's health (Hurdle, 2001) and it has been repeatedly found that social support from family, friends, and spouses all predict physical activity behavior among women (Eyler et al., 1999; Felton & Parsons, 1994; Tamers et al., 2011). Researchers have suggested that women more frequently seek out and receive social support than do men (Greenglass, Burke, & Ondrack, 1990; Narayanan, Menon, & Spector, 1999), and have a greater need for social support when engaged in a challenging task or time period (Neff & Karney, 2005). Given the unique and life-altering challenges that women commonly experience throughout pregnancy and postpartum, regular physical activity participation may be difficult without some assistance. Therefore, the need for physical activity social support is heightened among pregnant and postpartum women.

Overcoming Barriers to Physical Activity During Pregnancy

Regardless of its operational breakdown, social support likely plays a role in determining physical activity among pregnant women. Da Costa and Ireland (2013) found social support to be inversely related to reported barriers to gestational physical activity among pregnant women, particularly if less physically active pre-pregnancy. In addition, pregnant women have reported that social support from family or friends is critical in alleviating the challenges of consistently participating in physical activity (Cioffi et al. 2010; Evenson, Moos et al., 2009). Though collective findings within the literature suggest social support is critical in enabling physical activity during pregnancy, individual investigations have focused primarily on the impact of social support on specific pregnancy-related challenges.

Fatigue and Physical Discomforts

There are physical complications during pregnancy that may frequently illicit a prescription of inactivity or bed rest from the health care provider. However, the more common physical barriers to physical activity for pregnant women appear to be fatigue and or lack of energy, particularly during the first and third trimesters (Evenson, Moos et al., 2009; Hegaard, Kjaergaard et al., 2010), as well as discomfort or pain in the back, hips, and legs (Evenson, Moos et al., 2009; Pivarnik et al., 2006). Fatigue and general lack of energy during the initial weeks of pregnancy has been suggested to be partly the result of the woman's hormonal changes and an increased metabolic demand imposed on the maternal-fetal unit (Chang, Pien, Duntley, & Macones, 2010; Lee, Zaffke, & McEnany, 2000). However, fatigue during the third trimester appears to result more from sleeping difficulties and general discomfort during sleeping periods (Chang et

al., 2010; Lee et al., 2000). Preliminary research shows that inadequate sleep duration and quality during pregnancy may elevate the risk of various adverse outcomes, including longer periods of labor, pain during labor, caesarean section, and preterm birth (Chang et al., 2010; Lee & Gay, 2004; Micheli et al., 2011). Furthermore, it has been reported among third-trimester pregnant women that the number of individuals available to help is inversely associated with fear of childbirth, anxiety, and fatigue (Hall et al., 2009).

Pregnancy-induced nausea is an additional physical barrier to gestational activity and if severe enough, may eliminate habitual physical activity from a woman's lifestyle. Most commonly observed in the first trimester, nausea and vomiting in early pregnancy is reported by as many as 75% of pregnant women, with approximately 35% of patients requiring clinical aid (Attard et al., 2002; Davis, 2004; Gadsby, Barnie-Adshead, & Jagger, 1993; Lacroix, Eason, & Melzack, 2000). Over 90% of these women report the disappearance of nausea and vomiting by 20 weeks gestation, however, in some cases the condition may last the entire pregnancy (Gadsby et al., 1993). In very rare cases hyperemesis gravidarum may occur, which is characterized by severe levels of nausea and vomiting, ultimately leading to hospitalization as a result of dehydration, electrolyte imbalance, and weight loss (Niebyl, 2010). Nausea and fatigue during pregnancy have been shown to be negatively associated with level of social support received, but positively related to levels of stress and depression (Attard et al., 2002; Buckwalter & Simpson, 2002; Chou, Lin, Cooney, Walker, & Riggs, 2003; Da Costa et al., 2010; Koken et al., 2008; Kuo, Wang, Tseng, Jian, & Chou, 2007). Thus, social support given to pregnant women from friends, family or significant others could be instrumental in ensuring physical and mental relief and rest to allow for physical activity.

Fear of Harming the Baby

Some pregnant women cite fear of harm to themselves or their baby as an underlying reason for decreasing physical activity levels (Doran & O'Brien, 2007; Duncombe et al., 2009; Evenson & Bradley, 2010; Evenson, Moos et al., 2009; Hegaard, Kjaergaard et al., 2010). The fear of harming the baby during physical activity may be particularly prominent among those women who have previously miscarried, received fertility treatment, or experienced a traumatic event during pregnancy themselves or via someone they knew (Hegaard, Kjaergaard et al., 2010). In the past there was indeed some concern that vigorous-intensity activity during pregnancy could be harmful to the maternal-fetal unit. Vigorous-intensity physical activity has been seldom investigated in this population. However, preliminary investigations indicate a reduced risk for various adverse outcomes to both mother and fetus, with prepregnancy vigorous-activity being of utmost importance (Evenson, Siega-Riz, Savitz, Leiferman, & Thorp, 2002; Hegaard et al., 2008; Oken et al., 2006; Zhang et al., 2006). Because there is no

empirical evidence that pregnant women can safely begin to engage in vigorous-intensity physical activity during pregnancy, the 2008 Physical Activity Guidelines for Americans suggest that healthy pregnant women may remain active at a vigorous-intensity level if they were habitually vigorously-active before pregnancy (DHHS, 2008). Indeed, these recommendations suggest that any increases in prenatal physical activity should be gradual and discussed regularly with prenatal health care providers.

Mudd et al. (Mudd, Nechuta, Pivarnik, & Paneth, 2009) recently assessed the perceptions of physical activity safety in a cross-sectional, ethnically diverse sample of pregnant women from nine prenatal care practices in western Michigan. Although 80% of these women intended to be active throughout pregnancy, only 29% reported achieving at least 150 min of physical activity per week. The majority felt moderate-intensity activity was not dangerous to engage in; however, only 36% felt vigorous intensity activity to be safe. Similarly, Evenson & Bradley (2010) found that 78% of pregnant women believed the moderate-intensity activity to be beneficial, but only 13% of pregnant women agreed that vigorous-intensity physical activity has some gestational benefit. It is possible that fear of harming the unborn child is a more notable reason why pregnant women are avoidant of physical activity, particularly of vigorous-intensity (Hegaard, Kjaergaard et al., 2010; Mudd et al., 2009). However, an alternate reason for such avoidant behavior may be that vigorous-intensity physical activities are more detrimental to an individual's activity maintenance efficacy beliefs than are moderate-intensity activities (Sallis, Hovell, & Hofstetter, 1992).

Informational social support may have a critical impact on minimizing perceptions of fear of harming the baby as a result of gestational physical activity. Clarke and Gross (2004) conducted prospective investigation among 57 pregnant women and found that nearly all received some physical activity advice at one point during their pregnancy, with approximately half of the women reporting on more than three occasions (Clarke & Gross, 2004). However, it was also found that one in five pregnant women have received confusing and or contradictory information or advice regarding gestational physical activity (Clarke & Gross, 2004). Preliminary investigations have suggested that many of pregnant women reported reading books and magazines as their primary source for information for physical activity during pregnancy, particularly early on (Clarke & Gross, 2004; Gross & Bee, 2004). However, family and friends have been cited as the more preferred and constant source of physical activity advice throughout pregnancy (Gross & Bee, 2004). Moreover, Melender (2002) reported that fears during pregnancy can be alleviated through talking openly about feelings and increasing knowledge surrounding the pregnancy experience, two services that families are often capable of providing. However, it must also be considered that the strong influence of familial informational support toward pregnant women may

also be negative. This may be illustrated by the finding that 59% of pregnant women receive discouragement of physical activity from family members at some point during the second trimester, and a higher 85% at some point during the third trimester (Clarke & Gross, 2004).

In the absence of familial social support, accurate information and current physical activity recommendations provided by prenatal health care providers may be crucial in minimizing fears. However, Krans et al. (2005) reported that only 31% of pregnant women engaged in a physician-initiated physical activity discussion, somewhat higher than Clarke and Gross (2004) and Evenson and Pompeii (2010) who found that only 18% and 23.5% of pregnant women received physical activity advice from their prenatal health care providers. Health care providers may be extremely conservative in the physical activity advice they provide, and some may not discuss gestational physical activity at all with their patients. This behavior may result from the providers being unfamiliar with the most recent recommendations and research on health benefits of maternal physical activity. For example, Entin and Munhall (2006) showed that 62% of obstetricians still specify a maximum heart rate during exercise and more than 50% suggest reduced activity during the 3rd trimester for healthy pregnancies, neither of which are recommended in the most recent guidelines. In addition, Bauer et al. (2010) found that 64% of prenatal health care providers do not believe heart rate should exceed 140 beats per minute during maternal exercise, a recommendation which was removed from all guidelines published after 1985. Furthermore, Bauer et al. (2010) found only 6% of obstetricians believe vigorous physical activity during pregnancy to be beneficial to the maternal-fetal unit.

Prenatal health care providers, as sources of informational support, are in an influential position where they can potentially initiate and promote positive behavior change. Because of a unique concern that pregnant women may have regarding the health of their unborn child, it is plausible that their receptiveness to health care providers' advice is increased compared with prepregnancy. For this reason, it is critical for prenatal health care providers to be knowledgeable and supportive regarding the benefits of and most current recommendations for gestational physical activity. It is likewise crucial that they convey this information regarding physical activity to their patients by initiating discussion multiple times throughout pregnancy.

Pregnancy-Related Depression

Psychological health and mood clearly affect physical activity levels during pregnancy (Poudevigne & O'Connor, 2006). Although diagnosed depression is not commonly reported by pregnant women as a reason for their being physically inactive, depressive symptoms such as fatigue and lack of motivation are prominent impediments. Symptoms of depression and anxiety vary substantially during pregnancy, with the

second and third trimesters being a particularly vulnerable time, potentially affecting 12–13% of all pregnant women (Bennett, Einarson, Taddio, Koren, & Einarson, 2004b). Emotional distress and depressive symptoms during pregnancy may be even more severe than in the postpartum period (Josefsson, Berg, Nordin, & Sydsjo, 2001) and have been shown to be related to critical health indicators such as physical inactivity, poor dietary habits, and sleep difficulties (Da Costa, Dritsa, Rippen, Lowensteyn, & Khalife, 2006; Da Costa, Rippen, Dritsa, & Ring, 2003; Hurley, Caulfield, Sacco, Costigan, & Dipietro, 2005). Women with prenatal depression have been shown to be more likely to miss prenatal care visits and are at greater risk for obstetric complications than are pregnant women without depressive symptoms (Bennett, Einarson, Taddio, Koren, & Einarson, 2004a; Bowen & Muhajarine, 2006; Lusskin, Pundiak, & Habib, 2007). In addition, there is evidence that social support has some impact on minimizing the physical and social impairment among pregnant women battling depressive symptoms (Setse et al., 2009). Croezen et al. (2012) reported recent longitudinal findings that poor mental health is related to both low amounts of positive social support and high amounts of negative social support in a nonpregnant population and also that physical inactivity is associated with poor experiences with social support. Significant inverse associations between perceived social support and depressive symptoms, body-image dissatisfaction, and levels of stress have been shown during the first trimester (Chou et al., 2003).

Depression, anxiety, self-esteem, body-image dissatisfaction, and stress level are all closely related barriers to physical activity and are intrapersonal in nature. Therefore, emotional and esteem support from a solid support system, consisting of immediate family and friends, may be critical in the overcoming these barriers, especially through providing comfort and confidence (Tarkka & Paunonen, 1996). MacDonald et al. (1992) found that married pregnant women had significantly lower levels of depression than did unmarried cohabitating pregnant women and pregnant women living alone. In addition, women with supportive husbands appear to have lower anxiety and distress levels in each trimester compared with women without supportive husbands (Kalil, Gruber, Conley, & Sytniac, 1993). Rodriguez et al. (2001) provided evidence that social support predicted maternal adjustment to pregnancy as well as time spent in physical activity. The fact that among pregnant women, depression, anxiety, and other negative mental health conditions may be either a result of or cause of physical inactivity is an interesting paradox.

Considerations for Specific Subgroups of Pregnant Women

Behavioral response to social support during pregnancy may vary depending on the subgroup of pregnant women being studied (Dunkel-Schetter et al., 1996). Specifically, ethnicity seems to play a role in a woman's perception of

the benefit and/or risk of being physically active during pregnancy. For example, Hispanic or Latino women have greater fears of harming the baby as a result of physical activity compared with pregnant women of other ethnicities, and have been shown to be less physically active during pregnancy (Evenson, Savitz, & Huston, 2004; Mudd et al., 2009; Ning et al., 2003; Petersen, Leet, & Brownson, 2005). Among Hispanic or Latino women, the extended family plays an important role in providing support, particularly emotional support, including grandparents, aunts, uncles, and cousins (Dunkel-Schetter et al., 1996; Keefe, Padilla, & Carlos, 1979). Further, female relatives and the baby's father have been shown to provide the majority of support (Engle, Scrimshaw, Zambrana, & Dunkel-Schetter, 1990; Thornton et al., 2006; Zayas & Solari, 1994). Engle et al. (1990) discovered that family support among Hispanic or Latino women during pregnancy was associated with a greater knowledge of, and more advanced preparation for pregnancy and delivery. Some investigations have revealed that Hispanic or Latino women need and receive less emotional and tangible support than do women from other ethnicities and that they report less stress and greater satisfaction with the support they do receive (Collins et al., 1993; Norbeck & Anderson, 1989). However, it is also possible that the more commonplace and consistent nature of social support in this culture may lead to differences in how it is defined compared with individuals from other cultures (Dunkel-Schetter et al., 1996). Thus social support among Hispanic or Latino women may be simply underreported.

Physical activity levels are significantly lower and adverse prenatal conditions are significantly higher in Latino women than other ethnicities (Chasan-Taber et al., 2007). With the intent to understand the distinctive nature of support in this culture, Thornton et al. (2006) conducted a community-based investigation to assess the impact of social support on physical activity and dietary behaviors of Latino pregnant women. Specific to gestational physical activity, husbands were found to be the most influential source of informational, tangible, and emotional support to pregnant women. However, the investigators also found that Latino pregnant women believed that husbands rarely provided the tangible support of watching children so that their wives could exercise. In addition, Latino pregnant women were also reminded from all immediate and extended family to abstain from vigorous physical activity whenever possible (Thornton et al., 2006).

Social support provided to pregnant teenagers may be uniquely important, as they are in a transient phase of psychological and physical development common during the teen years. Investigations have shown the quantity of and teenager's satisfaction with social support is directly related to birth complications (Barrera, 1981; Rogers, Peoples-Sheps, & Suchindran, 1996). In addition, length of labor among pregnant teenagers has been shown to be inversely related to social network size (May 1992). Family social support is critical to this subgroup of pregnant women, and has been shown to be associated

with psychological health, most notably, postpartum depression (Dunkel-Schetter et al., 1996; Turner, Grindstaff, & Phillips, 1990). Emotional and financial support have been reported as the greatest needs for this specific subgroup of pregnant women, with the teenager's mother as the most prominent source of support (May 1992).

Overcoming Barriers to Postpartum Physical Activity

With new responsibilities and lifestyle changes that accompany the birth of a child, postpartum women are challenged with a unique set of barriers to physical activity. While some first-time mothers experience an increase in postpartum vitality, a significant decrease in perceived quality of life has been reported over the initial postpartum months (Gjerdingen et al., 2003). Moreover, during the postpartum period there is an increased perceived domestic workload for the mother (Gjerdingen et al., 2005), as well as a possible decrease in perceived partner support as the postpartum period progresses (McVeigh et al., 2000). Various investigations have shown that social support has an enabling influence on physical activity behavior among postpartum women (Albright, Maddock, & Nigg, 2005; Evenson, Aytur, et al., 2009; Smith et al., 2005). Similar to pregnancy, the influence of physical activity social support during the postpartum period has been most comprehensively investigated with respect to specific physical activity barriers commonly experienced.

Lack of Time and Child Care

The many responsibilities that accompany infant care combined with household errands and the possible return of work responsibilities can be time consuming. Women in the postpartum period have indicated overwhelmingly that a lack of time is the most common reason for physical inactivity (Evenson, Aytur et al., 2009). In general, physical activity is markedly decreased for parents compared with nonparents, with parenthood having the greatest effect on the activity levels of mothers (Bell & Lee, 2005; Brown & Trost, 2003). Nomaguchi and Bianchi (2004) found that mothers spend almost 1.5 hours less every two weeks participating in leisure-time physical activity compared with fathers. Although more likely to engage in household activities and errands, mothers participate in substantially less exercise and leisure-time physical activity, particularly at moderate to vigorous-intensity than do nonmothers (Bellows-Riecken & Rhodes, 2008; Scharff, Homan, Kreuter, & Brennan, 1999; Sternfeld, Ainsworth, & Quesenberry, 1999). Furthermore, both the age and number of children at home may influence maternal physical activity levels with younger children requiring more attention, possibly exacerbating the lack of time issue (Bellows-Riecken & Rhodes, 2008; Nomaguchi & Bianchi, 2004). Other investigations indicate that mothers with multiple children have less time for leisure-time activities (Sternfeld et al., 1999) and that there may

be a negative dose-response relationship between the number of children and physical activity levels (Brown & Trost, 2003).

Not surprisingly, one of the most commonly reported enablers to postpartum women being active is tangible support provided by the partner (Evenson, Aytur et al., 2009; Hamilton & White, 2010). Partner assistance with child care has been shown to be associated with maternal sport and exercise participation of higher intensity, in addition to an improved perceived partner relationship (Blum, Beaudoin, & Caton-Lemos, 2004). Moreover, Hinton and Olson (2001) found that the husband's exercise habits may predict maternal exercise frequency among postpartum women. One specific psychological variable related to the barrier of child care is a perceived guilt that parents may experience as a result from having to ask others to watch or care for their child/children while they participate in physical activity (Hamilton & White, 2010). However, in many cases family can serve as a crucial provider of tangible support during pregnancy, including child care (Thornton et al., 2006). This source of support is especially crucial given the findings of Hamilton and White (2010), who found that parents are able to engage in physical activity free of guilt when family members are the individuals watching their children.

Miller, Trost, & Brown (2002) conducted a randomized control trial with the intent to increase maternal activity through printed informational booklets and also discussion groups. These groups focused on the benefits of physical activity, strategies to overcome physical activity barriers by increasing partner support, social advocacy, and capacity building. In addition to finding that partner support and self-efficacy may be the primary mediators to physical activity levels of young mothers, investigators found that women who received printed information and participated in discussion groups with other young mothers were more likely to achieve current recommendations of at least 150 min of moderate-intensity activity per week (Miller et al., 2002).

Fatigue and Lack of Energy

Fatigue, irregular sleep, and general lack of energy are common issues during the postpartum period and have been shown to impede women from engaging in leisure time physical activity (Beilock et al., 2001; Evenson, Aytur et al., 2009). Although there is a unique metabolic demand placed on both pregnant women and women who breastfeed during the postpartum period, a probable difference between pregnancy and postpartum fatigue is the adjustment to constant sleep disruptions to care for the child. Among postpartum women, help at home from a significant other or immediate family member has been reported to be the most important facilitator of sufficient maternal rest (Price et al., 2012), theoretically enabling mothers to feel they have the energy necessary to be active. However, the majority of postpartum women believe that participating in postpartum physical activity would make them feel more energetic (Evenson, Aytur et

al., 2009). Because of the emotional and physical distress that irregular sleeping patterns illicit, it is little wonder that fatigue in this time period is a symptom of postpartum depression. Confirming this relationship, various investigations have shown that lower amounts of sleep, greater levels of fatigue, and suboptimal infant sleeping patterns are all associated with greater depressive symptoms in the postpartum period (Dennis & Ross, 2005; Lee et al., 2000; Wolfson, Crowley, Anwer, & Bassett, 2003).

Postpartum Depression

The experience of “baby blues” is the mild experience of any of a number of depressive symptoms, including fatigue, guilt, loss of interest in life, insecurity, anxiety, mood swings, inability to sleep, loss of appetite, reluctance to breast feed, harmful thoughts, and reduced quality of life (Da Costa et al., 2006; Hatton et al., 2005). In contrast, clinically diagnosed postpartum depression is usually denoted by the extreme or uncontrollable experience of any or a combination of these symptoms and has been shown to afflict 6–13% of childbearing women (Gaynes et al., 2005; O’Hara & Swain, 1996). It is estimated that approximately half of the total cases occur in the initial 3 months following delivery, with the peak incidence usually occurring within the first 4–6 weeks (Cooper, Campbell, Day, Kennerley, & Bond, 1988; Cox, Murray, & Chapman, 1993). Although this incidence may be no greater than at other times during the lifespan of women, the argument can be made that postpartum depression is more difficult to endure with sudden imposing demands of caring for a newborn child. Postpartum depression is an extremely complex condition that requires treatment to prevent negative experiences for both mother and child. These may include difficult maternal-fetal interactions (Murray, Fiori-Cowley, Hooper, & Cooper, 1996), mothers having more negative perceptions of infant behavior (Mayberry & Affonso, 1993), and an increased risk of future episodes of depression (Wisner, Parry, & Piontek, 2002). Furthermore, infants of women suffering from postpartum depression are more likely to show behavioral issues (Miller, Barr, & Eaton, 1993) and reduced capability to perform tasks using cognitive function (Murray, 1992).

Investigators have shown consistently that there is a strong inverse relationship between postnatal social support and risk of postpartum depression (Collins, Dunkel-Schetter, Lobel, & Scrimshaw, 1993; Logsdon, McBride, & Birkimer, 1994; Xie, He, Koszycki, Walker, & Wen, 2009; Xie et al., 2010). Some even suggest that a solid social support system may serve as a buffer to postpartum depression onset (Beck, 2001). Webster et al. (2011) recently found that postpartum women who reported low levels of social support had significantly higher levels of depressive symptoms than did women who reported adequate levels of social support. Likewise, the authors found that women receiving only low levels of social support, specifically from families or significant others, yielded significantly lower physical,

psychological, social, and environmental quality of life scores compared with women reporting adequate family support (Webster et al., 2011). Xie et al. (2010) found that the husband’s level of support provides the most influential role of all immediate relationships in influencing the risk for postpartum depression.

Current research regarding the impact of postpartum physical activity on reducing depression is minimal but provides strong initial evidence that it may be an effective natural treatment (Daley et al., 2007; Poudevigne & O’Connor, 2006). Armstrong et al. have recently investigated the effects of group-based pram walking in initiating postpartum physical activity and reducing depressive symptoms via randomized controlled trials (Armstrong & Edwards, 2003, 2004). Although sample size was relatively small in both studies, results suggest that the social interaction provided by the group sessions in conjunction with regular physical activity provided reductions in depressive symptoms. However, in some cases postpartum depression may act as a barrier and prevent women from attending such social gatherings. Therefore, medical intervention for the depression may be necessary first for women to be able receive the benefits physical activity provides on alleviating depressive symptoms.

Conclusion

Given the life-changing events and associated challenges presented to women during pregnancy and postpartum, the role of social support appears to be critically important in enabling many to achieve sufficient levels of physical activity. Barriers to physical activity during pregnancy and postpartum are not yet fully understood, particularly with respect to how they can be attenuated. Social support is a promising avenue in which pregnant and postpartum women may be able to become more active, and in so doing, secure the many health-related benefits of physical activity for themselves and their babies. However, there are multiple needs within this line of research if the true impact of physical activity social support is to be thoroughly understood as it pertains to this specific population. The relationship between different types of social support and each individual barrier should be an initial step in the research process, particularly given the complex nature of most prenatal and postpartum challenges faced by women. Within this assessment, specific sources of support within a woman’s social network (i.e., family, friends, significant others) should also be considered. Furthermore, the effect of physical activity social support on various combinations of physical activity barriers should be examined as it is unlikely that pregnant and postpartum women rarely experience a single impeding factor. In addition, there is a current need to conduct intervention trials to determine the extent to which social support decreases levels of nausea, fatigue, and physical discomfort in these populations. Future research should continue to assess the impact of informational support

from both familial and health care sources. Specifically, investigations are needed to examine whether accurate physical activity information provided by these sources will alleviate fears and enhance efficacy beliefs of pregnant women and increase levels of physical activity. Given that physical activity self-efficacy has been shown to predict exercise behavior in both pregnant and postpartum women (Hinton & Olson, 2001; Cramp & Bray, 2009; Cramp & Bray, 2011) and that elements of social support have been theorized to predict efficacy beliefs (Bandura, 1977), investigations are needed that examine the possible mediating influence of self-efficacy within the social support/gestational physical activity relationship. The challenge to encourage pregnant women to be sufficiently physically active is formidable, given the complex, multidimensional nature of the prenatal period. A further and more precise exploration of social support among this population may reveal specific strategies that can be used to increase maternal physical activity and provide concomitant health benefits to both mother and baby.

References

- Albright, C., Maddock, J.E., & Nigg, C.R. (2005). Physical activity before pregnancy and following childbirth in a multiethnic sample of health women in Hawaii. *Women & Health, 42*, 95–110. doi:10.1300/J013v42n03_06
- Armstrong, K., & Edwards, H. (2003). The effects of exercise and social support on mothers reporting depressive symptoms: A pilot randomized controlled trial. *International Journal of Mental Health Nursing, 12*, 130–138. doi:10.1046/j.1440-0979.2003.00229.x
- Armstrong, K., & Edwards, H. (2004). The effectiveness of a pram-walking exercise programme in reducing depressive symptomatology for postnatal women. *International Journal of Nursing Practice, 10*, 177–194. doi:10.1111/j.1440-172X.2004.00478.x
- Attard, C.L., Kohli, M.A., Coleman, S., Bradley, C., Hux, M., Atanackovic, G., & Torrance, G.W. (2002). The burden of illness of severe nausea and vomiting of pregnancy in the United States. *American Journal of Obstetrics and Gynecology, 186*, S220–S227. doi:10.1067/mob.2002.122605
- Bandura, A. (1977). Self efficacy: Toward a unifying theory of behavioral change. *Psychological Review, 84*, 191–215. doi:10.1037/0033-295X.84.2.191
- Barrera, M. (1981). Social support in the adjustment of pregnant adolescents: assessment issues. *Social Networks and Social Support, 4*, 69–96.
- Bauer, P.W., Broman, C.L., & Pivarnik, J.M. (2010). Exercise and pregnancy knowledge among healthcare providers. *Journal of Women's Health, 19*, 335–341. doi:10.1089/jwh.2008.1295. doi:10.1089/jwh.2008.1295
- Beck, C.T. (2001). Predictors of postpartum depression: An update. *Nursing Research, 50*, 275–285. doi:10.1097/00006199-200109000-00004
- Beilock, S.L., Feltz, D.L., & Pivarnik, J.M. (2001). Training patterns of athletes during pregnancy and postpartum. *Research Quarterly for Exercise and Sport, 72*, 39–46. doi:10.1080/02701367.2001.10608930
- Bell, S., & Lee, C. (2005). Emerging adulthood and patterns of physical activity among young Australian women. *International Journal of Behavioral Medicine, 12*, 227–235. doi:10.1207/s15327558ijbm1204_3. doi:10.1207/s15327558ijbm1204_3
- Bellows-Riecken, K.H., & Rhodes, R.E. (2008). A birth of inactivity? A review of physical activity and parenthood. *Preventive Medicine, 46*, 99–110. doi:10.1016/j.ypmed.2007.08.003. doi:10.1016/j.ypmed.2007.08.003
- Bennett, H.A., Einarson, A., Taddio, A., Koren, G., & Einarson, T.R. (2004a). Depression during pregnancy: Overview of clinical factors. *Clinical Drug Investigation, 24*, 157–179. doi:10.2165/00044011-200424030-00004
- Bennett, H.A., Einarson, A., Taddio, A., Koren, G., & Einarson, T.R. (2004b). Prevalence of depression during pregnancy: Systematic review. *Obstetrics and Gynecology, 103*, 698–709. doi:10.1097/01.AOG.0000116689.75396.5f. doi:10.1097/01.AOG.0000116689.75396.5f
- Blum, J.W., Beaudoin, C.M., & Caton-Lemos, L. (2004). Physical activity patterns and maternal well-being in postpartum women. *Maternal and Child Health Journal, 8*, 163–169. doi:10.1023/B:MACI.0000037649.24025.2c
- Bowen, A., & Muhajarine, N. (2006). Antenatal depression. *The Canadian Nurse, 102*, 26–30.
- Brown, W.J., & Trost, S.G. (2003). Life transitions and changing physical activity patterns in young women. *American Journal of Preventive Medicine, 25*, 140–143. doi:10.1016/S0749-3797(03)00119-3
- Buckwalter, J.G., & Simpson, S.W. (2002). Psychological factors in the etiology and treatment of severe nausea and vomiting in pregnancy. *American Journal of Obstetrics and Gynecology, 186*, S210–S214. doi:10.1067/mob.2002.122600
- Bullock, J.E., Jull, G.A., & Bullock, M.I. (1987). The relationship of low back pain to postural changes during pregnancy. *The Australian Journal of Physiotherapy, 33*, 10–17. doi:10.1016/S0004-9514(14)60580-8
- Carron, A.V., Hausenblas, H.A., & Mack, D. (1996). Social influence and exercise: A meta-analysis. *Journal of Sport & Exercise Psychology, 18*, 1–16.
- Chang, J.J., Pien, G.W., Duntley, S.P., & Macones, G.A. (2010). Sleep deprivation during pregnancy and maternal and fetal outcomes: Is there a relationship? *Sleep Medicine Reviews, 14*, 107–114. doi:10.1016/j.smrv.2009.05.001. doi:10.1016/j.smrv.2009.05.001
- Chasan-Taber, L., Schmidt, M.D., Pekow, P., Sternfeld, B., Manson, J., & Markenson, G. (2007). Correlates of physical activity in pregnancy among Latina women. *Maternal and Child Health Journal, 11*, 353–363. doi:10.1007/s10995-007-0201-8. doi:10.1007/s10995-007-0201-8
- Chou, F.H., Lin, L.L., Cooney, A.T., Walker, L.O., & Riggs, M.W. (2003). Psychosocial factors related to nausea, vomiting, and fatigue in early pregnancy. *Journal of nursing scholarship: an official publication of Sigma Theta Tau International Honor Society of Nursing / Sigma Theta Tau, 35*, 119–125.

- Cioffi, J., Schmied, V., Dahlen, H., Mills, A., Thornton, C., Duff, M., . . . Kolt, G.S. (2010). Physical activity in pregnancy: Women's perceptions, practices, and influencing factors. *Journal of Midwifery & Women's Health, 55*, 455–461. doi:10.1016/j.jmwh.2009.12.003
- Clapp, J.F., 3rd. (1990). The course of labor after endurance exercise during pregnancy. *American Journal of Obstetrics and Gynecology, 163*, 1799–1805. doi:10.1016/0002-9378(90)90753-T
- Clapp, J.F., 3rd. (1996). Morphometric and neurodevelopmental outcome at age five years of the offspring of women who continued to exercise regularly throughout pregnancy. *The Journal of Pediatrics, 129*, 856–863. doi:10.1016/S0022-3476(96)70029-X
- Clapp, J.F., 3rd, Simonian, S., Lopez, B., Appleby-Wineberg, S., & Harcar-Sevcik, R. (1998). The one-year morphometric and neurodevelopmental outcome of the offspring of women who continued to exercise regularly throughout pregnancy. *American Journal of Obstetrics and Gynecology, 178*, 594–599. doi:10.1016/S0002-9378(98)70444-2
- Clark, S.L., Cotton, D.B., Lee, W., Bishop, C., Hill, T., Southwick, J., . . . Phelan, J. (1989). Central Hemodynamic Assessment of Normal Term Pregnancy. *American Journal of Obstetrics and Gynecology, 161*, 1439–1442. doi:10.1016/0002-9378(89)90900-9
- Clarke, P.E., & Gross, H. (2004). Women's behaviour, beliefs and information sources about physical exercise in pregnancy. *Midwifery, 20*, 133–141. doi:10.1016/j.midw.2003.11.003
- Cohen, S. (1988). Psychosocial models of the role of social support in the etiology of physical disease. *Health Psychology, 7*, 269–297. doi:10.1037/0278-6133.7.3.269
- Collins, N.L., Dunkel-Schetter, C., Lobel, M., & Scrimshaw, S.C. (1993). Social support in pregnancy: Psychosocial correlates of birth outcomes and postpartum depression. *Journal of Personality and Social Psychology, 65*, 1243–1258. doi:10.1037/0022-3514.65.6.1243
- Cooper, P.J., Campbell, E.A., Day, A., Kennerley, H., & Bond, A. (1988). Non-psychotic psychiatric disorder after childbirth. A prospective study of prevalence, incidence, course and nature. *The British Journal of Psychiatry, 152*, 799–806. doi:10.1192/bjp.152.6.799
- Cox, J.L., Murray, D., & Chapman, G. (1993). A controlled study of the onset, duration and prevalence of postnatal depression. *The British Journal of Psychiatry, 163*, 27–31. doi:10.1192/bjp.163.1.27
- Cramp, A.G., & Bray, S.R. (2009). A prospective examination of exercise and barrier self-efficacy to engage in leisure-time physical activity during pregnancy. *Annals of Behavioral Medicine, 37*, 325–334. doi:10.1007/s12160-009-9102-y
- Cramp, A.G., & Bray, S.R. (2011). Understanding exercise self-efficacy and barriers to leisure-time physical activity among postnatal women. *Maternal and Child Health Journal, 15*, 642–651. doi:10.1007/s10995-010-0617-4
- Croezen, S., Picavet, H.S., Haveman-Nies, A., Verschuren, W.M., de Groot, L.C., & van't Veer, P. (2012). Do positive or negative experiences of social support relate to current and future health? Results from the Doetinchem Cohort Study. *BMC Public Health, 12*, 65. doi:10.1186/1471-2458-12-65
- Da Costa, D., Dritsa, M., Rippen, N., Lowensteyn, I., & Khalife, S. (2006). Health-related quality of life in postpartum depressed women. *Archives of Women's Mental Health, 9*, 95–102. doi:10.1007/s00737-005-0108-6
- Da Costa, D., Dritsa, M., Verreault, N., Balaa, C., Kudzman, J., & Khalife, S. (2010). Sleep problems and depressed mood negatively impact health-related quality of life during pregnancy. *Archives of Women's Mental Health, 13*, 249–257. doi:10.1007/s00737-009-0104-3
- Da Costa, D., & Ireland, K. (2013). Perceived benefits and barriers to leisure-time physical activity during pregnancy in previously inactive and active women. *Women & Health, 53*, 185–202. doi:10.1080/03630242.2012.758219
- Da Costa, D., Rippen, N., Dritsa, M., & Ring, A. (2003). Self-reported leisure-time physical activity during pregnancy and relationship to psychological well-being. *Journal of Psychosomatic Obstetrics and Gynaecology, 24*, 111–119. doi:10.3109/01674820309042808
- Daley, A. J., Macarthur, C., & Winter, H. (2007). The role of exercise in treating postpartum depression: A review of the literature. *J Midwifery Womens Health, 52*, 56–62. doi:10.1016/j.jmwh.2006.08.017
- Danforth, D.N. (1967). Pregnancy and labor from the vantage point of the physical therapist. *American Journal of Physical Medicine, 46*, 653–658.
- Davis, M. (2004). Nausea and vomiting of pregnancy: an evidence-based review. *The Journal of Perinatal & Neonatal Nursing, 18*, 312–328. doi:10.1097/00005237-200410000-00002
- Dempsey, J. C., Butler, C. L., Sorensen, T. K., Lee, I. M., Thompson, M. L., Miller, R. S., Frederick, I. O., Williams, M. A. (2004). A case-control study of maternal recreational physical activity and risk of gestational diabetes mellitus. *Diabetes Res Clin Pract, 66*, 203–215. doi:10.1016/j.diabetes.2004.03.010
- Dennis, C.L., & Ross, L. (2005). Relationships among infant sleep patterns, maternal fatigue, and development of depressive symptomatology. *Birth (Berkeley, Calif.), 32*, 187–193. doi:10.1111/j.0730-7659.2005.00368.x
- Doran, F., & O'Brien, A. P. (2007). A brief report of attitudes towards physical activity during pregnancy. *Health promotion journal of Australia: official journal of Australian Association of Health Promotion Professionals, 18*(2), 155–158.
- Downs, D.S., LeMasurier, G.C., & DiNallo, J.M. (2009). Baby steps: Pedometer-determined and self-reported leisure-time exercise behaviors of pregnant women. *Journal of Physical Activity and Health, 6*, 63–72.
- Duncombe, D., Wertheim, E.H., Skouteris, H., Paxton, S.J., & Kelly, L. (2009). Factors related to exercise over the course of pregnancy including women's beliefs about the safety of exercise during pregnancy. *Midwifery, 25*, 430–438. doi:10.1016/j.midw.2007.03.002

- Dunkel-Schetter, C., Sagrestano, L.M., Feldman, P., & Killingsworth, C. (Eds.). (1996). *Social support and pregnancy: A comprehensive review focusing on ethnicity and culture*. New York: Plenum Press.
- Engle, P. L., Scrimshaw, S. C., Zambrana, R. E., & Dunkel-Schetter, C. (1990). Prenatal and postnatal anxiety in Mexican women giving birth in Los Angeles. *Health psychology: official journal of the Division of Health Psychology, American Psychological Association*, 9, 285–299.
- Entin, P.L., & Munhall, K.M. (2006). Recommendations regarding exercise during pregnancy made by private/small group practice obstetricians in the USA. *Journal of Sports, Science, and Medicine*, 5, 449–458.
- Evenson, K.R., Aytur, S.A., & Borodulin, K. (2009). Physical activity beliefs, barriers, and enablers among postpartum women. *Journal of Women's Health*, 18, 1925–1934. doi:10.1089/jwh.2008.1309. doi:10.1089/jwh.2008.1309
- Evenson, K.R., & Bradley, C.B. (2010). Beliefs about exercise and physical activity among pregnant women. *Patient Education and Counseling*, 79, 124–129. doi:10.1016/j.pec.2009.07.028
- Evenson, K.R., Moos, M.K., Carrier, K., & Siega-Riz, A.M. (2009). Perceived barriers to physical activity among pregnant women. *Maternal and Child Health Journal*, 13, 364–375. doi:10.1007/s10995-008-0359-8
- Evenson, K.R., & Pompeii, L.A. (2010). Obstetrician practice patterns and recommendations for physical activity during pregnancy. *Journal of Women's Health*, 19(9), 1733–1740. doi:10.1089/jwh.2009.1833. doi:10.1089/jwh.2009.1833
- Evenson, K. R., Savitz, D. A., & Huston, S. L. (2004). Leisure-time physical activity among pregnant women in the US. *Paediatr Perinat Epidemiol*, 18, 400–407. doi:10.1111/j.1365-3016.2004.00595.x
- Evenson, K.R., Siega-Riz, A.M., Savitz, D.A., Leiferman, J.A., & Thorp, J.M., Jr. (2002). Vigorous leisure activity and pregnancy outcome. *Epidemiology (Cambridge, Mass.)*, 13, 653–659. doi:10.1097/00001648-200211000-00009
- Evenson, K.R., & Wen, F. (2010). National trends in self-reported physical activity and sedentary behaviors among pregnant women: NHANES 1999–2006. *Preventive Medicine*, 50, 123–128. doi:10.1016/j.ypmed.2009.12.015
- Eyler, A.A., Brownson, R.C., Donatelle, R.J., King, A.C., Brown, D., & Sallis, J.F. (1999). Physical activity social support and middle- and older-aged minority women: results from a US survey. *Social Science & Medicine*, 49, 781–789. doi:10.1016/S0277-9536(99)00137-9
- Felton, G.M., & Parsons, M.A. (1994). Factors influencing physical activity in average-weight and overweight young women. *Journal of Community Health Nursing*, 11, 109–119. doi:10.1207/s15327655jchn1102_6
- Flaherty, J., & Richman, J. (1989). Gender differences in the perception and utilization of social support: theoretical perspectives and an empirical test. *Social Science & Medicine*, 28, 1221–1228. doi:10.1016/0277-9536(89)90340-7
- Gadsby, R., Barnie-Adshead, A. M., & Jagger, C. (1993). A prospective study of nausea and vomiting during pregnancy. *The British journal of general practice: the journal of the Royal College of General Practitioners*, 43, 245–248.
- Galper, D. I., Trivedi, M. H., Barlow, C. E., Dunn, A. L., & Kampert, J. B. (2006). Inverse association between physical inactivity and mental health in men and women. *Med Sci Sports Exerc*, 38, 173–178. doi: 00005768-200601000-00027 [pii]
- Gaynes, B.N., Gavin, N., Meltzer-Brody, S., Lohr, K.N., Swinson, T., Gartlehner, G., . . . Miller, W.C. (2005). Perinatal depression: prevalence, screening accuracy, and screening outcomes. *Evidence Report/Technology Assessment (Summary)*, 119, 1–8.
- Giroux, I., Inglis, S.D., Lander, S., Gerrie, S., & Mottola, M.F. (2006). Dietary intake, weight gain, and birth outcomes of physically active pregnant women: A pilot study. *Applied Physiology, Nutrition, and Metabolism*, 31, 483–489. doi:10.1139/h06-024
- Gjerdingen, D.K., & Center, B.A. (2003). First-time parents' prenatal to postpartum changes in health, and the relation of postpartum health to work and partner characteristics. *Journal of the American Board of Family Medicine*, 16, 304–311.
- Gjerdingen, D.K., & Center, B.A. (2005). First-time parents' postpartum changes in employment, childcare, and housework responsibilities. *Social Science Research*, 34, 103–116.
- Gjerdingen, D.K., Froberg, D.G., & Fontaine, P. (1991). The effects of social support on women's health during pregnancy, labor and delivery, and the postpartum period. *Family Medicine*, 23, 370–375.
- Greenglass, E.R., Burke, R.J., & Ondrack, M. (1990). A Gender-Role Perspective of Coping and Burnout. *Applied Psychology-an International Review-Psychologie Appliquee-Revue Internationale*, 39, 5–27. doi:10.1111/j.1464-0597.1990.tb01035.x
- Gross, H., & Bee, P.E. (2004). Perceptions of effective advice in pregnancy - The case of activity. *Clinical Effectiveness in Nursing*, 8, 161–169. doi:10.1016/j.cein.2005.03.002
- Haakstad, L. A., Voldner, N., Henriksen, T., & Bo, K. (2007). Physical activity level and weight gain in a cohort of pregnant Norwegian women. *Acta Obstet Gynecol Scand*, 86, 559–564. doi:10.1080/00016340601185301
- Hall, W.A., Hauck, Y.L., Carty, E.M., Hutton, E.K., Fenwick, J., & Stoll, K. (2009). Childbirth fear, anxiety, fatigue, and sleep deprivation in pregnant women. *Journal of Obstetric, Gynecologic, and Neonatal Nursing*, 38(5), 567–576. doi:10.1111/j.1552-6909.2009.01054.x
- Hamilton, K., & White, K.M. (2010). Parental physical activity: exploring the role of social support. *American Journal of Health Behavior*, 34, 573–584. doi:10.5993/AJHB.34.5.7
- Hartmann, S., & Bung, P. (1999). Physical exercise during pregnancy—physiological considerations and recommendations. *Journal of Perinatal Medicine*, 27, 204–215. doi:10.1515/JPM.1999.029
- Hatton, D. C., Harrison-Hohner, J., Coste, S., Dorato, V., Curet, L. B., & McCarron, D. A. (2005). Symptoms of postpartum depression and breastfeeding. *Journal of Human Lactation: Official Journal of International Lactation Consultant Association*, 21, 444–449. doi:10.1177/0890334405280947

- Hegaard, H. K., Hedegaard, M., Damm, P., Ottesen, B., Petersson, K., & Henriksen, T. B. (2008). Leisure time physical activity is associated with a reduced risk of preterm delivery. *Am J Obstet Gynecol*, *198*, 180 e181-185. doi:10.1016/j.ajog.2007.08.038
- Hegaard, H.K., Kjaergaard, H., Damm, P.P., Petersson, K., & Dykes, A.K. (2010). Experiences of physical activity during pregnancy in Danish nulliparous women with a physically active life before pregnancy. A qualitative study. *BMC Pregnancy and Childbirth*, *10*, 33. doi:10.1186/1471-2393-10-33
- Hegaard, H.K., Pedersen, B.K., Nielsen, B.B., & Damm, P. (2007). Leisure time physical activity during pregnancy and impact on gestational diabetes mellitus, pre-eclampsia, preterm delivery and birth weight: a review. *Acta Obstetrica et Gynecologica Scandinavica*, *86*, 1290-1296. doi:10.1080/00016340701647341. doi:10.1080/00016340701647341
- Hinton, P.S., & Olson, C.M. (2001). Predictors of pregnancy-associated change in physical activity in a rural white population. *Maternal and Child Health Journal*, *5*, 7-14. doi:10.1023/A:1011315616694
- Hurdle, D.E. (2001). Social support: a critical factor in women's health and health promotion. *Health & Social Work*, *26*, 72-79. doi:10.1093/hsw/26.2.72
- Hurley, K.M., Caulfield, L.E., Sacco, L.M., Costigan, K.A., & Dipietro, J.A. (2005). Psychosocial influences in dietary patterns during pregnancy. *Journal of the American Dietetic Association*, *105*, 963-966. doi:10.1016/j.jada.2005.03.007. doi:10.1016/j.jada.2005.03.007
- Josefsson, A., Berg, G., Nordin, C., & Sydsjo, G. (2001). Prevalence of depressive symptoms in late pregnancy and postpartum. *Acta Obstetrica et Gynecologica Scandinavica*, *80*, 251-255. doi:10.1034/j.1600-0412.2001.080003251.x
- Juhl, M., Andersen, P. K., Olsen, J., Madsen, M., Jorgensen, T., Nohr, E. A., & Andersen, A. M. (2008). Physical exercise during pregnancy and the risk of preterm birth: a study within the Danish National Birth Cohort. *Am J Epidemiol*, *167*, 859-866. doi:10.1093/aje/kwm364
- Kalil, K.M., Gruber, J.E., Conley, J., & Sytniac, M. (1993). Social and family pressures on anxiety and stress during pregnancy. *Journal of Prenatal & Perinatal Psychology & Health*, *8*, 113-118.
- Keefe, S.E., Padilla, A.M., & Carlos, M.L. (1979). Mexican-American extended family as an emotional support system. *Human Organization*, *38*, 144-152.
- Koken, G., Yilmazer, M., Cosar, E., Sahin, F.K., Cevrioglu, S., & Gecici, O. (2008). Nausea and vomiting in early pregnancy: Relationship with anxiety and depression. *Journal of Psychosomatic Obstetrics and Gynaecology*, *29*(2), 91-95. doi:10.1080/01674820701733697
- Krans, E.E., & Chang, J.C. (2011). A will without a way: Barriers and facilitators to exercise during pregnancy of low-income, African American women. *Women & Health*, *51*, 777-794. doi:10.1080/03630242.2011.633598
- Krans, E.E., Gearhart, J.G., Dubbert, P.M., Klar, P.M., Miller, A.L., & Replogle, W.H. (2005). Pregnant woman's beliefs and influences regarding exercise during pregnancy. *Journal of the Mississippi State Medical Association*, *46*, 67-73.
- Kuo, S.H., Wang, R.H., Tseng, H.C., Jian, S.Y., & Chou, F.H. (2007). A comparison of different severities of nausea and vomiting during pregnancy relative to stress, social support, and maternal adaptation. *Journal of Midwifery & Women's Health*, *52*, e1-e7. doi:10.1016/j.jmwh.2006.10.002
- Lacroix, R., Eason, E., & Melzack, R. (2000). Nausea and vomiting during pregnancy: A prospective study of its frequency, intensity, and patterns of change. *American Journal of Obstetrics and Gynecology*, *182*, 931-937. doi:10.1016/S0002-9378(00)70349-8
- Lancaster, C.A., Gold, K.J., Flynn, H.A., Yoo, H., Marcus, S.M., & Davis, M.M. (2010). Risk factors for depressive symptoms during pregnancy: a systematic review. *American Journal of Obstetrics and Gynecology*, *202*, 5-14. doi:10.1016/j.ajog.2009.09.007
- Lee, K.A., & Gay, C.L. (2004). Sleep in late pregnancy predicts length of labor and type of delivery. *American Journal of Obstetrics and Gynecology*, *191*, 2041-2046. doi:10.1016/j.ajog.2004.05.086
- Lee, K.A., Zaffke, M.E., & McEnany, G. (2000). Parity and sleep patterns during and after pregnancy. *Obstetrics and Gynecology*, *95*, 14-18. doi:10.1016/S0029-7844(99)00486-X
- Logsdon, M.C., McBride, A.B., & Birkimer, J.C. (1994). Social support and postpartum depression. *Research in Nursing & Health*, *17*, 449-457. doi:10.1002/nur.4770170608
- Lundberg, U., & Frankenhaeuser, M. (1999). Stress and workload of men and women in high-ranking positions. *Journal of Occupational Health Psychology*, *4*, 142-151. doi:10.1037/1076-8998.4.2.142
- Lusskin, S.I., Pundiak, T.M., & Habib, S.M. (2007). Perinatal depression: hiding in plain sight. *Canadian Journal of Psychiatry*, *52*, 479-488.
- MacDonald, L.D., Peacock, J.L., & Anderson, H.R. (1992). Marital status: association with social and economic circumstances, psychological state and outcomes of pregnancy. *Journal of Public Health Medicine*, *14*, 26-34.
- Marshall, E.S., Bland, H., & Melton, B. (2013). Perceived barriers to physical activity among pregnant women living in a rural community. *Public Health Nursing (Boston, Mass.)*, *30*, 361-369. doi:10.1111/phn.12006
- May, K.M. (1992). Social networks and help-seeking experiences of pregnant teens. *Journal of Obstetric, Gynecologic, and Neonatal Nursing*, *21*, 497-502. doi:10.1111/j.1552-6909.1992.tb01770.x
- Mayberry, L.J., & Affonso, D.D. (1993). Infant temperament and postpartum depression: A review. *Health Care for Women International*, *14*, 201-211. doi:10.1080/07399339309516041
- McVeigh, C. (2000). Investigating the relationship between satisfaction with social support and functional status after childbirth. *American Journal of Maternal Child Nursing*, *25*, 25-30.
- Melender, H.L. (2002). Fears and coping strategies associated with pregnancy and childbirth in Finland. *Journal of Midwifery & Women's Health*, *47*, 256-263. doi:10.1016/S1526-9523(02)00263-5
- Melzer, K., Schutz, Y., Soehnchen, N., Othenin-Girard, V., Martinez de Tejada, B., Irion, O., Boulvain, M., Kayser, B.

- (2010). Effects of recommended levels of physical activity on pregnancy outcomes. *American journal of obstetrics and gynecology*, 202, 266 e261-266. doi:10.1016/j.ajog.2009.10.876
- Micheli, K., Komninos, I., Bagkeris, E., Roumeliotaki, T., Koutis, A., Kogevas, M., & Chatzi, L. (2011). Sleep patterns in late pregnancy and risk of preterm birth and fetal growth restriction. *Epidemiology (Cambridge, Mass.)*, 22, 738-744. doi:10.1097/EDE.0b013e31822546fd
- Miller, A.R., Barr, R.G., & Eaton, W.O. (1993). Crying and motor behavior of six-week-old infants and postpartum maternal mood. *Pediatrics*, 92, 551-558.
- Miller, Y.D., Trost, S.G., & Brown, W.J. (2002). Mediators of physical activity behavior change among women with young children. *American Journal of Preventive Medicine*, 23(Suppl.) 98-103. doi:10.1016/S0749-3797(02)00484-1
- Mudd, L.M., Nechuta, S., Pivarnik, J.M., & Paneth, N. (2009). Factors associated with women's perceptions of physical activity safety during pregnancy. *Preventive Medicine*, 49, 194-199. doi:10.1016/j.ypmed.2009.06.004. doi:10.1016/j.ypmed.2009.06.004
- Mudd, L.M., Pivarnik, J., Holzman, C.B., Paneth, N., Pfeiffer, K., & Chung, H. (2012). Leisure-time physical activity in pregnancy and the birth weight distribution: where is the effect? *Journal of Physical Activity and Health*, 9, 1168-1177.
- Murray, L. (1992). The impact of postnatal depression on infant development. *Journal of Child Psychology and Psychiatry, and Allied Disciplines*, 33, 543-561. doi:10.1111/j.1469-7610.1992.tb00890.x
- Murray, L., Fiori-Cowley, A., Hooper, R., & Cooper, P. (1996). The impact of postnatal depression and associated adversity on early mother-infant interactions and later infant outcome. *Child Development*, 67, 2512-2526. doi:10.2307/1131637
- Narayanan, L., Menon, S., & Spector, P.E. (1999). Stress in the workplace: A comparison of gender and occupations. *Journal of Organizational Behavior*, 20, 63-73. doi:10.1002/(SICI)1099-1379(199901)20:1<63::AID-JOB873>3.0.CO;2-J
- Neff, L.A., & Karney, B.R. (2005). Gender differences in social support: A question of skill or responsiveness? *Journal of Personality and Social Psychology*, 88, 79-90. doi:10.1037/0022-3514.88.1.79
- Niebyl, J.R. (2010). Clinical practice. Nausea and vomiting in pregnancy. *The New England Journal of Medicine*, 363, 1544-1550. doi:10.1056/NEJMcp1003896. doi:10.1056/NEJMcp1003896
- Ning, Y., Williams, M.A., Dempsey, J.C., Sorensen, T.K., Frederick, I.O., & Luthy, D.A. (2003). Correlates of recreational physical activity in early pregnancy. *The Journal of Maternal-Fetal & Neonatal Medicine*, 13, 385-393. doi:10.1080/jmf.13.6.385.393
- Nomaguchi, K.M., & Bianchi, S.M. (2004). Exercise time: Gender differences in the effects of marriage, parenthood, and employment. *Journal of Marriage and the Family*, 66, 413-430. doi:10.1111/j.1741-3737.2004.00029.x. doi:10.1111/j.1741-3737.2004.00029.x
- Norbeck, J.S., & Anderson, N.J. (1989). Life stress, social support, and anxiety in mid- and late-pregnancy among low income women. *Research in Nursing & Health*, 12, 281-287. doi:10.1002/nur.4770120503
- O'Hara, M.W., & Swain, M. (1996). Rates and risk of postnatal depression—a meta analysis. *Int Rev Psychol*, 8, 37-54. doi:10.3109/09540269609037816
- Oken, E., Ning, Y., Rifas-Shiman, S. L., Radesky, J. S., Rich-Edwards, J. W., & Gillman, M. W. (2006). Associations of physical activity and inactivity before and during pregnancy with glucose tolerance. *Obstet Gynecol*, 108, 1200-1207. doi:10.1097/01.AOG.0000241088.60745.70
- Owe, K.M., Nystad, W., & Bo, K. (2009). Association between regular exercise and excessive newborn birth weight. *Obstetrics and Gynecology*, 114, 770-776. doi:10.1097/AOG.0b013e3181b6c105. doi:10.1097/AOG.0b013e3181b6c105
- Pereira, M. A., Rifas-Shiman, S. L., Kleinman, K. P., Rich-Edwards, J. W., Peterson, K. E., & Gillman, M. W. (2007). Predictors of change in physical activity during and after pregnancy: Project Viva. *Am J Prev Med*, 32, 312-319. doi:10.1016/j.amepre.2006.12.017
- Petersen, A. M., Leet, T. L., & Brownson, R. C. (2005). Correlates of physical activity among pregnant women in the United States. *Med Sci Sports Exerc*, 37, 1748-1753.
- Pivarnik, J., Chambliss, H.O., Clapp, J.F., Dugan, S.A., Hatch, M.C., Lovelady, C.A., . . . Williams, M.A. (2006). Impact of physical activity during pregnancy and postpartum on chronic disease risk. *Medicine and Science in Sports and Exercise*, 38, 989-1006. doi:10.1249/01.mss.0000218147.51025.8a. doi:10.1249/01.mss.0000218147.51025.8a
- Pivarnik, J.M. (1996). Cardiovascular responses to aerobic exercise during pregnancy and postpartum. *Seminars in Perinatology*, 20, 242-249. doi:10.1016/S0146-0005(96)80017-6
- Pivarnik, J.M., Ayres, N.A., Mauer, M.B., Cotton, D.B., Kirshon, B., & Dildy, G.A. (1993). Effects of Maternal Aerobic Fitness on Cardiorespiratory Responses to Exercise. *Medicine and Science in Sports and Exercise*, 25, 993-998. doi:10.1249/00005768-199309000-00004
- Poudevigne, M. S., & O'Connor, P. J. (2006). A review of physical activity patterns in pregnant women and their relationship to psychological health. *Sports Med*, 36, 19-38.
- Price, S.N., McDonald, J., Oken, E., Haines, J., Gillman, M.W., & Taveras, E.M. (2012). Content analysis of motivational counseling calls targeting obesity-related behaviors among postpartum women. *Maternal and Child Health Journal*, 16, 439-447. doi:10.1007/s10995-011-0746-4
- Rees, T., & Hardy, L. (2000). An investigation of the social support experiences of high-level sports performers. *The Sport Psychologist*, 14, 327-347.
- Rees, T., Hardy, L., & Evans, L. (2007). Construct validity of the social support survey in sport. *Psychology of Sport and Exercise*, 8, 355-368. doi:10.1016/j.psychsport.2006.06.005
- Richman, J.M., Rosenfeld, L.B., & Hardy, C.J. (1993). The Social Support Survey—a Validation-Study of a Clinical Measure of the Social Support Process. *Research on Social Work Practice*, 3, 288-311. doi:10.1177/104973159300300304

- Rodriguez, A., Bohlin, G., & Lindmark, G. (2001). Symptoms across pregnancy in relation to psychosocial and biomedical factors. *Acta Obstetrica et Gynecologica Scandinavica*, *80*, 213–223. doi:10.1034/j.1600-0412.2001.080003213.x
- Rogers, M. M., Peoples-Sheps, M. D., & Suchindran, C. (1996). Impact of a social support program on teenage prenatal care use and pregnancy outcomes. *The Journal of adolescent health: official publication of the Society for Adolescent Medicine*, *19*, 132–140. doi:10.1016/1054-139X(95)00227-J
- Rousham, E. K., Clarke, P. E., & Gross, H. (2006). Significant changes in physical activity among pregnant women in the UK as assessed by accelerometry and self-reported activity. *Eur J Clin Nutr*, *60*, 393–400. doi:10.1038/sj.ejcn.1602329
- Rudra, C.B., Sorensen, T.K., Luthy, D.A., & Williams, M.A. (2008). A prospective analysis of recreational physical activity and preeclampsia risk. *Medicine and Science in Sports and Exercise*, *40*, 1581–1588. doi:10.1249/MSS.0b013e31817cabb1
- Saftlas, A. F., Logsdon-Sackett, N., Wang, W., Woolson, R., & Bracken, M. B. (2004). Work, leisure-time physical activity, and risk of preeclampsia and gestational hypertension. *Am J Epidemiol*, *160*, 758–765. doi:10.1093/aje/kwh277
- Sallis, J.F., Hovell, M.F., & Hofstetter, C.R. (1992). Predictors of adoption and maintenance of vigorous physical activity in men and women. *Preventive Medicine*, *21*, 237–251. doi:10.1016/0091-7435(92)90022-A
- Scharff, D.P., Homan, S., Kreuter, M., & Brennan, L. (1999). Factors associated with physical activity in women across the life span: implications for program development. *Women & Health*, *29*, 115–134. doi:10.1300/J013v29n02_08
- Setse, R., Grogan, R., Pham, L., Cooper, L.A., Strobino, D., Powe, N.R., & Nicholson, W. (2009). Longitudinal study of depressive symptoms and health-related quality of life during pregnancy and after delivery: the Health Status in Pregnancy (HIP) study. *Maternal and Child Health Journal*, *13*(5), 577–587. doi:10.1007/s10995-008-0392-7. doi:10.1007/s10995-008-0392-7
- Sherwood, N.E., & Jeffery, R.W. (2000). The behavioral determinants of exercise: implications for physical activity interventions. *Annual Review of Nutrition*, *20*, 21–44. doi:10.1146/annurev.nutr.20.1.21
- Smith, B.J., Cheung, N.W., Bauman, A.E., Zehle, K., & McLean, M. (2005). Postpartum physical activity and related psychosocial factors among women with recent gestational diabetes mellitus. *Diabetes Care*, *28*, 2650–2654. doi:10.2337/diacare.28.11.2650
- Sorensen, T.K., Williams, M.A., Lee, I.M., Dashow, E.E., Thompson, M.L., & Luthy, D.A. (2003). Recreational physical activity during pregnancy and risk of preeclampsia. *Hypertension*, *41*, 1273–1280. doi:10.1161/01.HYP.0000072270.82815.91
- Stein, A.D., Rivera, J.M., & Pivarnik, J.M. (2003). Measuring energy expenditure in habitually active and sedentary pregnant women. *Medicine and Science in Sports and Exercise*, *35*, 1441–1446. doi:10.1249/01.MSS.0000079107.04349.9A
- Sternfeld, B., Ainsworth, B.E., & Quesenberry, C.P. (1999). Physical activity patterns in a diverse population of women. *Preventive Medicine*, *28*, 313–323. doi:10.1006/pmed.1998.0470
- Stuebe, A. M., Oken, E., & Gillman, M. W. (2009). Associations of diet and physical activity during pregnancy with risk for excessive gestational weight gain. *Am J Obstet Gynecol*, *201*, e51–58. doi:10.1016/j.ajog.2009.02.025
- Symons Downs, D., & Hausenblas, H.A. (2004). Women's exercise beliefs and behaviors during their pregnancy and postpartum. *Journal of Midwifery & Women's Health*, *49*, 138–144.
- Tamers, S.L., Beresford, S.A., Cheadle, A.D., Zheng, Y., Bishop, S.K., & Thompson, B. (2011). The association between worksite social support, diet, physical activity and body mass index. *Preventive Medicine*, *53*, 53–56. doi:10.1016/j.ypmed.2011.04.012
- Tarkka, M.T., & Paunonen, M. (1996). Social support and its impact on mothers' experiences of childbirth. *Journal of Advanced Nursing*, *23*(1), 70–75. doi:10.1111/j.1365-2648.1996.tb03137.x
- Thornton, P.L., Kieffer, E.C., Salabarria-Pena, Y., Odoms-Young, A., Willis, S.K., Kim, H., & Salinas, M.A. (2006). Weight, diet, and physical activity-related beliefs and practices among pregnant and postpartum Latino women: the role of social support. *Maternal and Child Health Journal*, *10*, 95–104. doi:10.1007/s10995-005-0025-3
- Treiber, F.A., Baranowski, T., Braden, D.S., Strong, W.B., Levy, M., & Knox, W. (1991). Social support for exercise: relationship to physical activity in young adults. *Preventive Medicine*, *20*, 737–750. doi:10.1016/0091-7435(91)90068-F
- Turner, R.J., Grindstaff, C.F., & Phillips, N. (1990). Social support and outcome in teenage pregnancy. *Journal of Health and Social Behavior*, *31*, 43–57. doi:10.2307/2137044
- United States Department of Health and Human Services. (2008). *2008 physical activity guidelines for Americans*. Retrieved from <http://www.health.gov/paguidelines/guidelines/default.aspx>
- Webster, J., Nicholas, C., Velacott, C., Cridland, N., & Fawcett, L. (2011). Quality of life and depression following childbirth: impact of social support. *Midwifery*, *27*, 745–749. doi:10.1016/j.midw.2010.05.014
- Weir, Z., Bush, J., Robson, S.C., McParlin, C., Rankin, J., & Bell, R. (2010). Physical activity in pregnancy: a qualitative study of the beliefs of overweight and obese pregnant women. *BMC Pregnancy and Childbirth*, *10*, 1–7. doi:10.1186/1471-2393-10-18
- Wisner, K.L., Parry, B.L., & Piontek, C.M. (2002). Clinical practice. Postpartum depression. *The New England Journal of Medicine*, *347*, 194–199. doi:10.1056/NEJMc011542
- Wolfson, A.R., Crowley, S.J., Anwer, U., & Bassett, J.L. (2003). Changes in sleep patterns and depressive symptoms in first-time mothers: last trimester to 1-year postpartum. *Behavioral Sleep Medicine*, *1*, 54–67. doi:10.1207/S15402010BSM0101_6
- Xie, R.H., He, G., Koszycki, D., Walker, M., & Wen, S.W. (2009). Prenatal social support, postnatal social support, and postpartum depression. *Annals of Epidemiology*, *19*, 637–643. doi:10.1016/j.annepidem.2009.03.008

- Xie, R.H., Yang, J., Liao, S., Xie, H., Walker, M., & Wen, S.W. (2010). Prenatal family support, postnatal family support and postpartum depression. *Australian and New Zealand Journal of Obstetrics and Gynaecology*, *50*, 340–345. doi:10.1111/j.1479-828X.2010.01185.x
- Zayas, L.H., & Solari, F. (1994). Early-childhood socialization in Hispanic families—context, culture, and practice implications. *Professional Psychology, Research and Practice*, *25*, 200–206. doi:10.1037/0735-7028.25.3.200
- Zhang, C., Solomon, C. G., Manson, J. E., & Hu, F. B. (2006). A prospective study of pregravid physical activity and sedentary behaviors in relation to the risk for gestational diabetes mellitus. *Arch Intern Med*, *166*, 543–548. doi:10.1001/archinte.166.5.543
- Zhang, J., & Savitz, D.A. (1996). Exercise during pregnancy among US women. *Annals of Epidemiology*, *6*, 53–59. doi:10.1016/1047-2797(95)00093-3