Abuse: A risk factor for low birth weight? A systematic review and meta-analysis

Research

Recherche

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This article has been peer reviewed.

CMAJ 2001;164(11):1567-72

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Abstract

Background: Abuse during pregnancy is considered to be a potentially modifiable risk factor for low birth weight (LBW). We conducted a systematic review and meta-analysis to determine the strength of association between physical, sexual or emotional abuse during pregnancy and LBW.

Methods: We selected papers for review from an electronic search of MEDLINE (1966–1999), CINAHL (1982–1997) and the Cochrane Library. We retrieved articles using the following MeSH headings and keywords: "infant low birth weight," "fetus," "perinatal care," "pregnancy," "prenatal care," "infant mortality," "violence," "battered women," "spouse abuse," "infant morbidity," "antenatal" and "neonatal." When necessary, we contacted authors to obtain data that were not included in the published material. We analyzed the methodological quality of each eligible study and selected those of the highest quality for meta-analysis.

Results: We reviewed 14 studies, of which 8 were selected for meta-analysis. Using a fixed-effects model, we found that women who reported physical, sexual or emotional abuse during pregnancy were more likely than nonabused women to give birth to a baby with LBW (odds ratio 1.4, 95% confidence interval 1.1–1.8).

Interpretation: Abuse may be part of a complex interaction of factors that contribute to LBW.

In Canada, the prevention of low birth weight (LBW), which is defined as a birth weight that is less than 2500 g regardless of gestational age, is a health care priority.[1] In 1995, the Canadian rate of LBW among live newborns was 5.8%. In developed countries such as Canada, LBW accounts for most neonatal mortality and contributes significantly to infant and childhood morbidity, as well as to rising health care costs. The prevention of LBW, however, poses a challenge in perinatal care. LBW may result from a broad range of biological, behavioural and socioeconomic problems.[1]

Abuse directed at pregnant women is recognized as a significant societal and public health issue.[2] Canadian studies suggest that 5.5%–6.6% of women are abused during pregnancy.[3,4] The Canadian Institute of Child Health identifies abuse during pregnancy as one of several modifiable risk factors for LBW.[1] However, the results of research on the association between violence during pregnancy and LBW appear to be mixed.[5]

The purpose of this systematic review and meta-analysis was to determine whether there is evidence for an association between physical, sexual or emotional abuse during pregnancy and LBW. If such an association exists, there is a need to study possible interventions to reduce abuse and its associated LBW risks. It may then be possible to reduce LBW rates through collaborative efforts between medical practitioners and promoters of community health.[1]

Methods

We selected papers for review from an electronic search of MEDLINE (1966–1999),

CINAHL (1982–1997) and the Cochrane Library. We retrieved articles using the following MeSH headings and keywords: "infant low birth weight," "fetus," "perinatal care," "pregnancy," "prenatal care," "infant mortality," "violence," "battered women," "spouse abuse," "infant morbidity," "antenatal" and "neonatal." We cross-checked references to articles. Abstracts from the Congress of the International Federation of Gynecologists and Obstetricians were examined. We did not attempt to locate unpublished studies. We contacted authors of selected studies to obtain data that were not included in the published material.

We selected studies if they met the following eligibility criteria: they were case–control or cohort studies published as a paper or abstract in English, and they focused on women abused during pregnancy or pregnant women living in a relationship that was abusive in the past, or both. Studies were chosen regardless of the relationship of the perpetrator to the victim, if they included clear definitions of physical, sexual or emotional abuse, or some combination of these, and examined the outcome of mean birth weight or LBW.

We used Bracken's[6] guidelines for observational studies to analyze the methodological quality of the eligible studies. Key domains included hypothesis, materials and methods, results and conclusions. We developed a grading system and tabulated scores on the basis of whether a study completely fulfilled, partially fulfilled or failed to fulfill applicable criteria. Two of us (C.M. and B.S.) independently calculated a percentage score. The scores awarded were then averaged for each study. Our findings are reported according to guidelines suggested by Thacker and colleagues[7] and by Greenhalgh.[8]

A meta-analysis was performed using a fixed-effects model. We calculated odds ratios for each study and combined them across studies, giving weight according to the inverse of variance in each separate study. The Mantel–Haenszel χ^2 statistic was used to combine the odds ratios. The Breslow–Day χ^2 statistic was calculated to test for possible heterogeneity among the calculated odds ratios.

Results

A total of 537 articles were retrieved. The majority of the papers were excluded on the basis of being noncontributory, such as clinical guidelines, antenatal health policy or prevalence studies that did not measure pregnancy outcomes. One study identified by an English abstract was written in Spanish and was translated for this review.[9] Fourteen studies met the eligibility criteria for the systematic review.

Two of us (C.M. and B.S.) independently assessed all the papers. Interrater reliability was moderate (intraclass correlation coefficient = 0.58).[10] The scores awarded by each author were then averaged for each study. These final scores clustered in 2 groups, fulfilling 55%–70% or 75%–90% of Bracken's criteria. We selected all studies that had a combined quality score of 75% or more for our meta-analysis.

The characteristics of the studies selected for meta-analysis are outlined in Table 1. The research was conducted in the United States, Australia and Norway.[11–18] Two case–control studies were included,[16,18] in which women who delivered an infant with LBW were compared with women who delivered infants of normal birth weight. In the Norwegian study,[16] participants (86 cases, 92 controls) were recruited consecutively from the University Hospital of Trondheim, which serves a geographically defined population, and thus represents the only study based on a population sample. The study by Campbell and colleagues[18] differed from the others in that separate analyses were conducted for infants over 38 weeks' gestation (63 cases, 189 controls) and under 38 weeks' gestation (238 cases, 88 controls).

Sample sizes ranged from 178 to 1897 women.[11–18] Amaro and colleagues,[11] Berenson and colleagues,[12] McFarlane and colleagues,[14] and Curry and colleagues[17] performed cohort studies of predominantly low-income and minority women. The study by Dye and colleagues[13] was unique in that it was the only selected study conducted in a rural setting. Finally, Webster and colleagues[15] studied a large cohort of Australian prenatal patients.

The wide range of prevalence rates of abuse in pregnancy documented in the studies selected for meta-analysis (5.6%–16.6%)[11–18] may reflect actual differences in the specific clinical populations or geographic locations. The wide variation may also be attributed to the definitions of abuse employed by researchers, the methods of ascertainment of exposure to abuse and the time period of the inquiry. For example, Webster and colleagues[15] inquired about physical, sexual and emotional abuse. Dye and colleagues[13] relied on a 2-question abuse screen, and Amaro and colleagues[11] used one question related to physical abuse or threats. In contrast, Berenson and colleagues,[12] McFarlane and colleagues,[14] Grimstad and colleagues,[16] Curry and colleagues[17] and Campbell and colleagues[18] used specific abuse-focused instruments. These instruments, which have been previously validated in the research literature on violence and pregnancy, included the Abuse Assessment Screen,[19] the Index of Spouse Abuse[19] and the Conflict Tactics Scale.[20]

The time and frequency of inquiries about abuse varied across the studies. Most studies interviewed women during the prenatal period.[11–15,17] Four studies reported conducting only one interview during the prenatal period.[12,13,15,17] McFarlane and colleagues[14] interviewed women 3 times during the prenatal period. Amaro and colleagues[11] interviewed once prenatally and once in the postpartum period. Campbell and colleagues[18] interviewed once within 72 hours of delivery, and Grimstad and colleagues[16] interviewed women during the postpartum period or 1 year after delivery.

For the meta-analysis, data were extrapolated from each study to assess the impact of abuse that occurred during the current pregnancy. This was not possible for the Norwegian study.[16] For this study, the data included in the meta-analysis were based on women abused in the current pregnancy or the current relationship, or both.

The definition of the outcome of LBW is a standard measurement of morbidity accepted as birth weight of less

than 2500 g.[1] Two studies[12,17] defined LBW as less than or equal to 2500 g. The cause of LBW may stem from prematurity or poor intrauterine growth. In most studies, however, the mechanisms for LBW were not addressed separately.

The research findings are summarized in Table 2. In studies that only provided the percentages of LBW infants,[13–14] raw data were extrapolated using the totals in each exposure group. We contacted 3 authors[11,15,17] to obtain the number of LBW infants in the exposure groups.

Only one study[14] revealed a significant association between abuse and LBW. This study found that pregnant women who were abused were 1.8 times more likely to deliver a child with LBW (95% CI 1.1–2.9). However, after adjusting for age, ethnic origin, marital status, education, parity, poor obstetric history, inadequate weight gain, interpregnancy interval, infection, hemorrhage, anemia, smoking, and alcohol and drug use, this relation was no longer statistically significant.[14]

Three cohort studies[13–15] found statistically significant associations between abuse and mean birth weight. In the studies by McFarlane and colleagues[14] and Webster and colleagues,[15] the unadjusted mean birth weight was significantly lower for babies of abused women (133 g lower and 132 g lower respectively). On adjustment for differences in age, smoking, alcohol, education, ethnic origin, marital status, parity, number of terminations, antenatal visits and gestational age, Webster and colleagues[15] found that the relation between mean birth weight and current abuse was no longer statistically significant. The association between abuse and mean birth weight (164 g lower, $p < 0.05$) uncovered by Dye and colleagues[13] was not adjusted for confounders.

In a multiple regression analysis, controlling for biomedical risk, age, ethnic origin, smoking, and marijuana and other drug use, Curry and colleagues[17] found a statistically significant abuse and smoking interaction and an abuse and marijuana interaction associated with birth

Table 1: Characteristics of studies included in the meta-analysis

Study	Sample size	Study design/ recruitment/ study period	Interview period	Abuse/by whom/when(measure)
Amaro et al[11]	1664 - interviewed 1243 - delivery data 1226 - LBW data	Cohort/ Consecutive/ 07/14/1984–06/30/1987	During prenatal and postpartum period	Physically threatened or abused, or involved in fights or beatings/ By someone (94% knew their assailant)/ During current pregnancy
Berenson et al[12]	512 - interviewed 440 - delivery data 384 - analyzed*	Cohort/ Consecutive/ 05/08/1998–12/01/1998	First prenatal visit to clinic	Slapped, kicked, hit, or otherwise physically hurt/ By someone/ During current pregnancy (modified March of Dimes questionnaire)
Dye et al[13]	364 - interviewed 357 - delivery data	Cohort/ Selective/ not reported	Prenatal visit	Involved in a physical fight or physically hurt/ By someone/ During current pregnancy
McFarlane et al[14]	1203 - interviewed 1058 - delivery data 941 - analyzed*	Cohort/ Selective/ 01/1990–01/1993	First prenatal visit, second and third trimesters	Physical or sexual abuse/ By someone (77% abused by [ex] husband/ boyfriend)/ During current pregnancy (Abuse Assessment Screen)
Webster et al[15]	1014 - interviewed 940 - delivery data 923 - LBW data	Cohort/ Consecutive/ 12/1992	Prenatal visit	Emotional, physical or sexual abuse/ By partner/ During current pregnancy
Grimstad et al[16]	86 - LBW cases 92 - non-LBW controls	Case–control/ Consecutive/ 18-m period 1992–1994	Postpartum at maternity ward or 1 yr after delivery	Physical or sexual abuse/ By current partner/ Ever during relationship (modified Conflict Tactics Scales)
Curry et al[17]	1897 - interviewed 1597 - delivery data	Cohort/ Selective/ 03/1993–08/1996	Prenatal visit (mean 16 wk)	Physical or sexual abuse/ By someone/ During current pregnancy (Abuse Assessment Screen)
Campbell et al[18]	301 - LBW cases 277 - non-LBW controls	Case–control/ Selective, ethnic group sampling/ 1991–1996	During 72-h period after delivery	Physical or sexual abuse/ By current partner/ During current pregnancy (Index of Spouse Abuse ≥ 10 modified to reflect current pregnancy)

Note: Low birth weight (LBW) was defined as birth weight less than 2500 g, except for 2 studies[12,17] in which LBW was defined as less than or equal to 2500 g. No definition was provided in one study.[13]

*Excludes women reporting abuse in the past but not during pregnancy.

weight. For women who reported abuse, smoking and the use of marijuana increased the risk of delivering an infant with a lower birth weight.

A standard test for heterogeneity found that the pooled data were homogeneous and appropriate to test our general hypothesis that women who reported physical, sexual or emotional abuse during pregnancy were more likely than nonabused women to give birth to a baby with LBW. When the 8 studies were entered into the meta-analysis, an odds ratio of 1.4 was found (95% CI 1.1–1.8) (Fig. 1). To further examine our findings, we performed a sensitivity analysis. Removing the 2 case–control studies from the meta-analysis reduced the odds ratio to 1.3 (95% CI 1.0–1.8).

Interpretation

In our meta-analysis, we found a significant association between abuse and LBW. These findings are similar to those of the systematic review[21] by Peterson and colleagues of 7 research papers on violence and adverse outcomes of pregnancy. They found that only 2 pregnancy outcomes, mean birth weight and the incidence of LBW, appeared in more than one study to be

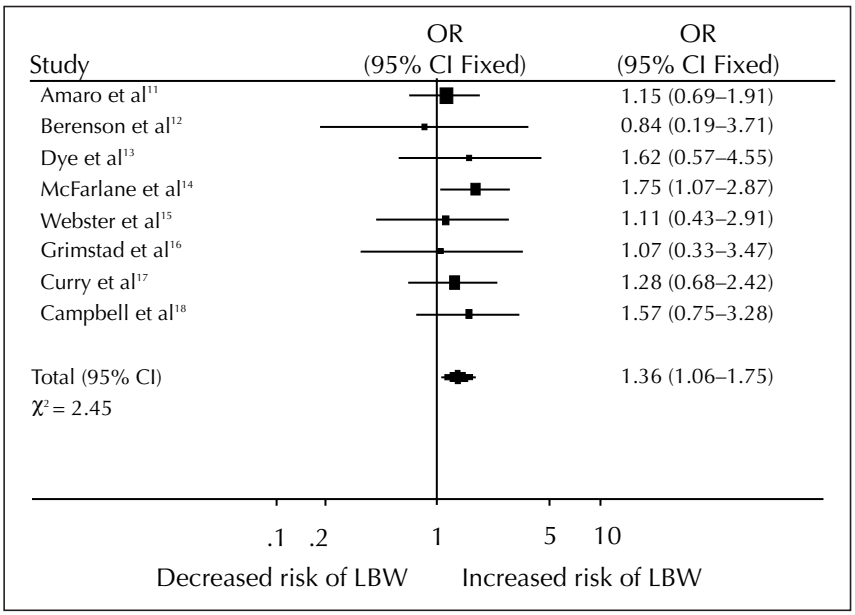

Fig. 1: Odds ratios for an association between abuse during pregnancy and low birth weight (LBW). CI = confidence interval.

Table 2: Results of studies included in the meta-analysis

Study	No. (and %) of abused women in sample*	No. (and %) of LBW infants: Abused mothers	No. (and %) of LBW infants: Nonabused mothers	Odds ratio (95% CI)	Mean birth weight data for babies of abused mothers compared with babies of nonabused mothers
Amaro et al[11]†	168/1226 (13.7)	20/168 (11.9)	111/1058 (10.5)	1.2 (0.7–1.9)	Adjusted mean difference: –19 g (95% CI –115 g to 78 g)
Berenson et al[12]	32/384 (8.3)	2/32 (6.2)	25/339‡§ (7.4)	0.8 (0.2–3.7)	Mean difference: –21 g Adjusted mean difference: not significant¶
Dye et al[13]	54/357 (15.1)	5/54 (9.3)	18/303 (5.9)	1.6 (0.6–4.6)	Mean difference: –164 g, $p < 0.05$
McFarlane et al[14]	176/1058 (16.6)	25/176 (14.2)	66/765§ (8.6)	1.8 (1.1–2.9)	Mean difference: –133 g Adjusted mean difference: $p < 0.05$
Webster et al[15]†	52/923 (5.6)	5/52 (9.6)	57/654§ (8.7)	1.1 (0.4–2.9)	Mean difference: –132 g, $p = 0.01$** Adjusted mean difference: $p = 0.20$
Grimstad et al[16]	Not applicable	6/12 (50.0)	80/166 (48.2)	1.1 (0.3–3.5)	Not reported
Curry et al[17]†	163/1597 (10.2)	12/163 (7.4)	69/1181§ (5.8)	1.3 (0.7–2.4)	Adjusted mean difference: significant abuse–smoking and abuse–marijuana interactions ($p = 0.02$, $p = 0.004$)
Campbell et al[18]	Not applicable	20/32 (62.5)	281/546 (51.5)	1.6 (0.8–3.3)	Not reported

Note: CI = confidence interval.
*Number of women for whom complete delivery data were available.
†Data obtained by personal correspondence with author.
‡Missing LBW data.
§ Excludes women abused in the past but not during pregnancy.
¶ *P* values and CIs not reported.
**Comparison is between women who were not abused and those reporting past or current abuse.

statistically associated with abuse during pregnancy. However, their review differed from ours in several ways. The authors did not perform a meta-analysis, nor were the studies assessed according to methodological quality. Finally, some of the papers included in their review were different from those included in our review.

The relation between adverse outcome of pregnancy and abuse during pregnancy may occur through direct and indirect mechanisms.[22] Direct mechanisms involve trauma to the pregnant abdomen leading to premature labour, rupture of membranes, placental abruption or a ruptured uterus.[22–24] Indirect mechanisms may stem from the abusive environment.[22] Women who are abused during pregnancy may be more likely to use nicotine, alcohol, and prescription, over-the-counter and illicit drugs.[4,12–15,17,25–27] Abuse during pregnancy has been associated with low socioeconomic status, poor maternal weight gain, anemia, an unhealthy diet, sexually transmitted diseases and psychological morbidity.[4,11,17,18,28] These variables, as well as stress and lack of social support, have been identified as risk factors for LBW.[1] It has been argued that if the health risks associated with abuse are sequelae of violence, then abuse may be a previously unrecognized cause of LBW.[14,15]

We acknowledge certain limitations of this meta-analysis. The variation in the definition of exposure and outcome used in each of the studies considered here may have altered the association between abuse and LBW. Individual patient interpretation of abuse may vary, making it harder to determine a reliable association. Reporting bias could also have led to the misclassification of abused women into a nonabused exposure group. Although 2 of us (C.M. and B.S.) conducted the assessment of study quality using a standard method, it was not done in a blinded fashion. Furthermore, the second author had been involved in 2 of the studies, and one of these was included in the meta-analysis. Finally, the number of studies available for review that were subsequently included in the meta-analysis was small. The study populations were predominately of lower socioeconomic status. The combination of data from more studies, with varied populations of women, would enhance generalizability and statistical power, thereby allowing for a more complete assessment of the impact of abuse on LBW.

Further research is needed on the influence of social factors on physiology and pregnancy outcomes[29] and the mechanisms through which abuse may affect birth weight. Several authors[2,30] have made recommendations to improve the investigation of violence and pregnancy. These include better methods to compare the frequency and severity of violence both during pregnancy and not during pregnancy, methods to study the context in which the violence occurs, and clarification of the role of risk factors in the association of violence and LBW. The US Centers for Disease Control and Prevention aim to standardize measures of abuse.[31] When these methodological improvements occur, a more definitive conclusion on the relation of abuse to LBW will be possible.

In the meantime, we need to strengthen the trend toward the assessment of psychosocial issues during pregnancy as a standard of care. The Society of Obstetricians and Gynaecologists of Canada recommends prenatal screening and the identification of women who are victims of abuse.[32] Other Canadian initiatives include the Antenatal Psychosocial Health Assessment (ALPHA) form, which can be used as a guide for health care providers to assess risk factors, such as abuse, that are associated with poor postpartum outcomes.[33] Questions about abuse could also be entered into databases such as the Canadian Perinatal Surveillance System.[34] A high index of suspicion among prenatal care providers is needed. The identification of violence during antenatal care may help identify women at risk of delivering a baby with LBW. Future research should address whether intervention strategies improve perinatal outcomes in women who experience abuse during pregnancy.

Competing interests: None declared.

Contributors: Dr. Murphy made a substantial contribution to the design and execution of the study and the data analysis. She also wrote the first draft of the paper. Dr. Schei made a substantial contribution to the design and execution of the study and assisted in extracting the data and in revising the paper. Ms. Myhr extracted and analyzed the data and made a substantial contribution to the revisions of the paper. Dr. Du Mont made a substantial contribution to the design and execution of the study and assisted in revising the manuscript.

Acknowledgements: We thank Drs. Nick Pimlott, Stephen Holzaphel and Rick Glazier for their insightful comments on an earlier draft of this paper.

We acknowledge the Atkinson Foundation for funding the Atkinson Chair in Women's Health Research, held by Dr. Berit Schei at the Centre for Research in Women's Health, a partnership of the Sunnybrook & Women's College Health Sciences Centre and the University of Toronto, Toronto, Ont.

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