Emotional Cues and Low Birth Weight: Evidence from the Super Bowl

Gordon B. Dahl
Department of Economics
University of California, San Diego
gdahl@ucsd.edu

Brian Duncan
Department of Economics
University of Colorado Denver
brian.duncan@ucdenver.edu

Hani Mansour
Department of Economics
University of Colorado Denver
hani.mansour@ucdenver.edu

Daniel I. Rees
Department of Economics
University of Colorado Denver
daniel.rees@ucdenver.edu

April 2012

Abstract

It has been shown that prenatal shocks in the form of natural disasters and terrorist attacks can reduce birth weight. However, no previous study has examined the effect of intrauterine exposure to a sporting event on birth outcomes. Using data from the National Vital Statistics System (NVSS) for the period 1969 through 2004, we investigate the impact of prenatal exposure to the Super Bowl on low birth weight. Winning the Super Bowl is associated with an increased risk of low birth weight. It is also associated with increases in maternal tobacco and alcohol use, both of which are potential mediators. Upset wins, which can be thought of as exogenously generated positive emotional cues, are associated with larger increases in the probability of low birth weight than predicted wins.

JEL Codes: I12, J13
Keywords: Low Birth Weight; Super Bowl; Prenatal Stress; Tobacco Use; Alcohol Use

1. INTRODUCTION

The Super Bowl, which has been described as "the biggest sporting event of the year," is the championship game of the National Football League (NFL). It is the culmination of a season that begins in September, draws tens of millions of television viewers, and generates billions of dollars in revenue.[1]

Major sporting events can elicit intense emotions and even violent reactions. They have been linked to heart attacks (Witte et al. 2000; Carroll et al. 2002; Wilbert-Lampen et al. 2008; Kloner et al. 2009; Kloner et al. 2011), assaults and vandalism (Rees and Schnepel 2009), domestic violence (White et al. 1992; Card and Dahl 2011), and even homicides (Philips 1983; Miller 1991). The focus of the current study is on a potential byproduct of the intense emotions surrounding major sporting events: specifically, we are interested in the relationship between prenatal exposure to the Super Bowl and low birth weight. It has been shown that experiencing the shock of a terrorist attack or an earthquake in the first trimester of pregnancy can increase the risk of having a low birth weight child (Eskenazi et al. 2007; Torch 2011). However, to our knowledge, no previous study has examined the effect of intrauterine exposure to a sporting event on birth outcomes.

[1] The 2011 Super Bowl drew a record 111 million viewers (Klayman 2011), 46 percent of whom were women (Cunningham 2012). In comparison, the 2011 Academy Awards drew 37 million viewers (Huff 2011). Recent Super Bowls have generated over 100 million dollars in merchandise sales, and over 200 million dollars in advertising revenue (MacMillian and Lehman 2008; Smith 2010; Rushe 2011). When spending on Super Bowl-related items such as food, beverages, TVs, furniture, team apparel and decorations is included, the total was more than 10 billion in 2011 (Zmuda 2011).

One advantage to using the Super Bowl as a natural experiment is that we know the pre-game Las Vegas point spread. Using this information, we can identify upset (i.e., unexpected) wins and losses. Rees and Schnepel (2009) found that upsets in college football lead to substantial increases in assaults, alcohol-related offenses, and vandalism. Card and Dahl (2011) found that upset losses in professional football lead to increased violence committed by men against their wives and girlfriends. Card and Dahl (2011) concluded that such losses act as a negative "emotional cue," sparking intimate partner violence at home.

Drawing on publicly available data from the National Vital Statistics System (NVSS) for the period 1969 through 2004, we examine children who were conceived 1-4 months before the Super Bowl by mothers who lived no further than one county away from an NFL stadium. We find that winning the Super Bowl is associated with a 3.4 percent increase in the incidence of low birth weight (defined as weighing less than 2,500 grams at birth). Upset wins, which can be thought of as exogenously generated positive emotional cues, lead to larger increases in the incidence of low birth weight than predicted wins. When we control for gestation length, the estimated relationship between upset wins and low birth weight is reduced in magnitude by approximately one fourth, but is not eliminated. Finally, we find that winning the Super Bowl is associated with increased tobacco and alcohol use during pregnancy, both of which are potential mediators. However, the relationship between substance use and winning the Super Bowl is strongest when the sample is restricted to mothers who completed at least four years of high school, while the estimated relationship between winning the Super Bowl

and low birth weight is strongest among children whose mothers did not complete four years of high school.

2. BACKGROUND

2.1. Prenatal stress and birth weight

Women who report experiencing psychological stress while pregnant are more likely to have low birth weight children (Beydoun and Saftlas 2008). Possible biological mechanisms for this association include increased levels of Corticotropin-Releasing Hormone and decreased uterine blood flow (Mulder et al. 2002; Wadhwa et al. 2004; de Weerth and Buitelaar 2005), although behaviors such as smoking and drinking could also play an important role (Torche 2011). Tobacco and heavy alcohol use while pregnant are associated with low birth weight (Whitehead and Lipscomb 2003; Chiaffarino et al. 2006; Jaddoe et al. 2008; Polakowsk et al. 2009; Patra et al. 2011), as is physical exertion (Bonzi et al. 2007; Chasan-Taber et al. 2007) and lack of prenatal care (Reichman and Teitler 2003; Rous et al. 2004; Wehby et al. 2009).

To date, the strongest evidence that stress is causally related to birth outcomes comes from studies that exploit unexpected acts of extreme violence and catastrophic natural disasters. For instance, Eskenazi et al. (2007) used vital statistics records from New York City and upstate New York to examine the effect of prenatal exposure to the September 11, 2001 attack on World Trade Center. These authors found an increased risk of very low birth weight (i.e., less than 1,500 grams) among children born 33 through 36 weeks after the attack.[2] Glyn et al. (2001) found that first-trimester exposure to an

[2] At least two other studies have examined the relationship between intrauterine exposure to a terrorist attack and birth weight. Smits et al. (2006) examined a sample of Dutch children who were *in utero* when

earthquake that struck Northridge, California in 1994 was associated with a reduction in gestation duration of approximately 10 days, and Torche (2011) found that first-trimester exposure to an earthquake that struck northern Chile in 2005 was associated with fewer weeks of gestation and an increased risk of low birth weight.[3]

Of course, psychological stress is caused by a wide variety of events and circumstances. Terrorist attacks (Pfeffer et al. 2007; Pfeffer et al. 2009; Tucker et al. 2010) and natural disasters (Song et al. 2008) have been linked to increased levels of cortisol, a hormone released by the hypothalamic-pituitaryadrenal axis in response to stress.[4] There is also experimental evidence that arguing with a spouse (Kiecolt-Glaser et al. 1996; Heffner et al. 2004), speaking in public (Kemmer et al. 1986; Kirschbaum et al. 1996; al'Absi et al. 1997), being exposed to a loud noise or music (Testa et al. 1994;

---

the September 11th attack occurred. They found that second- and third-trimester exposure to the attack was associated with a reduction in birth weight. Lauderdale (2006) found that being born to a mother with an Arabic name after the attack was associated with an increased risk of low birth weight and concluded that the likely cause was "ethnicity-related stress or discrimination during pregnancy" (p.197). Camacho (2008) focused on estimating the impact of prenatal exposure to terrorist attacks in the form of landmine explosions. Using Colombian vital statistics records from the period 1998 through 2004, she found that first-trimester exposure to landmine explosions was associated with a reduction in birth weight. Exposure to landmine explosions in the later stages of pregnancy was essentially unrelated to birth weight (Camacho 2008, pp. 513-514).

[3] Additional studies of the relationship between a plausibly exogenous stressor and birth weight include: Catalano and Hartig (2001), Khashan et al. (2008) and Mansour and Rees (forthcoming). Medical researchers have also conducted experiments on animals aimed at documenting the effects of prenatal stress on various pregnancy outcomes. For instance, Schneider et al. (1999) subjected pregnant rhesus monkeys to stress by administering noise bursts. These authors found that early-pregnancy exposure to noise bursts led to significantly lower birth weight, but noise bursts administered later in the pregnancy did not. See Mulder et al. (2002) and Beydoun and Saftlas (2008) for reviews of the experimental literature in this area.

[4] According to Vigil et al. (2010, p. 1228), "short-term physiological responses to acute stressors include…increased activation of the hypothalamic-pituitary-adrenal (HPA) axis, and the synthesis and secretion of glucocorticoids (i.e., cortisol)…" However, "repeated and chronic stress exposure is associated with low or blunted HPA activity (e.g., low cortisol levels or flat-shallow diurnal pattern of cortisol production), potentially reflecting habituation or adaptation to these circumstances and the overall dampening of HPA reactivity."

Gerra et al. 1998), or even watching an amusing film (Hubert et al. 1993), can increase cortisol levels.[5]

Dramatic natural experiments provide support for the hypothesis that psychological stress is causally related to low birth weight. However, most pregnant women are at greater risk of having an argument with their spouse or speaking in public than experiencing an earthquake. As noted by Almond and Currie (2011, p. 164), commonplace intrauterine shocks are arguably more policy-relevant than rarer events:

> Economists have utilized the power of large-sample datasets to detect effects of relatively mild fetal insults. This extension is key as exposure to relatively mild pathogens is common. Hence, estimates of the effects of mild exposures may be more relevant to policy then estimates of the effects of disasters.

In a similar vein, Torche (2011, p. 1487) noted that, "the generalizability from an acute stressor, such as an earthquake, to chronic sources of stress is a remaining question."

2.2. Sporting events as prenatal stressors

Unlike earthquakes and terrorist attacks, the Super Bowl does not threaten its viewers with direct physical harm. However, there is evidence from a variety of sources that major sporting events can produce strong reactions, especially when their outcome is unexpected. For instance, Rees and Schnepel (2009) examined daily data on crime from communities with Division I-A college football programs. They found that these communities registered sharp increases in assaults, vandalism, disorderly conduct, and

[5] Dickerson and Kemeny (2004) review the experimental literature on acute stressors and cortisol response. Aizer et al. (2009) found no evidence of a relationship between maternal cortisol levels and birth weight, but noted that this result was "likely attributable to the fact that the sample was selected based such that mothers with the worst birth outcomes are excluded from the sample" (p. 24).

liquor-law violations on game days. Upset losses (defined as when a lower-ranked team beat a higher-ranked team) were associated with larger increases in the number of offenses than upset wins.[6]

Card and Dahl (2011) examined the relationship between domestic violence and the outcomes of regular-season NFL games. These authors argued that, conditional on the Las Vegas point spread, these outcomes could be thought of as exogenous.[7] Card and Dahl found that upset losses were associated with a 10 percent increase in the number of police reports of male-on-female intimate partner violence (IPV), while the estimated relationship between upset wins and male-on-female intimate partner violence was much smaller and statistically insignificant at conventional levels. There was little evidence that alcohol-related IPV increased by more than non-alcohol-related IPV after an upset loss (Card and Dahl 2011, p. 37).[8]

Finally, Kloner et al. (2009) analyzed Los Angeles County death records from January and February for the period 1980 through 1988. These authors found a spike in "cardiac events" immediately after the 1980 Super Bowl, when the Pittsburgh Steelers staged a fourth-quarter comeback to beat the Los Angeles Rams. Four years later when the Los Angeles Raiders cruised to an easy victory over the Washington Redskins (the

[6] See also Baumann et al. (2009), who examined the impact of professional sports franchises on crime. They found little evidence that either professional sports franchises or championship gamers were related to crime.

[7] In order to ensure that the betting market clears, Las Vegas bookmakers produce "point-spreads" before each regular-season and post-season NFL game. Research by Pankoff (1968), Gandar et al. (1988), and Card and Dahl (2011) provides evidence that the closing point spread is a strong, unbiased predictor of game outcome.

[8] Other studies in this area include Drake and Panday (1996), who examined data on child abuse cases from Missouri in 1992. These authors found no evidence of a relationship between playoff games in the four major professional sports and reports of child abuse. Sachs and Chu (2000) examined the association between professional football games and domestic violence dispatches, and White et al. (1992) examined the relationship between professional football games and emergency room admissions of women.

final score was 38 to 9), there was no detectible increase in heart attacks in the Los Angeles area, and the overall death rate actually fell slightly.[9] Kloner et al. (2009) acknowledged that "overindulgence is common" (p. 1650) on Super Bowl Sunday, but nevertheless concluded that, "the emotional stress of loss by a local sports team in a highly publicized rivalry such as the Super Bowl can serve as a trigger of cardiovascular deaths" (p. 1649).

3. THE DATA

The registration of births, deaths and other vital events is done at the state level, but the National Center for Health Statistics (NCHS) is responsible for collecting and disseminating vital statistics data, which are made available through the National Vital Statistics System (NVSS). [10] Our empirical analysis draws on NVSS data for the period 1969 through 2004, the final year in which geographic identifiers were publicly available. The sample is composed of 12,179,714 children, all of whom were conceived approximately 1-4 months before the Super Bowl by mothers living in what we label an NFL "fan base area." NFL fan base area is assigned using the mother's county of residence. In 1969 there were 10 AFL (American Football League) and 16 NFL football teams. By 2004, the two leagues had merged, and the NFL included 32 teams, some of which had changed stadiums during the previous 35 years. If an NFL stadium was

[9] A related study examined cardiovascular events among residents of the greater Munich area during the 2006 Federation Internationale de Football Association World Cup (Wilbert-Lampen et al. 2008). The authors found that when the German team played, cardiac emergencies increased sharply among both men and women. See also Witte et al. (2000), Toubiana et al. (2001), Carroll et al. (2002), and Kloner et al. (2011) for more estimates of the relationship between major sporting events and cardiovascular events.

[10] In addition to the fifty states, New York City, the District of Columbia, and the U.S. territories represent separate, independent registration areas (Martin 2007).

located in a county at any time during the period 1969 through 2004, then that county and its neighboring counties constitute one of 32 unique NFL fan base areas in the empirical analysis below.[11]

Month of conception was assigned using gestation duration (in weeks) and month of birth.[12] In order to focus on exposure to the Super Bowl in early pregnancy, we restrict the sample to children whose likely month of conception was October, November, and December.[13] With a handful of exceptions, previous studies have concluded that psychological stress experienced after the first trimester is unrelated to birth outcomes (Paarlberg et al. 1999; Schneider et al. 1999; Glyn et al. 2001; Eskenazi et al. 2007; Camacho 2008; Torche 2011; Rees and Mansour forthcoming).[14] The sample is further restricted to children with a gestation length of 25 weeks or greater.[15] Obstetricians and gynecologists consider a fetus potentially viable at 24 weeks (Morgan et al. 2008), but the survival rate is less than 50 percent (Kaemph et al. 2006). The survival rate at 25 weeks of gestation is approximately 60 percent (Kaemph et al. 2006).

[11] Several of the 32 NFL fan base areas did not have football teams every year during the period under study. However, all children born between 1969 and 2004 to mothers living in these fan base areas were included in the analysis.

[12] Between 1969 and 1988, the public-use NVSS data included an exact date of birth. However, because of changing confidentiality standards, only month of birth was provided after 1988. We assigned date of birth to the 15th of the month to children whose birth date was missing and, by subtracting gestation duration (in weeks), determine their likely month of birth. We experimented with assigning date of birth to the first day of the month. Our results were not sensitive to this alternative method of assigning date of birth. Likewise, we experimented with assigning date of birth to last day of the month. Again, our results were not sensitive to this alternative method of assigning date of birth.

[13] The Super Bowl took place in January until 2002, when it was played on February 3; in 2003, it was played on January 26, and in 2004 it was played on February 1.

[14] Catalano and Hartig (2001), Smits et al. (2006) and Khashan et al. (2008) concluded that psychological stress experienced in the later stages of pregnancy can lead to low birth weight.

[15] This restriction reduced the sample by 37,802 births (or by 0.31 percent). Including children with a gestation length shorter than 25 weeks does not appreciably alter the results reported below.

The mean birth weight in our sample is 3,314 grams (Table 1). Seven percent of the children weighted less than 2,500 grams at birth, the standard cut-off for low birth weight in the medical literature.[16] Using vital statistics records from 2006, Martin et al. (2008) found that 8.3 percent of infants born in the United States weighed less than 2,500 grams.[17] Mean gestation duration in our sample is 39.0 weeks, as compared to 38.7 weeks among singletons born to U.S. mothers in 2005 (Centers for Disease Control and Prevention 2008).[18]

Prior to 1989, the Standard Certificate of Birth did not include items on smoking and alcohol consumption, both of which are associated with low birth weight.[19] From

[16] In 2005, the mean birth weight of singletons born in the United States was 3,389 grams (Donahue et al. 2010).

[17] Low birth weight is strong predictor of educational attainment and earnings as an adult, although there is some question as to whether it is causally related to these outcomes. Currie and Hyson (1999) and Currie and Moretti (2007) for estimates of the relationship between low birth weight and outcomes of interest to economists. Black et al. (2007) Royer (2009) provide estimates of the relationship between birth weight and these outcomes using twins data. Black (2007, p. 409) concluded:

> birth weight does matter; despite short-run twin fixed effects estimates that are much smaller than OLS estimates, the effects on longer-run outcomes such as adult height, IQ, earnings, and education are significant and similar in magnitude to OLS estimates.

Conversely, Royer (2009, p.82) concluded, "While birth weight does have a statistically significant impact on many long run outcomes--education, birth weight of one's offspring, and pregnancy complications--the estimated effects are typically small."

[18] According to the Centers for Disease Control and Prevention (2008), the mean gestation duration for twins was 35.2 weeks in 2005; among triplets it was 31.9 weeks. In the NVSS, gestation duration is based on the interval between the first day of the mother's last normal menstrual period (LMP) and the date of birth or a "clinical estimate of gestation." Martin (2007) provides a detailed description of gestation duration in vital statistics data and its limitations.

[19] Smoking before conception and in early pregnancy is essentially unrelated to birth weight (Rush and Cassano 1983; Lieberman et al. 1994; Bernstein et al. 2005; Jaddoe et al. 2008). However, smoking in late pregnancy substantially increases the risk of having a low birth weight child (Rush and Cassano 1983; Lieberman et al. 1994; Bernstein et al. 2005; Jaddoe et al. 2007a; Jaddoe et al. 2008; Polakowsk et al. 2009; Vardavas et al. 2010). Moderate drinking, typically defined as a maximum of one drink per day, is only weakly related to birth weight (Henderson et al. 2007; Patra et al. 2011), but there is evidence that heavy drinking leads to an increased risk of having a low birth weight child (Whitehead and Lipscomb 2003; Chiaffarino et al. 2006; Jaddoe et al. 2007b; Patra et al. 2011). O'Callaghan et al. (2003) found that the

1989 through 2004, the majority of states reported tobacco use during pregnancy (yes/no), the average number of cigarettes smoked per day, whether alcohol was consumed (yes/no), and the average number of drinks per week.[20] Almost 11 percent of the births in our sample were to women who reported smoking while pregnant; fewer than two percent were to mothers who reported drinking. It should be noted, however, that researchers, by examining medical records, have found that substance use is under-reported on birth certificates (Buescher et al. 1993; Piper et al. 1993; Reichman and Hade 2001).

Although an earthquake or terrorist attack could, in theory, provoke "maladaptive coping behaviors such as smoking and alcohol use" (Eskenazi et al. (2007, p. 3014), this possibility has, for the most part, been ignored by previous authors.[21] For instance, Eskenazi et al. (2007) controlled for tobacco use during pregnancy, but Torche (2011) did not--despite the fact that approximately one third of Chilean women smoke (Nichter et al. 2010).[22]

---

estimated relationship between drinking in late pregnancy and low birth weight was entirely explained by tobacco use.

[20] The Standard Certificate of Birth was revised in 1989 and again in 2003 (Friedman 2007). The NCES recommends the use of the Standard Birth Certificate, but not all states comply (Freedman et al. 1988; Friedman 2007). For instance, during the period under study, California did not report information on smoking or alcohol use; before 1999, Indiana reported whether the mother smoked, but did not report the average number of cigarettes smoked per day; before 1992, New York did not report alcohol use.

[21] In fact, there is evidence that ex-smokers often relapse after experiencing "acute emotional upset" (Shiffman et al. 1996, p. 373). Moreover, Bullock et al. (2001) and Grangé et al. (2006) found that failure to quit smoking during pregnancy is positively related to self-reported stress. In the Unites States, between 57 and 77 percent of women smokers fail to quit smoking when they become pregnant (Schneider et al. 2010, p. 83).

[22] Smits et al. (2006) and Khashan et al. (2008) controlled for tobacco use during pregnancy, but Catalano et al. (2001), Glyn et al. (2001), Lauderdale (2006), Camacho (2008), and Rees and Mansour (forthcoming) did not. Rees and Mansour , who used data on women living in the West Bank collected by the Palestinian Central Bureau of Statistics, noted that "only three percent of Palestinian women ages 10 and above reported ever having used tobacco, and only one percent reported ever having smoked a cigarette."

4. THE EMPIRICAL MODEL

Our focus is on whether exposure to the Super Bowl affected the lower tail of the birth-weight distribution.[23] Specifically, we estimate:

$$(1)\quad \textit{Low Birth Weight}_{iat} = \beta_0 + \beta_1 \textit{SuperBowl}_{iat} + \beta_2 \textit{LostDivision}_{iat} + B_3 \textit{LostConference}_{iat} + \boldsymbol{X_{iat}\beta_4} + v_a + w_t + \Theta_a \cdot t + \varepsilon_{iat,}$$

where $\textit{Low Birth Weight}_{iat}$ is equal to 1 if child i weighed strictly less than 2,500 grams at birth, and is equal to 0 otherwise, a indexes (NFL fan base) areas, and t indexes year of birth. Area and year fixed effects are represented by v_a and w_t, and area-specific linear time trends, which are intended to control for factors at the area that influence birth weight but evolve smoothly, are represented by $\Theta_a \cdot t$.

The variable $\textit{SuperBowl}_{iat}$ is an indicator for whether child i was exposed to the Super Bowl in the early stages of pregnancy. It is equal to 1 if the NFL team located in area a went to the Super Bowl in year t, and is equal to 0 otherwise. Because we include indicators for whether a team was eliminated in the divisional or the conference playoffs, the coefficient of interest, β_1, represents the effect exposure to the Super Bowl on the

[23] As noted by Currie and Walker (2011, p. 71), most studies of infant health have focused on the lower tail of the birth weight distribution by using a 2,500 gram cutoff for low birth weight.

probability of having a low birth weight child as compared to not having been exposed to a Divisional Playoff game.[24]

The vector of controls, $\boldsymbol{X_{iat}}$, includes indicators for likely month of conception (October, November), gender, hospital birth, multiple birth, first born, father indicated on birth certificate, and mother's race, ethnicity, age, marital status, and educational attainment. Mothers whose team advanced to the Super Bowl were less likely to be Hispanic, less likely to smoke, and more likely to have graduated college than their counterparts whose team did not advance to the Divisional Playoffs (Appendix Table 1). Previous studies have shown that factors such as these are associated with birth weight (Reichman 2005). If gestation length is added to the vector $\boldsymbol{X_{iat}}$, then the coefficient of interest, β_1, represents the effect of exposure to the Super Bowl on low birth weight through intrauterine growth (Kelly 2011).[25]

In an alternative set of estimations, $SuperBowl_{iat}$ is replaced with two indicators: $Won\ SuperBowl_{iat}$, equal to one if the NFL team located in area *a* won the Super Bowl in year *t* (and equal to zero otherwise); and $Lost\ SuperBowl_{iat}$, equal to one if the NFL team located in area *a* lost the Super Bowl in year *t* (and equal to zero otherwise). Previous studies have focused almost exclusively on the relationship between negative events and birth outcomes, but there is some evidence that positive emotional cues can lead to psychological stress. For instance, Brown et al. (1993) found that experimentally

[24] Not reaching the Divisional Playoffs, losing a Divisional Playoff, losing a Conference Playoff, and going to the Super Bowl are mutually exclusive and exhaustive events. Prior to 1978, the Divisional Playoffs were the first round, and the Conference Playoffs were the second round, of the NFL playoffs. In 1978, the NFL added an additional playoff round, the "Wild Card Playoffs," and the Divisional Playoffs became the second round of the playoffs.

[25] Using data from Great Britain, Kelly (2011) controlled for gestation length in order to isolate the effect of exposure to the 1957-58 influenza pandemic.

induced elation and sadness were both associated with increased levels of cortisol, while Hubert et al. (1993) found that cortisol levels increased when participants were exposed to an amusing film. Hubert et al. (1993) concluded that "cortisol secretion may be linked to emotional arousal, regardless of the emotional valence" (p. 265).[26]

We extend our exploration of the relationship between Super Bowl outcomes and low birth weight by replacing $SuperBowl_{iat}$ with six, mutually exclusive variables based on the Las Vegas point spread and the work of Card and Dahl (2011):

1. *Upset Win* is equal to 1 if the NFL team located in area *a* won the Super Bowl in year *t* but was predicted to lose by 4 or more points (and is equal to 0 otherwise).

2. *Unpredictable Win* is equal to 1 if the NFL team located in area *a* won the Super Bowl in year *t* but the point spread was less than 4 (and is equal to 0 otherwise).

3. *Predictable Win* is equal to 1 if the NFL team located in area *a* won the Super Bowl in year *t* but was predicted to win by 4 or more points (and is equal to 0 otherwise).

4. *Upset Loss* is equal to 1 if the NFL team located in area *a* lost the Super Bowl in year *t* but was predicted to win by 4 or more points (and is equal to 0 otherwise).

5. *Unpredictable Loss* is equal to 1 if the NFL team located in area *a* lost the Super Bowl in year *t* but the point spread was less 4 (and is equal to 0 otherwise).

6. *Predictable Loss* is equal to 1 if the NFL team located in area *a* lost the Super Bowl in year *t* but was predicted to lose by 4 or more points (and is equal to 0 otherwise).

Thirty-six Super Bowls were played during the period under study. Nineteen of these Super Bowls produced an expected outcome (in other words, the closing Las Vegas point spread was greater than or equal to four and the favored team won). Six of these

[26] In contrast, Peeters et al. (2003) found essentially no association between "positive daily events" and cortisol levels. Likewise, Berk et al. (1989) and Buchanan et al. (1999) found that cortisol levels fell after watching a humorous video, while nether Clark et al. (2001) nor Hucklebridge et al. (2000) found evidence of a relationship between induced mood and cortisol levels. Scarpa and Luscher (2002) found that cortisol levels fell after exposure to white noise.

Super Bowls produced an upset (in other words, the closing Las Vegas point spread was greater than or equal to four and the underdog team won). The outcome of the remaining games was unpredictable. Appendix Table 2 presents the Las Vegas point spreads and the outcomes of the 36 Super Bowls played over the period 1969 through 2004.

5. THE RESULTS

5.1. Graphical results

Figure 1 plots the percentage of births under the 2,500-gram low birth weight cutoff to mothers whose team did not advance to the divisional playoffs (denoted with a solid line). The percentage of births under this cutoff to mothers whose team won the Super Bowl (denoted with a +), and the percentage of births under this cutoff to mothers whose team lost the Super Bowl (denoted with a -), are also shown.

Super Bowl wins and losses appear to be scattered fairly evenly around the solid control line, with a few notable exceptions. For instance, when the Los Angeles Raiders beat the Washington Redskins in 1984, 12.3 percent of children born to mothers living in the Washington area were low birth weight, well above the mean in the control areas. To take another example, when the Baltimore Ravens beat the New York Giants in 2001, 9.7 percent of the children born to mothers living in the Baltimore area were low birth weight versus 7.1 percent in the control NFL fan base areas. These comparisons are consistent with the hypothesis that early-pregnancy Super Bowl exposure can lead to low birth weight, but could easily reflect area-level factors, the influence of which, if time invariant, will be captured by the NFL area fixed effects in the regression analysis.

5.2. Regression results

The first column of Table 2A presents ordinary least squares (OLS) estimates of the relationship between early-pregnancy Super Bowl exposure and birth weight in grams. Following Bertrand et al. (2004), standard errors are corrected for clustering at the NFL area level. Advancing to the Super Bowl is associated with a reduction in birth weight of 3.28 grams as compared to not advancing to the Divisional Playoffs. Losing in the conference playoffs is associated with an increase in birth weight of 2.40 grams, although this estimate is not significant at the 0.05 level. The second column of Table 2A explores whether the outcome of the Super Bowl is related to birth weight. Winning the Super Bowl is associated with a reduction in birth weight of 6.05 grams. In contrast, the estimated coefficient of $Lost\ SuperBowl_{iat}$ is much smaller and statistically insignificant at conventional levels.

A similar pattern of results is obtained when we turn our focus to low birth weight, the principal outcome: neither losing the Super Bowl nor losing in the playoffs is associated with low birth weight; advancing to the Super Bowl is associated with a 0.0014 increase in the probability of having a child who weighed less than the 2,500 gram cutoff, which corresponds to a 1.9 percent increase in the incidence of low birth weight (0.0014/0.0735 = 0.0190); and winning the Super Bowl is associated with a 0.0025 increase in this probability, or a 3.4 percent increase in the incidence of low birth weight.

These estimates are an order of magnitude smaller than those documented by previous researchers who exploited natural experiments. For instance, Torche (2011) found that first-trimester exposure to an earthquake led to an almost 40 percent increase in the incidence of low birth weight, and Eskenazi et al. (2007) found that exposure to the

September 11, 2001 attack on the World Trade Center increased the odds of very low birth weight by approximately 30 percent. However, any increase in the incidence of low birth weight associated with winning the Super Bowl is best interpreted as an intent-to-treat effect (as opposed to, for instance, the effect of treatment on the treated). In 1969, the Super Bowl drew an estimated 41.7 million viewers, or 21 percent of the U.S. population; by 1986, viewership had risen to 92.6 million, or 39 percent of the U.S. population. Although viewership has risen above 100 million in recent years, the popularity of the Super Bowl arguably peaked in the mid-1980s.[27]

In Table 2B, we explore what happens to the estimated relationship between Super Bowl exposure and low birth weight when gestation duration is added to the right-hand side of equation (1). Controlling for gestation duration, neither advancing to, nor winning, the Super Bowl is associated with low birth weight, suggesting that Super Bowl exposure does not impact intrauterine growth. These results are consistent with those of Torche (2011), who found that prenatal exposure to the 2005 earthquake that struck northern Chile worked almost entirely through reducing weeks of gestation.[28]

[27] Gorman (2009) provides viewership statistics for Super Bowls played between 1967 and 2009. Three of the five highest-rated Super Bowls were played between 1982 and 1986 (Super Bowl XVI, Super Bowl XVII, and Super Bowl XX); the remaining two were played in 1978 and 1979 (Super Bowl XII and Super Bowl XIII). Although a majority of women consider themselves to be fans, professional football is much more popular among men than among women (Jones 2001; Cunningham, 2012). In 2001, 53 percent of American women reported that they were fans of professional football, as compared to 74 percent of men (Jones 2001). Super Bowl ratings at the metropolitan level are available for the period 2006 through 2011 from The Nielson Company. When the Pittsburgh Steelers played the Seattle Seahawks in 2006 (Super Bowl XL), 58 percent of Pittsburgh television-equipped households, and 55 percent of Seattle television-equipped households, were tuned to the game; nationwide, 42 percent of television-equipped households were tuned to the game (The Nielsen Company 2007). When the Chicago, Bears played the Indianapolis Colts in 2007 (Super Bowl XLI), 56 percent of Indianapolis television-equipped households, and 50 percent of Chicago television-equipped households, were tuned to the game; nationwide, 43 percent of television-equipped households were tuned to the game (The Nielsen Company 2008).

[28] Kelly (2011) found that prenatal exposure to the Asian influenza pandemic of 1957 reduced birth weight through gestation duration when the mother was less than 155 centimeters in height; exposure worked through restricting intrauterine growth when the mother smoked.

Next, we expand our sample to include children who were conceived 5 through 7 months before the Super Bowl and allow the impact of exposure to vary by month of conception. The results, reported in Table 3, provide evidence that the effect of Super Bowl exposure is strongest in the early stages of pregnancy. Estimates of β_1 are small and statistically insignificant for children conceived in July through October; among children conceived in November, advancing to the Super Bowl is associated with a 0.0013 increase in the probability of low birth weight; among children conceived in December, advancing to the Super Bowl is associated with a 0.0022 increase in this probability. Winning the Super bowl is associated with a 0.0014 to 0.0019 increase in the probability of low birth weight among children conceived before November; among children conceived in November and December, it is associated with a 0.0024 to 0.0032 increase in this probability. Interestingly, among children conceived in December, losing the Super Bowl is associated with a 0.0021 increase in the probability of low birth weight. This estimate, however, is not significant at the 0.05 level.

As noted above, sporting events that end in an upset appear to generate strong reactions among sports fans. These reactions include assaults, vandalism, and IPV (Rees and Schnepel 2009; Card and Dahl 2011). In order to explore the role of expectations, especially unmet expectations, we assign mothers whose team advanced to the Super Bowl one of the 6 outcomes introduced in the previous section (upset win, unpredictable win, predictable win, upset loss, unpredictable loss, and predictable loss). The results of this exercise are reported in column (3) of Table 4; to facilitate comparison, columns (1) and (2) of Table 4 reproduce estimates originally reported in Table 2.

Among children who were likely conceived 1-4 months before the Super Bowl, loses (whether predicted or not) are essentially unrelated to low birth weight, whereas early-pregnancy exposure to an upset win seems to sharply increase the risk of low birth weight. Specifically, upset wins are associated with a 0.0046 increase in the probability of having a child who weighed less than the 2,500 gram cutoff, which corresponds to a 6.3 percent increase in the incidence of low birth weight. Although the estimated coefficient of *Unpredictable Win* is small and statistically insignificant, predicted wins are associated with a 0.0024 increased probability of low birth weight.[29]

In column (4) of Table 4, we add gestation duration to the right-hand side of the estimating equation. After conditioning on gestation duration, the estimated coefficient of *Predicted Win* falls by half and is no longer statistically distinguishable from zero; the estimated impact of exposure to an upset Super Bowl win falls by about one fourth (from 0.0046 to 0.0034), but remains statistically significant at the 0.05 level. Likewise, conditional on gestation duration, upset losses are positively related to low birth weight, suggesting that prenatal exposure to Super Bowl upsets reduces intrauterine growth regardless of whether the game ended in an upset win or loss.

5.3. The importance of maternal characteristics

Table 5 presents estimates of equation (1) by mother's educational attainment. Despite the fact that NFL fans are more likely to have graduated from high school than non-fans (Jones 2001; Scarborough Research 2004), there is little evidence that Super Bowl exposure is associated with low birth weight among children whose mothers had at

[29] The estimated coefficients of predicted win, unpredictable win, and upset win are significantly different from each other at the 0.05 level.

least four years of secondary schooling. In contrast, among children whose mothers did not complete high school, advancing to the Super Bowl is associated with a 0.0019 increase in the probability of low birth weight. One potential explanation for this pattern of results is that women who did not complete high school were at greater risk of IPV in the event of a loss, and therefore under more psychological stress during the game, than their counterparts with a high school or college education.[30] However, winning the Super Bowl is associated with a 0.0047 increase in the probability of low birth weight among children whose mothers did not complete high school (or a 5.1 percent increase in the incidence of low birth weight), while the estimated coefficient of *Lost SuperBowl* is actually negative, although not statistically significant. Card and Dahl (2011) found no evidence that regular-season wins were associated with IPV.

Professional football appears to be especially popular among non-whites. According to a Gallup poll conducted in 2004, 71 percent of non-whites said that they were NFL fans as compared to 62 percent of whites (Jones 2005). Table 6 provides estimates of the relationship between Super Bowl exposure and low birth weight by the mother's race and ethnicity. When the sample is restricted to the children of white mothers, advancing to the Super Bowl is associated with a 0.0008 increase in the probability of low birth weight, and winning the Super Bowl is associated with a 0.0017 increase in this probability; when the sample is restricted to the children of black mothers, the estimate of β_1 increases to 0.0036, and the estimated impact of winning the Super Bowl increases to 0.0055. Although professional football is not particularly popular among Hispanics (Scarborough Research 2004), a similar pattern of results is

[30] Farmer and Tiefenthaler (2003) provide evidence that women without a high school degree are at greater risk of IPV than their counterparts with a high school or college education.

obtained when we restrict the sample to the children of mothers who identified themselves as Hispanic: advancing to the Super Bowl is associated with a 0.0033 increase in the probability of low birth weight, and winning the Super Bowl is associated with a 0.0045 increase in this probability.

Finally, the sample is divided based on the mother's marital status in Table 7. We find that Super Bowl exposure is associated with an increased probability of having a low birth weight child for both married and single mothers. However, this increase is almost five times larger when the sample is restricted to children whose mothers were single. Likewise, winning the Super Bowl is associated with an increased probability of low birth weight among both married and single women, but this increase is almost five times larger when the sample is restricted to the children of single women.

5.4. The role of substance use

Next, we examine the relationship between Super Bowl exposure and substance use. As noted above, pregnant women could cope with Super Bowl-induced stress through substance use. It is also possible that pregnant women whose team advances to the Super Bowl are simply exposed to more substance use than their counterparts whose team did not make it to the divisional playoff. Tens of millions of Americans attend Super Bowl parties or watch the game at a bar or restaurant (Grannis 2012), and fans of the winning team typically stage a celebratory parade a few days after the game.[31]

[31] Beer sales spike before the Super Bowl (Simcox 2012), and traffic fatalities involving alcohol sharply increase immediately after the game (Redelmeier and Stewart 2003). There is evidence that alcohol consumption (Torrent et al. 2004) and exposure to second-hand smoke (Kaneita et al. 2007) are associated with failure to quit smoking by pregnant women.

Because the NVSS did not include measures of substance use prior to the 1989 revision of the Standard Certificate of Birth, we focus on the period 1989 through 2004. It should be noted, however, that when the sample is restricted to these years, the estimated relationship between Super Bowl exposure and low birth weight, although positive, is not statistically significant at conventional levels (Appendix Table 3).[32] Therefore, we cannot directly test whether substance use mediates the relationship between Super Bowl exposure and low birth weight.

Table 8 presents estimates of the following equation:

$$(2)\ \textit{Alcohol Use}_{iat} = \pi_0 + \pi_1 \textit{SuperBowl}_{iat} + \pi_2 \textit{LostDivision}_{iat} + \pi_3 \textit{LostConference}_{iat} + \boldsymbol{X_{iat}\pi_4} + v_a + w_t + \Theta_a \cdot t + \varepsilon_{iat,}$$

where *Alcohol Use* is equal to 1 if the mother of child *i* reported drinking while pregnant, and is equal to 0 otherwise. Table 9 presents estimates of an analogous equation for tobacco use. Although both estimates of π_1 are positive, neither is statistically significant at the 0.05 level. When *SuperBowl* is replaced with *Won SuperBowl* and *Lost SuperBowl*, we find strong evidence that the outcome of the Super Bowl influences substance use. Specifically, winning the Super Bowl is associated with a 33.3 percent increase in the incidence of alcohol use (0.0053/0.0159 = 0.333), and a 5 percent increase

[32] Advancing to the Super Bowl is associated with a (statistically insignificant) 0.0008 increase in the probability of low birth weight; losing is associated with a (statistically insignificant) 0.0005 increase in this probability; and winning is associated with a (statistically insignificant) 0.001 increase in this probability. Both alcohol consumption and tobacco use are positively related to low birth weight (Appendix Table 3).

in the incidence of tobacco use (0.0055/0.1086 = 0.051). Losing the Super Bowl is associated with small, statistically insignificant reductions in substance use.

These results raise the possibility that Super Bowl exposure impacts low birth weight through substance use. However, when *SuperBowl* is replaced by the six outcome variables based on the Las Vegas point spread, we find that predicted wins are associated with larger increases in substance use than either upset or unpredictable wins.[33] In contrast, upset wins were associated with the largest increase in the probability of having a low birth weight child. Likewise, the relationship between substance use and winning the Super Bowl is strongest when the sample is restricted to mothers who completed at least four years of high school (Appendix Table 4), while the estimated relationship between winning the Super Bowl and low birth weight was strongest among children whose mothers did not complete four years of high school. Finally, the relationship between substance use and winning the Super Bowl is strongest among non-minority and married mothers (Appendix Tables 5 and 6), while estimates of the relationship between winning the Super Bowl and low birth weight by race and marital status showed the opposite pattern. Although we cannot definitively rule out the possibility that substance use mediates the relationship between Super Bowl exposure and low birth weight, these results suggest that an alternative mechanism is at work.[34]

5.5. The 10 best Super Bowls

[33] It should be noted, however, that we cannot formally reject the hypothesis that these coefficients are equal.

[34] Appendix Tables 8 and 9 present estimates of the relationship between Super Bowl exposure and substance use intensity (conditional on substance use). There is no evidence that Super Bowl exposure impacts drinks per day. However, unpredictable losses are associated with 0.21 fewer cigarettes per day, while unpredictable wins are associated with an increase in consumption of 0.31 cigarettes per day.

Up to this point in the analysis, we have focused on Super Bowl outcomes and the role of expectations. However, there are other aspects of the Super Bowl that could potentially affect its emotional impact. For instance, a game between traditional rivals could have more emotional impact than a game between two teams that have never met. Likewise, a hard-fought game could have more impact than a game in which one team was clearly outplayed from start to finish.

Sports Illustrated has compiled a list of the "Ten Best Super Bowls," based on admittedly subjective factors such as whether the game was close, the players and teams involved, and whether the game was decided on the last play. According to Sports Illustrated, 8 of the 10 best Super Bowls were played during the period 1969-2004.[35] In an effort to explore whether aspects of the Super Bowl beyond outcome and expectations affected low birth weight, we replace the variable *SuperBowl* with two new variables:

1. *Played Exciting Super Bowl* is equal to 1 if the NFL team located in area *a* played in one of the "10 Best Super Bowls" in year *t* (and is equal to 0 otherwise).

2. *Played Other Super Bowl* is equal to 1 if the NFL team located in area *a* advanced to the Super Bowl in year *t*, but the Super Bowl was not among the 10 best (and is equal to 0 otherwise).

In addition, we interacted the outcome of the game with these new variables.

The results are reported in Table 10. They provide little evidence that the relationship between low birth weight and exciting Super Bowls is stronger than the

[35] Fox News also compiled a list of the 10 best Super Bowls. The Sports Illustrated and Fox News lists overlap precisely during the period 1969-2004 with one exception: Super Bowl XIV did not make the Fox News list. The Sports Illustrated list is available at: http://sportsillustrated.cnn.com/multimedia/photo_gallery/1002/nfl.best.super.bowls.ever/content.5.html. The Fox News list is available at: http://msn.foxsports.com/nfl/lists/Top_10_Best_Super_Bowl_games#photo-title=Do%20it%20again&photo=30591902

relationship between low birth weight and Super Bowls that did not make the Sports Illustrated 10 best list. Exposure to an exciting Super Bowl is associated with a (statistically insignificant) 0.0011 increase in the probability of having a low birth weight child. In comparison, exposure to a Super Bowl that did not make the Sports Illustrated top 10 list is associated with a 0.0015 increase in this probability. Winning an exciting Super Bowl is associated with a 0.0028 increase in the probability of having a low birth weight child, while winning a Super Bowl that did not make the Sports Illustrated top 10 list is associated with a 0.0024 increase in this probability. Finally, there is evidence that Super Bowls that made the Sports Illustrated top 10 list led to more substance use than other Super Bowls. Winning an exciting Super Bowl is associated with a 0.012 increase in the probability of tobacco use and a 0.013 increase in the probability of alcohol use, while winning a Super Bowl that did not make the Sports Illustrated top 10 list is associated with a 0.0037 increase in the probability of tobacco use and a 0.0031 increase in the probability of alcohol use.

6. CONCLUSION

A wide variety of intrauterine shocks can influence birth weight (Almond and Currie 2011). They include malnutrition (Lumey 1998; Almond and Mazumder 2011), pollution (Currie et al. 2009; Currie et al. 2011; Currie and Reed 2011), and infection (Kelly 2011). There is also evidence that these shocks can be psychological in nature. To date, the strongest evidence that psychological stress is causally related to birth weight comes from studies that exploit unexpected acts of extreme violence and catastrophic natural disasters. For instance, Eskenazi et al. (2007) found an increased risk of very low birth weight among children born 33 through 36 weeks after the attack on the World

Trade Center, and Torche (2011) found that first-trimester exposure to an earthquake that struck northern Chile in 2005 was associated with fewer weeks of gestation and an increased risk of low birth weight.

This study examines the relationship between the Super Bowl and low birth weight. In contrast to terrorist attacks and natural disasters, the Super Bowl does not threaten its viewers with direct physical harm, although there is evidence from a variety of sources that major sporting events can produce strong emotional reactions (Kloner et al. 2009; Rees and Schnepel 2009; Card and Dahl 2011; Kloner et al. 2011). Drawing on publicly available data from the National Vital Statistics System (NVSS) for the period 1969 through 2004, we find that winning the Super Bowl is associated with a 3.4 percent increase in the incidence of low birth weight (defined as weighing less than 2,500 grams at birth). Upset wins, which can be thought of as exogenously generated positive emotional cues, lead to larger increases in the incidence of low birth weight than predicted wins. When we control for gestation length, the estimated relationship between upset wins and low birth weight is reduced in magnitude by approximately one fourth, but is not eliminated.

This latter result is consistent with the hypothesis that positive emotional cues can directly impact birth weight through intrauterine growth, but we also find that winning the Super Bowl is associated with increased tobacco and alcohol use during pregnancy, both of which are associated with low birth weight (Whitehead and Lipscomb 2003; Chiaffarino et al. 2006; Jaddoe et al. 2008; Polakowsk et al. 2009; Patra et al. 2011). The relationship between substance use and winning the Super Bowl is strongest when the sample is restricted to mothers who completed at least four years of high school, while

the estimated relationship between winning the Super Bowl and low birth weight is strongest among children whose mothers did not complete four years of high school. However, because we do not have data on substance use prior to 1989, we cannot rule out the possibility that what Eskenazi et al. (2007, p. 3014) labeled "maladaptive coping behaviors" play an important role.

To our knowledge, this is the first study to examine the relationship between positive emotion cues and birth weight, although there is evidence that a wide variety of events can trigger the release of cortisol, a hormone released by the hypothalamic-pituitaryadrenal axis in response to stress (Hubert et al. 1993; al'Absi et al. 1997; Gerra et al. 1998; Heffner et al. 2004). Finally, to our knowledge, this is the first study to examine the relationship between emotional cues, either positive or negative, and substance use. In future work, we plan to plan to exploit other major sporting events such as the World Cup soccer tournament in an effort to gain further insight the effect of emotional cues on birth weight and the role of substance use.

7. REFERENCES

Aizer, Anna, Stroud, Laura and Stephen Buka. 2009. "Maternal Stress and Child Well-Being: Evidence from Siblings" Working paper, Brown University, Department of Economics. Available at: http://www.econ.brown.edu/fac/anna_aizer/

al'Absi, Mustafa., Stephen Bongard, Tony Buchanan, Gwendolyn A. Pincomb, Julio Licinio, and William R. Lovallo. 1997. "Cardiovascular and Neuroendocrine Adjustment to Public Speaking and Mental Arithmetic Stressors." Psychophysiology, Vol. 34, No. 3, pp. 266–275.

Almond, Douglas and Janet Currie. 2011. "Killing Me Softly: The Fetal Origins Hypothesis." *Journal of Economic Perspectives*, Vol. 25, No. 3, pp. 153-172.

Almond, Douglas Hilary W. Hoynes, and Diane Whitmore Schanzenbach. 2011 "Inside the War on Poverty: The Impact of Food Stamps on Birth Outcomes." Review of Economics and Statistics, Vol. 93, No. 2, pp. 387-403.

Almond, Douglas and Bhashkar Mazumder. 2011. "Health Capital and the Prenatal Environment: The Effect of Ramadan Observance during Pregnancy." American Economic Journal: Applied Economics, Vol. 3, No., 4, pp. 56–85.

Baumann, Robert, Taylor L. Ciavarra, Bryan Engelhardt, and Victor A. Matheson. 2009 "Sports Franchises, Stadiums, and City Livability: An Examination of Professional Sports and Crime Rates." Working Paper No. 09-13, Department of Economics, College of the Holy Cross.

Berk, Lee S., Sanda A. Tan, William F. Fry, B.J. Napier, Jae Woo Lee, Roger W. Hubbard, John E. Lewis, and W.C. Eby. 1989. "Neuroendocrine and Stress Hormone Changes during Mirthful Laughter." The American Journal of the Medical Sciences, Vol. 298, No. 6, pp. 390–396.

Bernstein, Ira M., Joan A. Mongeon, Gary J. Badger, Laura Solomon, Sarah H. Heil, and Stephen T. Higgins, 2005. "Maternal Smoking and its Association with Birth Weight." Obstetrics and Gynecology, Vol. 106, No. 5, pp. 986-991.

Bertrand, Marianne, Esther Duflo, and Sendhil Mullainathan. 2004. "How Much Should We Trust Differences-in-Differences Estimates? Quarterly Journal of Economics, Vol. 119, No. 1, pp. 249-276.

Beydoun, Hind, and Audrey F. Saftlas. 2008. "Physical and Mental Health Outcomes of Prenatal Maternal Stress in Human and Animal Studies: A Review of Recent Evidence." Paediatric and Perinatal Epidemiology, Vol. 22, No. 5, pp. 438--466.

Black, Sandra, Paul Devereux, and Kjell Salvanes. 2007. "From the Cradle to the Labour Market? The Effect of Birth Weight on Adult Outcomes." Quarterly Journal of Economics, Vol. 122, No. 1, pp. 409-439.

Bonzini, Matteo, David Coggon, and Keith T. Palmer. 2007. "Risk of Prematurity, Low Birthweight and Pre-Eclampsia in Relation to Working Hours and Physical Activities: A Systematic Review." Occupational and Environmental Medicine, Vol. 64, No. 4, pp. 228-243.

Brown, Walter A., Alan D. Sirota, Raymond Niaura, and Tilmer O. Engebretson. 1993. "Endocrine Correlates of Sadness and Elation." Psychosomatic Medicine, Vol. 55, No. 5, pp. 458–467.

Buchanan, Tony W., Mustafa al'Absi, and William R. Lovallo. 1999. "Cortisol Fluctuates with Increases and Decreases in Negative Affect." Psychoneuroendocrinology, Vol. 24, No. 2, pp. 227-241.

Buescher, Paul A., Karen P. Taylor, Mary H. Davis, and J. Michael Bowlin. 1993. "The Quality of the New Birth Certificate Data: A Validation Study in North Carolina." American Journal of Public Health, Vol. 83, No. 8, pp. 1163-1165.

Bullock, Linda F., Jennifer L.C. Mears, Cynthia Woodcock, Rachel Record. 2001. "Retrospective Study of the Association of Stress and Smoking during Pregnancy in Rural Women." Addictive Behavior, Vol. 26, No. 3, pp. 405–413.

Camacho, Adriana. 2008. "Stress and Birth Weight: Evidence from Terrorist Attacks." The American Economic Review, Vol. 98, No. 2, pp. 511-515.

Card, David and Gordon B. Dahl. 2011. "Family Violence and Football: The Effect of Unexpected Emotional Cues on Violent Behavior" Quarterly Journal of Economics, Vol. 126, No. 1, pp. 103-143.

Carroll, Douglas, Shah Ebrahim, Kate Tilling, John Macleod, and George Davey Smith. 2002. "Admissions for Myocardial Infarction and World Cup Football: Database Survey." British Medical Journal, 325, No. 7378, pp. 1439-1442.

Catalano, Ralph and Terry Hartig. 2001. "Communal Bereavement and the Incidence of Very Low Birthweight in Sweden." Journal of Health and Social Behavior, Vol. 42, No. 4, pp. 333-341.

Centers for Disease Control and Prevention. 2008. "QuickStats: Mean Gestational Age, by Plurality--United States, 2005." MMWR, Vol. 57, No. 9, p. 238.

Chasan-Taber, Lisa, Kelly R. Evenson, Barbara Sternfeld, and Seema Kengeri. 2007. "Assessment of Recreational Physical Activity during Pregnancy in Epidemiologic Studies of Birthweight and Length of Gestation: Methodologic Aspects." Women and Health, Vol. 45, No. 4, pp. 85-107.

Chiaffarino, F. Parazzini and L. Chatenoud. 2006. "Alcohol Drinking and Risk of Small for Gestational Age Birth." European Journal of Clinical Nutrition, Vol. 60, pp. 1062-1066.

Clark, Luke, Susan D. Iversen, and Guy M. Goodwin. 2001. "The Influence of Positive and Negative Mood States on Risk Taking, Verbal Fluency, and Salivary Cortisol." Journal of Affective Disorders, Vol. 63, No. 1-3, pp. 179-187.

Cunningham, Todd. 2012 "Super Bowl: Viewer Gender Gap Is Narrowing." The Wrap, February 01, Available at: http://www.thewrap.com/tv/article/super-bowl-viewer-gender-gap-narrowing-35005

Currie, Janet and Rosemary Hyson, 1999. "Is the Impact of Health Shocks Cushioned by Socioeconomic Status? The Case of Low Birthweight," The American Economic Review Papers and Proceedings, Vol. 89, No. 2, pp. 245-250.

Currie, Janet, Michael Greenstone, and Enrico Moretti. 2011. "Superfund Cleanups and Infant Health." American Economic Review, Vol. 101, No. 3, pp. 435-441.

Currie, Janet and Enrico Moretti. 2007. "Biology as Destiny? Short- and Long-Run Determinants of Intergenerational Transmission of Birth Weight" Journal of Labor Economics, Vol. 25, No. 2, pp. 231-264.

Currie, Janet, Matthew Neidell, and Johannes F. Schmeider. 2009. "Air Pollution and Infant Health: Lessons from New Jersey." Journal of Health Economics, Vol. 28, No. 3, pp. 688-703.

Currie, Janet and Reed W. Walker. 2011. "Traffic Congestion and Infant Health: Evidence from E-ZPass." American Economic Journal: Applied Economics, Vol. 3, No. 1, pp. 65-90.

de Weerth, Carolina, and Jan K. Buitelaar. 2005. "Physiological Stress Reactivity in Human Pregnancy. A Review." Neuroscience and Biobehavioral Reviews, Vol. 29, No. 2, pp. 295-312.

Dickerson, Sally S. and Margaret E. Kemeny. 2004. "Acute Stressors and Cortisol Responses: A Theoretical Integration and Synthesis of Laboratory Research." Psychological Bulletin, Vol. 130, No. 3, pp. 355–391.

Donahue, Sara M. A., Ken P. Kleinman, Matthew W. Gillman, and Emily Oken. 2010. "Trends in Birth Weight and Gestational Length among Singleton Term Births in the United States: 1990-2005." Obstetrics and Gynecology, Vol. 115, No 2 (Part 1), pp. 357-364.

Drake, Brett, and Shanta Pandey. 1996. "Do Child Abuse Rates Increase on Those Days on Which Professional Sporting Events are Held?" Journal of Family Violence, Vol. 11, No. 3, pp. 205-218.

Eskenazi, Brenda, Amy R. Marks, Ralph Catalano, Tim Bruckner, and Paolo G. Toniolo. 2007. "Low Birthweight in New York City and Upstate New York Following the Events of September 11th." Human Reproduction, Vol. 22, No.11, pp. 3013-3020.

Farmer, Amy and Jill Tiefenthaler. 2003. "Explaining the Recent Decline in Domestic Violence." Contemporary Economic Policy, Vol. 21, No. 2, pp. 158-172.

Freedman, Mary Anne, George A. Gay, John E. Brockert, Patricia W. Potrzebowski, and Charles J. Rothwell. 1988. "The 1989 Revisions of the US Standard Certificates of Live

Birth and Death and the US Standard Report of Fetal Death." American Journal of Public Health, Vol. 78, No. 2, pp. 168-172.

Friedman, Daniel J. 2007. "Assessing Changes in the Vital Statistics records and Statistics Infrastructure." Final Report, Population and Public Health Information Service. Available at: http://www.naphsis.org/index.asp?bid=984

Gandar, John, Richard Zuber, Thomas O'Brien, and Ben Russo. 1988. "Testing Rationality in the Point Spread Betting Market," Journal of Finance, Vol. 43, No. 4, pp. 995–1008.

Gerra, G., A. Zaimovic, D. Franchini, M. Palladino, G. Giucastro, N. Reali, D. Maestric, R. Caccavaria, R. Delsignored, and F. Brambillae 1998. "Neuroendocrine Responses of Healthy Volunteers to 'Techno-Music': Relationships with Personality Traits and Emotional State." International Journal of Psychophysiology, Vol. 28, No. 1, pp. 99–111.

Glyn, Laura M., Pathik D. Wadha, Christine Dunkel-Schetter, Aleksandra Chicz-Demet, and Curt A. Sandman. 2001. "When Stress Happens Matters: Effects of Earthquake Timing on Stress Responsivity in Pregnancy." American Journal of Obstetrics and Gynecology, Vol. 184, No. 4, pp. 637-642.

Gorman, Bill. 2009. "Super bowl TV Ratings." TV by the Numbers, January 18. Available at: http://tvbythenumbers.zap2it.com/2009/01/18/historical-super-bowl-tv-ratings/11044/

Grange´, Gilles, Christophe Vayssiere, Anne Borgne, Albert Ouazana, Jean-Pierre L'Huillier, Paul Valensi, Gerard Peiffer, Henri-Jean Aubin, Dominique Renon, Daniel Thomas, and Francois Lebargy. 2006. "Characteristics of Tobacco Withdrawal in Pregnant Women." European Journal of Obstetrics and Gynecology and Reproductive Biology Vol. 125, No. 1, pp. 38–43.

Grannis, Kathy. 2012. "Record Number of Americans to Celebrate Super Bowl This Year With Plans to Spend $11 Billion." Press Release, National Retail Federation, January 26. Available at: http://www.nrf.com/modules.php?name=News&op=viewlive&sp_id=1300

Heffner, Kathi L., Janice K. Kiecolt-Glaser, Timothy J. Loving, Ronald Glaser, and William B. Malarkey. 2004. "Spousal Support Satisfaction as a Modifier of Physiological Responses to Marital Conflict in Younger and Older Couples." Journal of Behavioral Medicine, Vol. 27, No. 3, pp. 233-254.

Henderson, Gray and Brocklehurst. 2008 "Systematic Review of Effects of Low–Moderate Prenatal Alcohol Exposure on Pregnancy Outcome." BJOG, Vol. 114, No. 3, pp. 243-252.

Henderson, Ulrik Kesmodel, Ron Gray. 2007. “Systematic Review of the Fetal Effects of Prenatal Binge-Drinking.” Journal of Epidemiology and Community, Vol. 61, No. 12, pp. 1069-1073.

Hucklebridge, F., S. Lambert, A. Clow, D.M. Warburton, P.D. Evans, and N. Sherwood. 2000. “Modulation of Secretory Immunoglobulin A in Aaliva: Response to Manipulation of Mood.” Biological Psychology, Vol. 53, No. 1 25–35.

Huff, Richard, 2011. “Oscars 2011 Ratings: ABC's Academy Awards Viewership Down to 37.6 million from 41.7 Last Year.” Daily News, February 28. Available at: http://articles.nydailynews.com/2011-02-28/entertainment/28656511_1_oscars-golden-globe-awards-abc-s-academy-awards

Hubert, Walter. Mathilde Moller, and Renate de Jong-Meyer. 1993. “Film-Induced Amusement Changes in Saliva Cortisol Levels.” Psychoneuroendocrinology, Vol. 18, No. 4, pp. 265-272.

Jaddoe, Vincent W., Bero O. Verburg BO, M.A.J. de Ridder, Albert Hofman, Johan P. Mackenbach, Henriëtte A. Moll, Eric A.P. Steegers, and Jacqueline C.M. Witteman. 2007a. “Maternal Smoking and Fetal Growth Characteristics in Different Periods of Pregnancy: The Generation R Study.” American Journal of Epidemiology, Vol. 165, No. 10, pp. 1207-1215.

Jaddoe Vincent W., Rachel Bakker, Albert Hofman, Johan P. Mackenbach, Henriette Moll, Eric A.P. Steegers, and Jacqueline C.M. Witteman. 2007b. “Moderate Alcohol Consumption during Pregnancy and the Risk of Low Birth Weight and Preterm Birth: The Generation R Study.” Annals of Epidemiology, Vol. 17, No. 10, pp. 834-840.

Jaddoe, Vincent W., Ernst-Jan W. M. Troe, Albert Hofman, Johan P. Mackenbach, Henriette A. Moll, Eric A. P. Steegers, and Jacqueline C. M. Witteman. 2008. “Active and Passive Maternal Smoking during Pregnancy and the Risks of Low Birthweight and Preterm Birth: The Generation R Study.” Paediatric and Perinatal Epidemiology, Vol. 22, No. 2, pp.162–171.

Jones, Jeffrey M. 2001. “More Americans are Fans of Pro Football than Any Other Sport.” Gallup News Service, April 20. Available at: http://www.gallup.com/poll/1786/more-americans-fans-pro-football-than-any-other-sport.aspx

Jones, Jeffrey M. 2005. “Six in 10 Americans Are Pro Football Fans.” Gallup News Service, February 4. Available at: http://www.gallup.com/poll/14812/six-americans-pro-football-fans.aspx

Kaemph, Joseph W., Mark Tomlinson, Cindy Arduza, Shelly Anderson, Betty Campbell, Linda A. Ferguson, Mara Zabari, Valerie T. Stewart. 2006. “Medical Staff Guidelines for

Periviability Pregnancy Counseling and Medical Treatment of Extremely Premature Infants." Pediatrics, Vol. 117, No. 1, pp. 22 -29.

Lieberman, Ellice., Isabelle Gremy, Janet M. Lang, and Amy P. Cohen. 1994. "Low Birthweight at Term and the Timing of Fetal Exposure to Maternal Smoking." American Journal of Public Health, Vol. 84, No 7, pp. 1127-1131.

Kaempf, Joseph W., Mark Tomlinson, Cindy Arduza, Shelly Anderson, Betty Campbell, Linda A. Ferguson, Mara Zabari, Valerie T. Stewart. 2006. "Medical Staff Guidelines for Periviability Pregnancy Counseling and Medical Treatment of Extremely Premature Infants." Pediatrics, Vol. 117, No. 1, pp. 22 -29.

Jones, Jeffrey M. 2001. "More Americans are Fans of Pro Football than Any Other Sport." Gallup News Service, April 20. Available at: http://www.gallup.com/poll/1786/more-americans-fans-pro-football-than-any-other-sport.aspx

Jones, Jeffrey M. 2005. "Six in 10 Americans Are Pro Football Fans." Gallup News Service, February 4. Available at: http://www.gallup.com/poll/14812/six-americans-pro-football-fans.aspx

Kaneita, Yoshitaka, Sone Tomofumi, Shinji Takemura, Kenshu Suzuki, Eise Yokoyama, Takeo Miyake, Satoru Harano, Eiji Ibuka, Akiyo Kaneko, Takako Tsutsui, and Takashi Ohida. 2007. "Prevalence of Smoking and Associated Factors among Pregnant Women in Japan." Preventive Medicine, Vol. 45, No. 1, pp. 15-20.

Kelly, Elaine. 2011. "The Scourge of Asian Flu: In Utero Exposure to Pandemic Influenza and the Development of a Cohort of British Children." The Journal of Human Resources, Vol. 46, No. 4, pp. 669–694.

Kemmer, Friedrich W., Rolf Bisping, Hans J. Steingrüber, Helmut Baar, Frank Hardtmann, Reiner Schlaghecke, and Michael Berger. 1986. "Psychological Stress and Metabolic Control in Patients with Type I Diabetes Mellitus." New England Journal of Medicine, Vol. 314, No. 17, pp. 1078–1084.

Kiecolt-Glaser, Janice K., Tamara Newton, John T. Cacioppo, Robert C. MacCallum, Ronald Glaser, and Willima B. Malarkey. 1996. "Marital Conflict and Endocrine Function: Are Men Really More Physiologically Affected than Women?" Journal of Consulting and Clinical Psychology, Vol. 64, No. 2, pp. 324–332.

Klayman, Ben. 2011. "Sunday's Super Bowl Set a New Record for the Largest U.S. Television Audience for a Single Broadcast. Reuters, Feb 7. Available at: http://www.reuters.com/article/2011/02/07/us-superbowl-ratings-idUSTRE7163GS20110207

Kloner, Robert A., Scott A. McDonald, Justin Leekaa, and W. Kenneth Poole. 2009. "Comparison of Total and Cardiovascular Death Rates in the Same City during a Losing versus Winning Super Bowl Championship." American Journal of Cardiology, Vol. 103, No. 12, pp. 1647–1650.

Kloner, Robert A. Scott A. McDonald, Justin Leeka, and W. Kenneth Poole. 2011. "The Role of Age, Sex, and Race on Cardiac and Total Mortality Associated With Super Bowl Wins and Losses." Clinical Cardiology, Vol. 34, No. 2, pp. 102-107.

Khashan, Ali S., Roseanne McNamee, Kathryn M. Abel, Marianne G. Pedersen, Roger T. Webb, Louise C. Kenny, Preben Bo Mortensen, and Philip N. Baker. 2008. "Reduced Infant Birthweight Consequent Upon Maternal Exposure to Severe Life Events." Psychosomatic Medicine, Vol. 70, No., 6, pp. 688-694.

Kirschbaum, Clemens, Jens C. Prussner, Arthur A. Stone, Ilona Federenko, Jens Gaab, Doris Lintz, Nicole Schommer and Dirk H. Hellhammer 1995. "Persistent High Cortisol Responses to Repeated Psychological Stress in a Subpopulation of Healthy Men." Psychosomatic Medicine, Vol. 57, No. 5, pp. 468-474.

Lauderdale, Diane S. 2006. "Birth Outcomes for Arabic-Named Women in California Before and After September 11." Demography, Vol. 43, No. 1, pp. 185-201.

MacMillian, Douglas and Paula Lehman. 2008. "The Economics of the Super Bowl." Bloomsberg Businessweek, January 27. Available at: http://www.msnbc.msn.com/id/22870460/ns/business-business_of_super_bowl_xlii/t/economics-super-bowl/

Maccini, Sharon and Dean Yang. 2009. "Under the Weather: Health, Schooling, and Economic Consequences of Early-Life Rainfall." American Economic Review, Vol. 99, No. 3, pp. 1006-26.

Mansour, Hani and Daniel I. Rees. Forthcoming. "Armed Conflict and Birth Weight: Evidence from the al-Aqsa Intifada." Journal of Development Economics.

Martin, Joyce A., Hsiang-Ching Kung, T.J. Mathews, Donna L. Hoyert, Donna M. Strobino, Bernard Guyer, and Shae R. Sutton. 2008. "Annual Summary of Vital Statistics: 2006." Pediatrics, Vol. 121, No. 4, pp. 788-801.

Martin, Joyce A. 2007. "United States Vital Statistics and the Measurement of Gestational Age." Paediatric and Perinatal Epidemiology, Vol. 21, No. S2, pp. 13–21.

McCarthy, Michael. 2009. "NFL Targeting Binge Drinking among Fans in New Season." USA Today, August 22. Available at: http://www.usatoday.com/sports/football/nfl/2009-08-20-nfl-beer-sales_N.htm

Miller, Todd Q., Linda Heath, John R. Molcan, and Bernard L. Dugoni. 1991. “Imitative Violence in the Real World: A Reanalysis of Homicide Rates Following Championship Prize Fights.” Aggressive Behavior, Vol. 17, pp. 121-134.

Morgan, Maria A., Robert L. Goldenberg, and Jay Schulkin. 2008. “Obstetrician-Gynecologists’ Practices Regarding Preterm Birth at the Limit of Viability.” Journal of Maternal-Fetal and Neonatal Medicine, Vol. 21, No. 2, pp. 115-121.

Mulder, E.J.H., P.G. Robles de Medina, A.C. Huizink, B.R.H. Van den Bergh, J.K. Buitelaar, G.H.A. Visser. 2002. “Prenatal Maternal Stress: Effects on Pregnancy and the (Unborn) Child.” Early Human Development, Vol. 70, No. 1-2. pp. 3-14.

Nichter, Mimi, Lorraine Greaves, Michele Bloch, Michael Paglia, Isabel Scarinci, Jorgee E. Tolosa, and Thomas E. Novotny. 2010. “Tobacco Use and Secondhand Smoke Exposure during Pregnancy in Low- and Middle-Income Countries: The Need for Social and Cultural Research.” Acta Obstetricia et Gynecologica Scandinavica, Vol. 89, No. 4, pp. 465–477.

O’Callaghan, Francis V., Michael O’ Callaghan, Jake M. Najmanc, Gail M. Williams, and William Bore. 2003. “Maternal Alcohol Consumption during Pregnancy and Physical Outcomes up to 5 Years of Age: A Longitudinal Study.” Early Human Development, Vol. 71, No. 2, pp. 137–148.

Paarlberg, Marieke K., J. J. M. Vingerhoets, Jan Passchier, Gustaaf A. Dekker, Antonius G. J. J. Heinen, and Herman P. van Geijn. 1999. “Psychosocial Predictors of Low Birthweight: A Prospective Study.” British Journal of Obstetrics and Gynaecology, Vol. 106, No. 8, pp. 834-41.

Pankoff, LynD. 1968. “Market Efficiency and Football Betting,” Journal of Business, Vol. 41, No. 2, pp. 203-214.

Patra, J., R. Bakker, H. Irving, V. Jaddoe, S. Malini, and J. Rehm. 2011. “Dose–Response Relationship between Alcohol Consumption before and during Pregnancy and the Risks of Low Birthweight, Preterm Birth and Small for Gestational Age (SGA)—A Systematic Review and Meta-Analyses.” BJOG, Vol. 118, No. 12, pp. 1411-1421.

Peeters, Frenk, Nancy A. Nicholson, and Johannes Berkhof. 2003. “Cortisol Responses to Daily Events in Major Depressive Disorder.” Psychosomatic Medicine, Vol. 65, No. 5, pp. 836-841.

Pfeffer, Cynthia R Margaret Altemus, Moonseong Heo, and Hong Jiang. 2007. “Salivary Cortisol and Psychopathology in Children Bereaved by the September 11, 2001 Terror Attacks.” Biological Psychiatry, Vol. 61, No. 8, pp. 957-965.

Pfeffer, Cynthia R. Margaret Altemus, Moonseong Heo, and Hong Jiang. 2009.

"Salivary Cortisol and Psychopathology in Adults Bereaved by the September 11, 2001 Terror Attacks." The International Journal of Psychiatry in Medicine, Vol. 39, No. 3, pp. 215-226.

Phillips, David P. 1983. "The Impact of Mass Media Violence on U.S. Homicides." American Sociological Review, Vol. 48, No. 4, pp. 560-568.

Piper, Joyce M, Edward F. Mitchel, Mary Snowden, Conni Hall, Margaret Adams, and Paula Taylor. 1993 "Validation of 1989 Tennessee Birth Certificates using Maternal and Newborn Hospital Records." American Journal of Epidemiology, Vol. 137, No. 7, pp. 758-768.

Polakowski, Laura L., Lara J. Akinbami, and Pauline Mendola. 2009. "Prenatal Smoking Cessation and the Risk of Delivering Preterm and Small-for-Gestational-Age Newborns." Obstetrics and Gynecology, Vol. 114, No. 2, Part 1, pp. 318-325.

Redelmeier, Donald A. and Craig L. Stewart. 2003. "Driving Fatalities on Super Bowl Sunday." New England Journal of Medicine, Vol. 348, No. 4, pp. 368-369.

Rees, I. Daniel and Kevin T. Schnepel. 2009. "College Football Games and Crime." Journal of Sports Economics, Vol. 10, No. 1, pp. 168-187.

Reichman, Nancy E. 2005. "Low Birth Weight and School Readiness" The Future of Children, Vol. 15 No. 1, pp. 91-116.

Reichman, Nancy E., and Erinn M. Hade. 2001. "Validation of Birth Certificate Data: A Study of Women in New Jersey's Health Start Program." Annals of Epidemiology, Vol. 11, No. 3, pp. 186-93.

Reichman, Nancy E. and Julien O. Teitler. 2003. "Effects of Psychosocial Risk Factors and Prenatal Interventions on Birth Weight: Evidence From New Jersey.s HealthStart Program." Perspectives on Sexual and Reproductive Health, Vol. 35, No. 3, pp. 130.137.

Rous, Je¤rey J., R. Todd Jewell, and Robert W. Brown. 2004. "The Effect of Prenatal Care on Birthweight: A Full-Information Maximum Likelihood Approach." Health Economics, Vol.13, No. 3, pp. 251.264.

Royer, Heather. N. 2009. "Separated at Girth: US Twin Estimates of the Long-Run and Intergenerational Effects of Fetal Nutrients." American Economic Journal: Applied Economics, Vol. 1, No. 1, pp. 49-85.

Rush, D., and P. Cassano. 1983. "Relationship of Cigarette Smoking and Social Class to Birth Weight and Perinatal Mortality among all Births in Britain, 5-11 April 1970." Journal of Epidemiology and Community Health, Vol. 37, No. 4, pp. 249-255.

Rushe, Dominic. 2011. “Super Bowl Advertisers Likely to Pay $100,000 a Second.” *The Observer*, February 5. Available at: http://www.guardian.co.uk/media/2011/feb/06/advertisers-us-super-bowl

Sachs, Carolyn J., and Lawrence D. Chu. 2000. “The Association Between Professional Football Games and Domestic Violence in Los Angeles County.” Journal of Interpersonal Violence, Vol. 15, No. 11, pp. 1192-1201.

Scarborough Research. 2004. “Get to Know the NFL Fan.” Street & Smith Sports Business Daily, September 6. Available at: http://www.sportsbusinessdaily.com/article/106148

Scarpa, Angela and Kristen A. Luscher. 2002. “Self-Esteem, Cortisol Reactivity, and Depressed Mood Mediated by Perceptions of Control.” Biological Psychology, Vol. 59, No. 2, pp. 93–103.

Schneider Mary L., Elizabeth C. Roughton, Alyssa J. Koehler, and Gabriele R. Lubach. 1999. “Growth and Development Following Prenatal Stress Exposure in Primates: An Examination of Ontogenetic Vulnerability.” Child Development, Vol. 70, No. 2, pp. 263-274.

Schneider, Sven, Christina Huy, Jessica Schutz, and Katharina Diehl. 2010. “Smoking Cessation during Pregnancy: A Systematic Literature Review.” Drug and Alcohol Review, Vo. 29, No. 1, pp. 81-90.

Shiffman, Saul, Jean A. Paty, Maryann Gnys, Jon A. Kassel, and Mary Hickcox 1996. “First Lapses to Smoking: Within-Subjects Analysis of Real-Time Reports.” Journal of Consulting and Clinical Psychology, Vol. 64, No. 2, 366-379.

Simcox, Shannon. 2012. “XL Beer Sales for Super Bowl XLVI.” York Daily Record, February 4. Available at: http://www.ydr.com/state/ci_19894366

Smits, Luc, Lydia Krabbendam, Rob de Bie, Gerard Essed, and Jim van Os. 2006. “Lower Birth Weight of Dutch Neonates who were in Utero at the Time of the 9/11 Attacks.” Journal of Psychosomatic Research, Vol. 61, No. 5, pp. 715-717.

Smith, Aaron Smith. 2010. “Super Bowl Ads are Going, Going ...” CNNMoney.com, January 8. Available at: http://money.cnn.com/2010/01/07/news/companies/super_bowl_ads/index.htm

Song, Yuqing, Dongfeng Zhou, and Xiangdong Wang 2008. “Increased Serum Cortisol and Growth Hormone Levels in Earthquake Survivors with PTSD or Subclinical PTSD.” Psychoneuroendocrinology, Vol. 33, No. 8, pp. 1155-1159.

Testa, R., A. Basso, L. Piantanelli, G. Coppa, A. Recchioni, G. De Sio, I. Testa, A.R. Bonfigli, and P. Dipaola. 1994. “Blood Catecholamine Levels and Lymphocyte

Betaadrenoceptors Following Acute Noise Stress." Bollettino della Societa Italiana di Biologia Sperimentale, Vol. 70, No. 8-9, pp. 193–198.

The Nielsen Company. 2007. "The Nielsen Company's Guide to the Super Bowl." PRNewswire, Jan. 31. Available at: http://www.prnewswire.com/news-releases/the-nielsen-companys-guide-to-the-super-bowl-54101752.html

The Nielsen Company. 2008. "The Nielsen Company's 2008 Guide to the Super Bowl." PRNewswire, Jan. 31. Available at: http://www.prnewswire.com/news-releases/the-nielsen-companys-2008-guide-to-the-super-bowl-57307192.html

Torche, Florencia. 2011. "The Effect of Maternal Stress on Birth Outcomes: Exploiting a Natural Experiment." Demography, Vol. 48, No. 4, pp. 1473-1491.

Torrent, Matías, Jordi Sunyer, Paul Cullinan, Xavier Basagaña, Jessica Harris, Oscar García, and Josep Maria Antó. 2004. "Smoking Cessation and Associated Factors during Pregnancy." Gaceta Sanitaria Vol. 18, No. 3, pp. 184-189.

Toubiana, L., T. Hanslik, and L. Letrilliart. 2001. "French Cardiovascular Mortality did not Increase during 1996 European Football Championship." The British Medical Journal. Vol. 322, No. 7297, p. 1306.

Tucker, Phebe Betty Pfefferbaum, Carol S. North, Adrian Kent, Haekyung Jeon-Slaughter, and Don E Parker, 2010. "Biological Correlates of Direct Exposure to Terrorism Several Years Postdisaster." Annals of Clinical Psychiatry, Vol. 22, No. 3, pp. 186-195.

Vardavas, Constantine I., Leda Chatzi, Evridiki Patelarou, Estel Plana, Katerina Sarri, Anthony Kafatos, Antonis D. Koutis, and Manolis Kogevinas. 2010. "Smoking and Smoking Cessation during Early Pregnancy and its Effect on Adverse Pregnancy Outcomes and Fetal Growth." European Journal of Pediatrics, Vol. 169, No. 6, pp. 741–748.

Vigil, Jacob M., David C. Geary, Douglas A. Granger, and Mark V. Flinn. 2010. "Sex Differences in Salivary Cortisol, Alpha-Amylase, and Psychological Functioning Following Hurricane Katrina." Child Development, Vol. 81, No. 4, pp. 1228–1240.

Wadhwa, Pathik D., Thomas J. Garite, Manuel Porto, Laura Glynn, Aleksandra Chicz-DeMet, Christine Dunkel-Schetter, and Curt A. Sandman. 2004. "Placental Corticotropin-Releasing Hormone (CRH), Spontaneous Preterm Birth, and Fetal Growth Restriction: A Prospective Investigation." American Journal of Obstetrics and Gynecology, Vol. 191, No. 4, pp. 1063-1069.

Wehby, George L., Je¤rey C. Murray, Eduardo E. Castilla, Jorge S. Lopez-Camelo, and Robert L. Ohsfeldt. 2009. "Quantile E¤ects of Prenatal Care Utilization on Birth Weight in Argentina." Health Economics, Vol. 18, No. 11, pp. 1307-1321.

White, Garland F., Janet Katz, and Kathryn E. Scarborough. 1992. "The Impact of Professional Football Games upon Violent Assaults on Women." Violence and Victims, Vol. 7, No. 2, pp. 157-171.

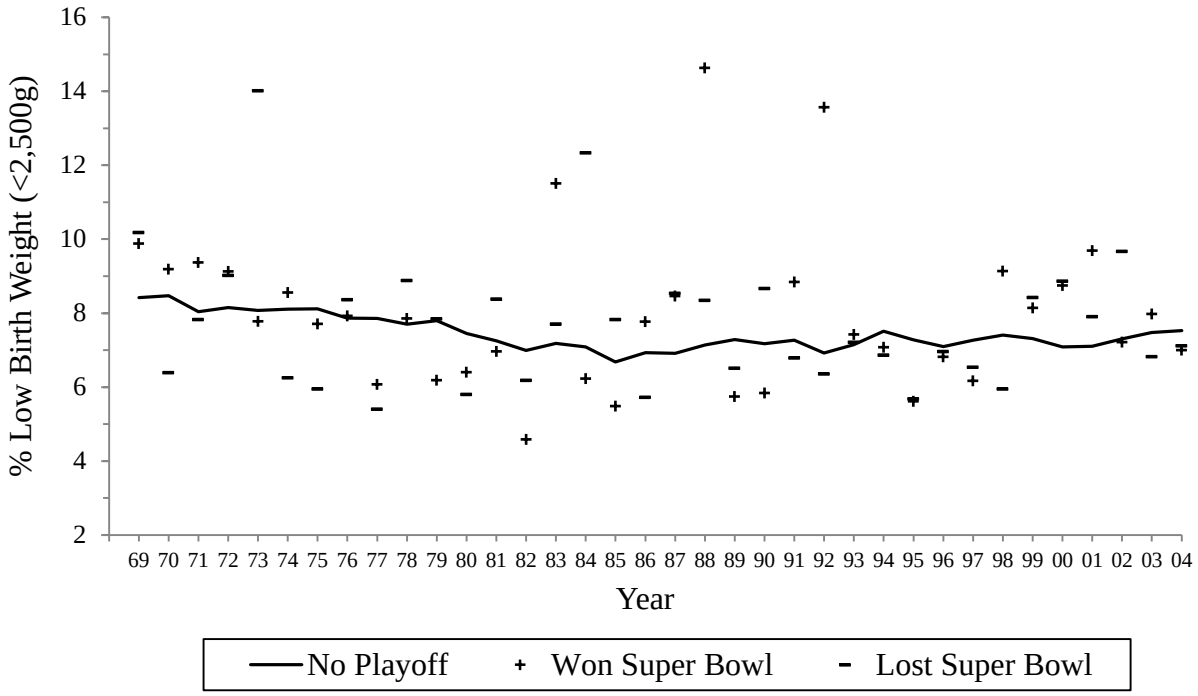
Whitehead, N. and L. Lipscomb. 2003. "Patterns of Alcohol Use Before and During Pregnancy and the Risk of Small-for-Gestational-Age Birth." American Journal of Epidemiology, Vol. 158, No. 7, pp. 654-662.

Wilbert-Lampen, Ute, David Leistner, Sonja Greven, Tilmann Pohl, Sebastian Sper, Christoph Völker, Denise Güthlin, Andrea Plasse, Andreas Knez, Helmut Küchenhoff, and Gerhard Steinbeck. 2008. "Cardiovascular Events during World Cup Soccer." New England Journal of Medicine, Vol. 358, No. 5, pp. 475-483.

Witte, Daniel R., Michiel L. Bots, Arno W. Hoes, and Diederick E Grobbee. 2000. "Cardiovascular Mortality in Dutch Men during 1996 European Football Championship: Longitudinal Population Study." The British Medical Journal, Vol. 321, No. 7276, pp. 1552-1554.

Zmuda, Natalie. 2011. "Super Bowl Consumer Spending to Hit $10 Billion." AdAge.com, January 25. Available at: http://adage.com/article/special-report-super-bowl/super-bowl-consumer-spending-hit-10-billion/1484

Figure 1. Low birth weight (<2,500g), by year



Source: National Center for Health Statistics, Vital Statistics Data, 1969-2004.

Notes: The sample includes children who were conceived by mothers living in an NFL fan base area in October, November, or December. See the notes to Table 1 for a more detailed description of the sample.

Table 1. Descriptive statistics

Birth outcomes	**Full Sample**
Birth weight (in grams)	3,314.2
	(.2)
Low birth weight (<2,500g)	.0735
Gestation duration (in weeks)	39.0
	(.001)
Preterm birth (< 35 weeks gestation)	.0967
Multiple birth	.0242
Born in hospital	.9872
Father indicated on birth certificate	.8862
Mother's characteristics	
Age	26.6
	(.002)
Married	.6391
Unknown marital status	.0875
First born child	.4105
White	.7523
Black	.1956
Asian	.0446
Other race	.0074
Hispanic	.1937
Unknown Hispanic origin	.2558
Less than four high school	.2069
Four years of high school or some college	.4557
Four or more years of college	.1715
Education not reported	.1659
Alcohol use	.0159
Drinks per week (conditional on alcohol use)	2.9
	(.02)
Tobacco use	.1086
Cigarettes per day (conditional on tobacco use)	11.1
	(.01)
Sample Size	12,179,714

Source: National Center for Health Statistics, Vital Statistics Data, 1969-2004.

Notes: Standard errors for continuous variables are shown in parentheses. The sample includes children who were conceived by mothers living in an NFL fan base area in October, November, or December. Month of conception was assigned using gestation duration (in weeks) and month of birth. NFL fan base area was assigned using the mother's county of residence. If an NFL stadium was located in a county at any time during the period 1969 through 2004, then that county and its neighboring counties constitute an NFL fan base area. Hispanic origin questions first appeared in the vital statistics data in 1978; substance use questions first appeared in 1988.

Table 2A. The relationship between birth weight and Super Bowl exposure

	Birth Weight in Grams		Low Birth Weight (<2,500g)	
	(1)	(2)	(3)	(4)
Lost in Divisional Playoffs	-.82	-.81	.00005	.00005
	(.68)	(.69)	(.00023)	(.00023)
Lost in Conference Playoffs	2.40*	2.38*	-.0006	-.0006
	(1.23)	(1.20)	(.0004)	(.0004)
Played in Super Bowl	-3.28***		.0014***	
	(.86)		(.0004)	
Lost Super Bowl		.13		.00003
		(1.32)		(.00063)
Won Super Bowl		-6.05***		.0025***
		(1.28)		(.0006)
Sample Size	12,179,714	12,179,714	12,179,714	12,179,714

*Statistically significant at 10% level; **at 5% level; ***at 1% level.

Notes: Standard errors clustered at the NFL fan base level are shown in parentheses. Not reaching the divisional playoffs (the reference category), losing in the divisional playoff, losing in the conference playoff, and going to the Super Bowl are mutually exclusive and exhaustive events. All regressions include year fixed effects, area fixed effects, and area-specific linear time trends. In addition, they include indicators for month of conception, gender, hospital birth, multiple birth, mother's first birth, father indicated on birth certificate, mother's race, ethnicity, education, age, and marital status.

Table 2B. The relationship between birth weight and Super Bowl exposure, controlling for gestation duration

	Birth Weight in Grams		Low Birth Weight (<2,500g)	
	(1)	(2)	(3)	(4)
Lost in Divisional Playoffs	-.95	-.95	.0001	.0001
	(1.05)	(1.04)	(.0005)	(.0005)
Lost in Conference Playoffs	3.51	3.50	-.0011	-.0011
	(2.35)	(2.34)	(.0008)	(.0008)
Played in Super Bowl	.97		-.0003	
	(3.78)		(.0015)	
Lost Super Bowl		2.72		-.0010
		(5.57)		(.0023)
Won Super Bowl		-.45		.0003
		(3.06)		(.0013)
Gestation (in weeks)	98.41***	98.41***	-.0387***	-.0388***
	(1.48)	(1.48)	(.0009)	(.0009)
Sample Size	12,179,714	12,179,714	12,179,714	12,179,714

*Statistically significant at 10% level; **at 5% level; ***at 1% level.

Notes: Standard errors clustered at the NFL fan base level are shown in parentheses. Not reaching the divisional playoffs (the reference category), losing in the divisional playoff, losing in the conference playoff, and going to the Super Bowl are mutually exclusive and exhaustive events. All regressions include year fixed effects, area fixed effects, and area-specific linear time trends. In addition, they include indicators for month of conception, gender, hospital birth, multiple birth, mother's first birth, father indicated on birth certificate, mother's race, ethnicity, education, age, and marital status.

Table 3. The relationship between the Super Bowl and low birth weight by likely month of conception

Panel A	July	August	September	October	November	December
Played in Super Bowl	.0005	.0007	.0008	.0006	.0013*	.0023***
	(.0004)	(.0006)	(.0007)	(.0007)	(.0007)	(.0005)
Panel B	July	August	September	October	November	December
Lost Super Bowl	-.0007	-.0001	-.0005	-.0010	-.0011	.0022*
	(.0009)	(.0009)	(.0008)	(.0010)	(.0007)	(.0012)
Won Super Bowl	.0014**	.0013**	.0019**	.0019*	.0032***	.0024***
	(.0005)	(.0006)	(.0009)	(.0010)	(.0008)	(.0006)
Sample Size	3,695,186	3,798,373	3,772,941	4,052,021	4,013,913	4,113,780

*Statistically significant at 10% level; **at 5% level; ***at 1% level.

Notes: Standard errors clustered at the NFL fan base level are shown in parentheses. All regressions include year fixed effects, area fixed effects, and area-specific linear time trends. In addition, they include indicators for month of conception, gender, hospital birth, multiple birth, mother's first birth, father indicated on birth certificate, mother's race, ethnicity, education, age, and marital status.

Table 4. The relationship between low birth weight and Super Bowl exposure

	(1)	(2)	(3)	(4)
Lost in Divisional Playoffs	.00005	.00005	.00005	.00009
	(.00023)	(.00023)	(.00023)	(.00049)
Lost in Conference Playoffs	-.0006	-.0006	-.0006	-.0011
	(.0004)	(.0004)	(.0004)	(.0008)
Played in Super Bowl	.0014***			
	(.0004)			
Lost Super Bowl		-.00003		
		(.00063)		
Upset Loss			.0001	.0039**
			(.0012)	(.0018)
Unpredictable Loss			.0003	-.0024
			(.0010)	(.0042)
Predicted Loss			-.0002	-.0011
			(.0008)	(.0017)
Won Super Bowl		.0025***		
		(.0006)		
Upset Win			.0046***	.0034**
			(.0004)	(.0015)
Unpredictable Win			.0001	.0005
			(.0018)	(.0020)
Predicted Win			.0025***	-.0012
			(.0005)	(.0011)
Gestation (in weeks)				-.0388***
				(.0009)
Sample Size	12,179,714	12,179,714	12,179,714	12,179,714

*Statistically significant at 10% level; **at 5% level; ***at 1% level.

Notes: Standard errors clustered at the NFL fan base level are shown in parentheses. Not reaching the divisional playoffs (the reference category), losing in the divisional playoff, losing in the conference playoff, and going to the Super Bowl are mutually exclusive and exhaustive events. An upset/predicted win/loss occurred when the Las Vegas point spread was greater than or equal to four points. An unpredictable win/loss occurred when the Las Vegas point spread was less than four points. All regressions include year fixed effects, area fixed effects, and area-specific linear time trends. In addition, they include indicators for month of conception, gender, hospital birth, multiple birth, mother's first birth, father indicated on birth certificate, mother's race, ethnicity, education, age, and marital status.

Table 5. The relationship between the Super Bowl and low birth weight by mother's educational attainment

	No High School Degree		High School		College	
	(1)	(2)	(3)	(4)	(5)	(6)
Played in Super Bowl	.0019**		.0007		.0007	
	(.0008)		(.0005)		(.0007)	
Lost Super Bowl		-.0019		-.0001		.0009
		(.00168)		(.00068)		(.0012)
Won Super Bowl		.0047***		.0015		.0006
		(.0009)		(.0010)		(.0007)
Sample Size	2,519,958	2,522,619	5,550,522	5,550,522	2,088,446	2,088,446

*Statistically significant at 10% level; **at 5% level; ***at 1% level.

Notes: Standard errors clustered at the NFL fan base level are shown in parentheses. Not reaching the divisional playoffs (the reference category), losing in the divisional playoff, losing in the conference playoff, and going to the Super Bowl are mutually exclusive and exhaustive events. All regressions include year fixed effects, area fixed effects, and area-specific linear time trends. In addition, they include indicators for month of conception, gender, hospital birth, multiple birth, mother's first birth, father indicated on birth certificate, mother's race, ethnicity, age, and marital status.

Table 6. The relationship between the Super Bowl and low birth weight by mother's race/ethnicity

	White		Black		Hispanic	
	(1)	(2)	(3)	(4)	(5)	(6)
Played in Super Bowl	.0008**		.0036***		.0033***	
	(.0003)		(.0011)		(.0011)	
Lost Super Bowl		-.0004		.0010		.0017
		(.0006)		(.0019)		(.0016)
Won Super Bowl		.0017***		.0055***		.0045***
		(.0005)		(.0010)		(.0013)
Sample Size	9,163,341	9,163,341	2,382,340	2,382,340	2,359,590	2,359,590

*Statistically significant at 10% level; **at 5% level; ***at 1% level.

Notes: Standard errors clustered at the NFL fan base level are shown in parentheses. Not reaching the divisional playoffs (the reference category), losing in the divisional playoff, losing in the conference playoff, and going to the Super Bowl are mutually exclusive and exhaustive events. All regressions include year fixed effects, area fixed effects, and area-specific linear time trends. In addition, they include indicators for month of conception, gender, hospital birth, multiple birth, mother's first birth, father indicated on birth certificate, mother's, education, age, and marital status. Regressions for whites and blacks include controls for Hispanic origin. Regressions for Hispanics include controls for race.

Table 7. The relationship between the Super Bowl and low birth weight by mother's marital status

	Married		Single	
	(1)	(2)	(3)	(4)
Played in Super Bowl	.0007**		.0033***	
	(.0003)		(.0009)	
Lost Super Bowl		.0001		.0003
		(.0006)		(.0014)
Won Super Bowl		.0012**		.0058***
		(.0004)		(.0009)
Sample Size	7,784,343	7,784,343	3,329,771	3,329,771

*Statistically significant at 10% level; **at 5% level; ***at 1% level.

Notes: Standard errors clustered at the NFL fan base level are shown in parentheses. Not reaching the divisional playoffs (the reference category), losing in the divisional playoff, losing in the conference playoff, and going to the Super Bowl are mutually exclusive and exhaustive events. All regressions include year fixed effects, area fixed effects, and area-specific linear time trends. In addition, they include indicators for month of conception, gender, hospital birth, multiple birth, mother's first birth, father indicated on birth certificate, mother's race, ethnicity, education, and age.

Table 8. The relationship between alcohol use during pregnancy and Super Bowl exposure. Analysis restricted to the years 1989-2004.

	(1)	(2)	(3)
Lost in Divisional Playoffs	-.00036	-.00037	-.00035
	(.00051)	(.00051)	(.00051)
Lost in Conference Playoffs	-.0008	-.0009	-.0009
	(.0009)	(.0009)	(.0009)
Played in Super Bowl	.0018		
	(.0012)		
Lost Super Bowl		-.00196	
		(.00163)	
Upset Loss			.0022
			(.0020)
Unpredictable Loss			-.0008*
			(.0004)
Predicted Loss			-.0031
			(.0026)
Won Super Bowl		.0053**	
		(.0024)	
Upset Win			.0047*
			(.0027)
Unpredictable Win			.0012**
			(.0005)
Predicted Win			.0059**
			(.0027)
Sample Size	4,436,824	4,436,824	4,436,824

*Statistically significant at 10% level; **at 5% level; ***at 1% level.

Notes: Standard errors clustered at the NFL fan base level are shown in parentheses. Not reaching the divisional playoffs (the reference category), losing in the divisional playoff, losing in the conference playoff, and going to the Super Bowl are mutually exclusive and exhaustive events. An upset/predicted win/loss occurred when the Las Vegas point spread was greater than or equal to four points. An unpredictable win/loss occurred when the Las Vegas point spread was less than four points. All regressions include year fixed effects, area fixed effects, and area-specific linear time trends. In addition, they include indicators for month of conception, mother's first birth, mother's race, ethnicity, education, age, and marital status.

Table 9. The relationship between tobacco use during pregnancy and Super Bowl exposure. Analysis restricted to the years 1989-2004.

	(1)	(2)	(3)
Lost in Divisional Playoffs	-.00129*	-.00129*	-.00128*
	(.00073)	(.00073)	(.00073)
Lost in Conference Playoffs	.0012	.0012	.0012
	(.0018)	(.0018)	(.0018)
Played in Super Bowl	.0026*		
	(.0015)		
Lost Super Bowl		-.00068	
		(.00250)	
Upset Loss			.0101
			(.0060)
Unpredictable Loss			-.0013
			(.0009)
Predicted Loss			-.0015
			(.0040)
Won Super Bowl		.0055**	
		(.0026)	
Upset Win			.0037
			(.0032)
Unpredictable Win			.00002
			(.00102)
Predicted Win			.0069*
			(.0036)
Sample Size	4,343,232	4,343,232	4,343,232

*Statistically significant at 10% level; **at 5% level; ***at 1% level.

Notes: Standard errors clustered at the NFL fan base level are shown in parentheses. Not reaching the divisional playoffs (the reference category), losing in the divisional playoff, losing in the conference playoff, and going to the Super Bowl are mutually exclusive and exhaustive events. An upset/predicted win/loss occurred when the Las Vegas point spread was greater than or equal to four points. An unpredictable win/loss occurred when the Las Vegas point spread was less than four points. All regressions include year fixed effects, area fixed effects, and area-specific linear time trends. In addition, they include indicators for month of conception, mother's first birth, mother's race, ethnicity, education, age, and marital status.

Table 10. Most Exciting Super Bowls vs. Other Super Bowls

	Low Birth Weight (<2,500g)		Tobacco Use	Alcohol Use
Panel A	(1)	(2)	(3)	(4)
Played in Exciting Super Bowl	.0009	-.0005	.0058	.0057
	(.0015)	(.0033)	(.0062)	(.0056)
Played in Other Super Bowl	.0015***	-.0002	.0018	.0008
	(.0004)	(.0013)	(.0018)	(.0013)
Gestation (in weeks)		-.0388***		
		(.0009)		
Panel B	(5)	(6)	(7)	(8)
Exciting Super Bowl Win	.0028**	.0038	.0120*	.0131***
	(.0013)	(.0032)	(.0068)	(.0042)
Exciting Super Bowl Loss	-.0019	-.0073*	-.0021	-.0039
	(.0010)	(.0043)	(.0063)	(.0039)
Other Super Bowl Win	.0024***	-.0011	.0037**	.0031**
	(.0006)	(.0012)	(.0017)	(.0012)
Other Super Bowl Loss	.0006	.0008	-.0002	-.0013
	(.0006)	(.0017)	(.0025)	(.0016)
Gestation (in weeks)		-.0388***		
		(.0009)		
Sample Size	12,179,714	12,179,714	4,343,232	4,436,824

*Statistically significant at 10% level; **at 5% level; ***at 1% level.

Notes: Standard errors clustered at the NFL fan base level are shown in parentheses. Not reaching the divisional playoffs (the reference category), losing in the divisional playoff, losing in the conference playoff, and going to the Super Bowl are mutually exclusive and exhaustive events. An upset/predicted win/loss occurred when the Las Vegas point spread was greater than or equal to four points. An unpredictable win/loss occurred when the Las Vegas point spread was less than four points. All regressions include year fixed effects, area fixed effects, and area-specific linear time trends. In addition, they include indicators for month of conception, mother's first birth, mother's race, ethnicity, education, age, and marital status.

Appendix Table 1. Descriptive statistics, by Super Bowl exposure

	Not in Divisional	Played in Super Bowl	
Birth outcomes	Playoffs	Lost	Won
Birth weight (in grams)	3,314.3	3,312.2	3,292.6
	(.2)	(1.0)	(1.0)
Low birth weight (<2,500g)	.0736	.0737	.0784
Gestation length (in weeks)	39.0	38.9	38.9
	(.001)	(.004)	(.004)
Preterm birth (< 35 weeks gestation)	.0974	.0868	.0963
Multiple birth	.0244	.0250	.0240
Born in hospital	.9880	.9860	.9900
Father indicated on birth certificate	.8826	.8930	.8896
Mother's characteristics			
Age	26.6	26.7	26.8
	(.002)	(.011)	(.010)
Married	.6477	.6824	.6335
Unknown marital status	.0756	.0549	.1085
First born child	.4078	.4224	.4291
White	.7540	.7609	.7250
Black	.1948	.1878	.2131
Asian	.0439	.0435	.0534
Other Race	.0073	.0078	.0084
Hispanic	.1935	.1661	.1860
Unknown Hispanic origin	.2610	.2920	.2486
Less than four high school	.2140	.1579	.1924
Four years of high school or some college	.4675	.4479	.4247
Four or more years of college	.1740	.1869	.1809
Education not reported	.1445	.2073	.2019
Alcohol use	.0161	.0127	.0148
Drinks per week (conditional on alcohol use)	2.8	2.3	2.5
	(.03)	(.12)	(.09)
Tobacco use	.1110	.0872	.0815
Cigarettes per day (conditional on tobacco use)	11.1	1.7	1.1
	(.01)	(.08)	(.07)
Sample Size	8,966,017	313,773	389,471

Source: National Center for Health Statistics, Vital Statistics Data, 1969-2004.

Notes: Standard errors for continuous variables are shown in parentheses. The sample includes children who were conceived by mothers living in an NFL fan base area in October, November, or December. Month of conception was assigned using gestation duration (in weeks) and month of birth. NFL fan base area was assigned using the mother's county of residence. If an NFL stadium was located in a county at any time during the period 1969 through 2004, then that county and its neighboring counties constitute an NFL fan base area. Hispanic origin questions first appear in the Vital Statistics Data in 1978; substance use questions first appear in in 1988.

Appendix Table 2. Super Bowl outcomes, 1969-2004

Super Bowl	Date	Winning Team	Losing Team	Winner's Line
XXXVIII	2/1/2004	New England Patriots 32	Carolina Panthers 29	-7 (P)
XXXVII	1/26/2003	Tampa Bay Buccaneers 48	Oakland Raiders 21	+4 (U)
XXXVI	2/3/2002	New England Patriots 20	St. Louis Rams 17	+14 (U)
XXXV	1/28/2001	Baltimore Ravens 34	New York Giants 7	-3
XXXIV	1/30/2000	St. Louis Rams 23	Tennessee Titans 16	-7 (P)
XXXIII	1/31/1999	Denver Broncos 34	Atlanta Falcons 19	-7½ (P)
XXXII	1/25/1998	Denver Broncos 31	Green Bay Packers 24	+11 (U)
XXXI	1/26/1997	Green Bay Packers 35	New England Patriots 21	-14 (P)
XXX	1/28/1996	Dallas Cowboys 27	Pittsburgh Steelers 17	-13½ (P)
XXIX	1/29/1995	San Francisco 49ers 49	San Diego Chargers 26	-18½ (P)
XXVIII	1/30/1994	Dallas Cowboys 30	Buffalo Bills 13	-10½ (P)
XXVII	1/31/1993	Dallas Cowboys 52	Buffalo Bills 17	-6½ (P)
XXVI	1/26/1992	Washington Redskins 37	Buffalo Bills 24	-7 (P)
XXV	1/27/1991	New York Giants 20	Buffalo Bills 19	+7 (U)
XXIV	1/28/1990	San Francisco 49ers 55	Denver Broncos 10	-12 (P)
XXIII	1/22/1989	San Francisco 49ers 20	Cincinnati Bengals 16	-7 (P)
XXII	1/31/1988	Washington Redskins 42	Denver Broncos 10	+3
XXI	1/25/1987	New York Giants 39	Denver Broncos 20	-9½ (P)
XX	1/26/1986	Chicago Bears 46	New England Patriots 10	-10 (P)
XIX	1/20/1985	San Francisco 49ers 38	Miami Dolphins 16	-3½
XVIII	1/22/1984	LA Raiders 38	Washington Redskins 9	+3
XVII	1/30/1983	Washington Redskins 27	Miami Dolphins 17	+3
XVI	1/24/1982	San Francisco 49ers 26	Cincinnati Bengals 21	-1
XV	1/25/1981	Oakland Raiders 27	Philadelphia Eagles 10	+3
XIV	1/20/1980	Pittsburgh Steelers 31	Los Angeles Rams 19	-10½ (P)
XIII	1/21/1979	Pittsburgh Steelers 35	Dallas Cowboys 31	-3½
XII	1/15/1978	Dallas Cowboys 27	Denver Broncos 10	-6 (P)
XI	1/9/1977	Oakland Raiders 32	Minnesota Vikings 14	-4 (P)
X	1/18/1976	Pittsburgh Steelers 21	Dallas Cowboys 17	-7 (P)
IX	1/12/1975	Pittsburgh Steelers 16	Minnesota Vikings 6	-3
VIII	1/13/1974	Miami Dolphins 24	Minnesota Vikings 7	-6½ (P)
VII	1/14/1973	Miami Dolphins 14	Washington Redskins 7	-1
VI	1/16/1972	Dallas Cowboys 24	Miami Dolphins 3	-6 (P)
V	1/17/1971	Baltimore Colts 16	Dallas Cowboys 13	-2½
IV	1/11/1970	Kansas City Chiefs 23	Minnesota Vikings 7	+12 (U)
III	1/12/1969	New York Jets 16	Baltimore Colts 7	+18 (U)

Notes: The winner's line, also known as the point spread, is the predicted margin of victory (it is actually the predicted margin of victory odds makers believe will elicit an equal amount of betting on both teams). A negative line indicates that the team is a favorite, whereas a positive line indicates the team is an underdog (e.g. a positive number in the winner's line column indicates that the underdog team won the super bowl). A predicted outcome (P) occurs when the winner's line is less than or equal to -4. An upset (U) occurs when the winner's line is greater than or equal to +4. The outcomes of games with a point spread between -4 and +4 are considered unpredictable.

Appendix Table 3. The relationship between low birth weight and Super Bowl exposure with and without controlling for substance use. Analysis restricted to the years 1989-2004.

	(1)	(2)	(3)	(4)
Played in Super Bowl	.0007		.0004	
	(.0005)		(.0005)	
Lost Super Bowl		.0005		.0006
		(.0010)		(.0011)
Won Super Bowl		.0009		.0003
		(.0007)		(.0005)
Alcohol use			.043***	.043***
			(.009)	(.009)
Tobacco use			.054***	.054***
			(.002)	(.002)
Sample Size	6,639,664	6,639,664	6,639,664	6,639,664

*Statistically significant at 10% level; **at 5% level; ***at 1% level.

Notes: Standard errors clustered at the NFL fan base level are shown in parentheses. Not reaching the divisional playoffs (the reference category), losing in the divisional playoff, losing in the conference playoff, and going to the Super Bowl are mutually exclusive and exhaustive events. All regressions include year fixed effects, area fixed effects, and area-specific linear time trends. In addition, they include indicators for month of conception, gender, hospital birth, multiple birth, mother's first birth, father indicated on birth certificate, mother's race, ethnicity, age, and marital status.

Appendix Table 4. The relationship between substance use during pregnancy and Super Bowl exposure by mother's educational attainment. Analysis restricted to the years 1989-2004.

Panel A: Alcohol Use	No High School Degree		High School		College	
Played in Super Bowl	.0009		.0014		.0035*	
	(.0013)		(.0012)		(.0020)	
Lost Super Bowl		-.0001		-.0020		-.0034
		(.0023)		(.0015)		(.0029)
Won Super Bowl		.0016		.0048**		.0102*
		(.0013)		(.0019)		(.0051)
Sample Size	948,476	948,476	2,268,945	2,268,945	1,116,956	1,116,956

Panel B: Tobacco Use	No High School Degree		High School		College	
Played in Super Bowl	.0045		.0025		.0022	
	(.0028)		(.0019)		(.0017)	
Lost Super Bowl		.0037		-.0008		-.0038
		(.0047)		(.0024)		(.0034)
Won Super Bowl		.0050		.0055**		.0078
		(.0031)		(.0023)		(.0056)
Sample Size	934,357	934,357	2,217,524	2,217,524	1,087,607	1,087,607

*Statistically significant at 10% level; **at 5% level; ***at 1% level.

Notes: Standard errors clustered at the NFL fan base level are shown in parentheses. Not reaching the divisional playoffs (the reference category), losing in the divisional playoff, losing in the conference playoff, and going to the Super Bowl are mutually exclusive and exhaustive events. All regressions include year fixed effects, area fixed effects, and area-specific linear time trends. In addition, they include indicators for month of conception, gender, hospital birth, multiple birth, mother's first birth, father indicated on birth certificate, mother's race, ethnicity, age, and marital status.

Appendix Table 5. The relationship between substance use during pregnancy and Super Bowl exposure, by mother's race/ethnicity. Analysis restricted to the years 1989-2004.

Panel A: Alcohol Use	White		Black		Hispanic	
Played in Super Bowl	.0022		.0007		.0003	
	(.0015)		(.0015)		(.0005)	
Lost Super Bowl		-.0022		-.0006		.0006
		(.0019)		(.0016)		(.0008)
Won Super Bowl		.0061*		.0022		.0001
		(.0030)		(.0021)		(.0011)
Sample Size	3,223,935	3,223,935	995,327	995,327	862,155	862,155

Panel B: Tobacco Use	White		Black		Hispanic	
Played in Super Bowl	.0025		.0040*		-.0008	
	(.0016)		(.0022)		(.0009)	
Lost Super Bowl		-.0015		.0035		.0009
		(.0027)		(.0031)		(.0019)
Won Super Bowl		.0057*		.0045*		-.0021
		(.0033)		(.0024)		(.0023)
Sample Size	3,151,128	3,151,128	976,115	976,115	854,023	854,023

*Statistically significant at 10% level; **at 5% level; ***at 1% level.

Notes: Standard errors clustered at the NFL fan base level are shown in parentheses. Not reaching the divisional playoffs (the reference category), losing in the divisional playoff, losing in the conference playoff, and going to the Super Bowl are mutually exclusive and exhaustive events. All regressions include year fixed effects, area fixed effects, and area-specific linear time trends. In addition, they include indicators for month of conception, gender, hospital birth, multiple birth, mother's first birth, father indicated on birth certificate, mother's, education, age, and marital status. Regressions for whites and blacks include the controls *Hispanic* and *Unknown Hispanic origin*. Regressions for Hispanics include controls for race.

Appendix Table 6. The relationship between substance use during pregnancy and Super Bowl exposure by mother's marital status. Analysis restricted to the years 1989-2004.

Panel A: Alcohol Use	Married		Single	
Played in Super Bowl	.0024		.0011	
	(.0014)		(.0016)	
Lost Super Bowl		-.0024		-.0009
		(.0019)		(.0018)
Won Super Bowl		.0065*		.0033*
		(.0033)		(.0017)
Sample Size	2,918,965	2,918,965	1,517,859	1,517,859

Panel B: Tobacco Use	Married		Single	
Played in Super Bowl	.0027*		.0032	
	(.0015)		(.0028)	
Lost Super Bowl		-.0010		.0004
		(.0030)		(.0029)
Won Super Bowl		.0057		.0061
		(.0039)		(.0037)
Sample Size	2,852,043	2,852,043	1,491,189	1,491,189

*Statistically significant at 10% level; **at 5% level; ***at 1% level.

Notes: Standard errors clustered at the NFL fan base level are shown in parentheses. Not reaching the divisional playoffs (the reference category), losing in the divisional playoff, losing in the conference playoff, and going to the Super Bowl are mutually exclusive and exhaustive events. All regressions include year fixed effects, area fixed effects, and area-specific linear time trends. In addition, they include indicators for month of conception, gender, hospital birth, multiple birth, mother's first birth, father indicated on birth certificate, mother's race, ethnicity, education,
and age.

Appendix Table 7. The relationship between drinks per week during pregnancy and Super Bowl exposure. Analysis restricted to the years 1989-2004.

	(1)	(2)	(3)
Lost in Divisional Playoffs	.057	.059	.058
	(.103)	(.103)	(.103)
Lost in Conference Playoffs	-.123	-.124	-.125
	(.150)	(.150)	(.150)
Played in Super Bowl	-.177		
	(.116)		
Lost Super Bowl		-.249	
		(.154)	
Upset Loss			-.209
			(.218)
Unpredictable Loss			-.185
			(.118)
Predicted Loss			-.261
			(.174)
Won Super Bowl		-.121	
		(.137)	
Upset Win			-.289
			(.216)
Unpredictable Win			.156
			(.105)
Predicted Win			-.097
			(.180)
Sample Size	52,291	52,291	52,291

*Statistically significant at 10% level; **at 5% level; ***at 1% level.

Notes: The sample is restricted to mothers who used alcohol during pregnancy. Standard errors clustered at the NFL fan base level are shown in parentheses. Not reaching the divisional playoffs (the reference category), losing in the divisional playoff, losing in the conference playoff, and going to the Super Bowl are mutually exclusive and exhaustive events. An upset/predicted win/loss occurred when the Las Vegas point spread was greater than or equal to four points. An unpredictable win/loss occurred when the Las Vegas point spread was less than four points. All regressions include year fixed effects, area fixed effects, and area-specific linear time trends. In addition, they include indicators for month of conception, mother's first birth, mother's race, ethnicity, education, age, and marital status.

Appendix Table 8. The relationship between cigarettes per day during pregnancy and Super Bowl exposure. Analysis restricted to the years 1989-2004.

	(1)	(2)	(3)
Lost in Divisional Playoffs	.027	.027	.026
	(.031)	(.031)	(.030)
Lost in Conference Playoffs	-.022	-.022	-.023
	(.068)	(.068)	(.068)
Played in Super Bowl	-.082		
	(.075)		
Lost Super Bowl		-.062	
		(.132)	
Upset Loss			-.372
			(.388)
Unpredictable Loss			-.209***
			(.069)
Predicted Loss			-.009
			(.158)
Won Super Bowl		-.100	
		(.071)	
Upset Win			-.198
			(.183)
Unpredictable Win			.302***
			(.066)
Predicted Win			-.118
			(.079)
Sample Size	439,077	439,077	439,077

*Statistically significant at 10% level; **at 5% level; ***at 1% level.

Notes: The sample is restricted to mothers who used tobacco during pregnancy. Standard errors clustered at the NFL fan base level are shown in parentheses. Not reaching the divisional playoffs (the reference category), losing in the divisional playoff, losing in the conference playoff, and going to the Super Bowl are mutually exclusive and exhaustive events. An upset/predicted win/loss occurred when the Las Vegas point spread was greater than or equal to four points. An unpredictable win/loss occurred when the Las Vegas point spread was less than four points. All regressions include year fixed effects, area fixed effects, and area-specific linear time trends. In addition, they include indicators for month of conception, mother's first birth, mother's race, ethnicity, education, age, and marital status.