Pregnancy-Associated Assault Hospitalizations: Prevalence and Risk of Hospitalized Assaults Against Women During Pregnancy[1]

By Harold B. Weiss, Bruce A. Lawrence, and Ted R. Miller

2004
NCJ 199706

Harold B. Weiss, Ph.D., M.P.H., is with the Center for Injury Research and Control, University of Pittsburgh. Bruce A. Lawrence, Ph.D., and Ted R. Miller, Ph.D., are with the Pacific Institute for Research and Evaluation.

This project study was supported under award number 1998–WT–VX–0016 from the National Institute of Justice, Office of Justice Programs, U.S. Department of Justice. The work was based in part on methods pioneered by Jesse Greenblatt, Andrew Dannenberg, and Christopher Johnson. The authors gratefully acknowledge the invaluable assistance of Karen Zuri in coordinating the data requested from all the States.

Violence against women during pregnancy is an issue that elicits broad interest. It is disturbing even to imagine that violence can intrude upon this poignant period in a woman's life. But intimate partner violence, if it exists in a relationship prior to pregnancy, does not always stop because a woman becomes pregnant. Furthermore, the answer to the question of whether it is more likely to begin, increase, or decrease during this period has remained elusive.

Violence against pregnant women has received a fair amount of attention in the literature through three perspectives. The most common has addressed issues related to fetal outcome. These studies have examined the impact of violence on fetal outcomes such as low birthweight, prematurity, or mortality (Bullock and McFarlane, 1989; Gazmararian et al., 1996; Parker, McFarlane, and Soeken, 1994; Cokkinides et al., 1999; Berenson et al., 1994; Dye et al., 1995; Campbell et al., 1999; McFarlane, Parker, and Soeken, 1996; Murphy et al., 2001). Complementing these studies are those that explore the impact of violence on maternal health and look at physical, reproductive, and psychological parameters of health and disease (Gazmararian et al., 1995; Campbell, Moracco, and Saltzman, 2000; Campbell, 1998; Campbell et al., 1995; Gazmararian et al., 2000).

Both fetal and maternal perspectives benefit from a third focus that measures the prevalence of violence against pregnant or recently pregnant women to understand whether pregnancy changes the risk or nature of violence. The older literature on violence and pregnancy often reported higher rates of violence against pregnant women than against women who were not pregnant (Gelles, 1974; Eisenberg and Micklow, 1997; Berrios and Grady, 1991). However, these findings began to be questioned when it was found that both violence and pregnancy rates are higher in younger women (Gelles, 1988). Design weaknesses (nonpopulation-based, small shelter- or clinic-based populations, lacking representativeness), differences in definitions of violence (physical, sexual, threats, psychological), different periods of coverage (violence around the time of pregnancy compared with violence during pregnancy), and a lack of comparison populations have left the question of pregnancy and the risk of violence unanswered (Gazmararian et al., 1996; Campbell, 2001; Campbell, Moracco, and Saltzman, 2000; Gazmararian et al., 2000; Ballard et al., 1998).

Although most victims of violence against women are not hospitalized, focusing on hospitalized cases has several advantages. First, it highlights serious injury, not often considered separately in the spectrum of such incidents. This is important because of the severity of the injury to the individual, the increased risk to the fetus, and the cost to society. Second, the existence of large population-based hospital discharge data systems makes it possible to examine the prevalence of violence against pregnant women and make comparisons, even though, relatively speaking, serious assaults to pregnant women make up a small proportion of all injuries. Third, hospital data are standardized across States, making aggregation and comparison on a large scale feasible. Fourth, discharge data contain charge information and can be used to model cost estimates. Finally, unlike clinic and emergency department settings, where the encounter is brief, hospital inpatients have more time to confide in and relate the abusive nature of their injuries to health care personnel.

The first population-based study of hospitalized maternal injury was conducted in 1997 by Greenblatt, Dannenberg, and Johnson, who looked at Maryland hospital discharge data for the

12-year period from 1979 to 1990. Among 80,311 injured women ages 15 to 45, 2.7 percent were reported to be pregnant. Ten percent of the injuries involving pregnant women were assault-related, and the rate ratio (comparing pregnant patients to all women ages 15 to 45) for assault-related hospitalization was 1.14 (not statistically significant). Although this study brought a fresh understanding of this serious problem and used creative methodological approaches, it contained several drawbacks, including incomplete E-coding (external cause of injury codes used for mechanism and intent) and use of screening codes that were not as refined or as expansive as desired. Further, the study was done before accreditation mandates for hospital identification of victims of abuse were common. Recognizing these issues, the authors recommended that their analyses of pregnancy-associated injury hospitalizations be repeated.

This recommendation was taken up in a study by Weiss, who borrowed from the Greenblatt study's methods and applied them to Pennsylvania's 1995 hospital discharge data (Weiss, 1999). This study, which had more diagnosis fields to search and an improved search algorithm, found that 761 (4.6 percent) of the discharges of injured women of reproductive age were associated with pregnancy. Rate ratios were significantly higher for assaults [rate ratio = 3.04, 95 percent confidence interval (*CI*) = 2.45, 3.78], with the increased risk concentrated in young women. This study recognized the challenge of differentiating between how much of the observed increases were due to increased injury rates compared with increased hospitalization rates because of evidence that pregnant women are more likely than nonpregnant women to be hospitalized for minor conditions (Greenblatt, Dannenberg, and Johnson, 1997; Poole et al., 1996). However, the small numbers of pregnancy-associated assaults in that study (89) limited the utility of trying to adjust for this concern. In addition, there were no perpetrator codes in 1995 from which one might distinguish intimate partner violence from other forms of violence. The current study fills those gaps by focusing on assault-related hospitalizations from a large, population-based, multi-State hospital discharge database.

Materials and Methods

Specific Aims

The study hypothesis was whether the hospitalization rate for assault was higher among pregnant women than among all women of reproductive age (ages 15 to 49), once controlled for age and severity. Secondary aims included quantifying the prevalence of hospitalized assaults in a large population-based sample of pregnant women and comparing and contrasting the patterns of assault injury mechanisms, severity, demographics, and costs.

Data Sources

Data were solicited from States that mandated E-coding for 2 years or more or had an E-code completeness rate of 90 percent or better and at least five diagnosis fields to search for pregnancy-associated codes. Three States that had large populations and fairly good completeness (> 60 percent) but had not mandated E-coding were also included (this lowered the overall E-coding rate but enhanced case finding). The data collection year of 1997 was chosen because it was the first complete year that perpetrator-specific codes and improved ICD–9–CM E-coding guidelines for intent were used (International Classification of Diseases, version 9, Clinical Modification), and it followed by 2 years the adoption of Joint Commission on

Accreditation of Healthcare Organizations hospital screening rules for domestic violence. States were contacted and arrangements were made to receive nonconfidential versions of statewide discharge data. Data were received from 19 States (Arizona, California, Florida, Maine, Maryland, Massachusetts, Michigan, Nebraska, New Hampshire, New Jersey, New York, Pennsylvania, Rhode Island, South Carolina, Utah, Vermont, Virginia, Washington, and Wisconsin) whose populations made up 51.9 percent of U.S. women ages 15 to 49. These 19 States represented the hospitalization experience of 36 million women who were residents of those States and 1.9 million resident births (National Center for Health Statistics, 1999). The combined dataset covered complete counts from about 2,000 hospitals and 13 million discharges for women, of which 176,267 were injuries to women ages 15 to 49.

Database Preparation and Case Selection

The data underwent extensive editing, filtering, grouping, and development of derived variables to enhance compatibility, ICD coding validity, and usability. Detailed algorithms were applied to identify injuries based on both diagnosis codes and E-codes and to exclude cases of noninjury such as complications of surgical and medical care, injuries coded only by place of injury, adverse effects of therapeutic drugs, and late effects of injury.

Costs were imputed for each record using a model derived from charges listed in the discharge record and diagnosis codes. Inputs into the cost model included data from the National Medical Expenditure Survey (NMES), the National Health Interview Survey (NHIS), Civilian Health and Medical Program of the Uniformed Services (CHAMPUS) [now TRICARE], and national and State hospital discharge systems. Monetary measures in this study included total hospital charges, lifetime medical costs, lifetime productivity loss, and lifetime monetized quality-adjusted life years (QALY). Costs were not assigned to duplicate records, readmissions, or fatalities. Costs were estimated in 1996 dollars separately for medical and other direct costs, and quality-of-life loss (Gold and Siegel, 1996). These methods are detailed elsewhere (Lawrence et al., 2000).

Injury severity was calculated using ICD–MAP (Tri-Analytics Inc., Bel Air, Mississippi), a computerized injury coder that assigns injury severity scores (ISS) based on ICD–9–CM injury diagnoses. ISS is a widely used severity score derived from an anatomically based threat-to-life scale that ranges from 1 (minor) to 75 (unsurvivable) (MacKenzie, 1984). Drug and alcohol involvement were determined by searching for coexisting drug- or alcohol-related diagnoses.

Pregnancy association was defined by examining diagnosis fields for ICD–9–CM diagnostic codes, including 630–669.9 (complications of pregnancy and childbirth) and 760–779.9 (certain conditions originating in perinatal period), and “V” codes, including V22 (normal pregnancy), V23 (supervision of high-risk pregnancy), V24 (postpartum care immediately after delivery), V27 (outcome of delivery), and V28 (antenatal screening).

The above steps were applied to all age- and gender-injury discharges (n = 1,220,506). The cases were progressively limited to females ages 15 to 49 (n = 176,267) with acute care visits (n = 156,713) who had a valid E-code assigned (n = 144,260), who were residents of the State (n = 137,887), and who had an assault-related hospitalization (n = 7,402).

Analyses

Incidence rates were calculated per 100,000 person-years. For the pregnant population, denominators were derived from State-specific birth data and adjusted downward to account for the 9-month period of gestation and the assumption that during the first 2 months of pregnancy the pregnancies would not be detectable in the hospital discharge data. For example, if there were 100,000 live births per year, multiplying 100,000 by 7/12 represents the actual person-years of exposure, i.e., the person-years for which women could have had their pregnancies identified.

Rate ratios were constructed between pregnant women and all women for different comparison groups. This comparison, rather than a pregnant versus "nonpregnant" group contrast, was done for several reasons. After subtracting known pregnant cases, the referent group still contains some pregnant women in the first 2 months of their pregnancy and other pregnant women not detected by the diagnosis algorithm. Thus, it would be a misnomer to label it a nonpregnant group. Second, because the desire is to compare pregnant women to nonpregnant women, the comparison takes into account the 5-month period of every pregnancy year in which pregnant women are not detectably pregnant (i.e., pregnant women contribute person-years to both groups because they are not pregnant over an entire year). In most instances, the issue of comparing the pregnancy-associated injuries to the entire group or the entire group minus the person-years of the pregnancy-associated injuries is academic: The rates for all reproductive age women are similar to nonpregnant women of the same age because, for most comparisons, 80 to 90 percent of women ages 15 to 49 are not pregnant at any given time (Dannenberg et al., 1995).

Rate ratios were calculated by dividing the group-specific (age, race, mechanism, intent, etc.) rate for pregnancy-associated injury discharges by the group-specific injury rate. In accordance with previous methods (Greenblatt, Dannenberg, and Johnson, 1997), consequences of multiple births and spontaneous and induced abortions in the person-year calculations were ignored because of their small impact and the difficulty of obtaining accurate enumerations of these conditions in the study population. Point and 95 percent *CI* estimates of the rate ratio, comparing the pregnant and all injured women ages 15 to 49, were computed according to standard methods (Rosner, 1994).

Two subsets were reported. First, assaults were analyzed to present prevalence rates and rate ratios for specific subgroups. Second, to adjust for the increased propensity of pregnant women to be hospitalized because they are pregnant, assaults were reanalyzed for cases with an injury severity score of four or greater.

Results

E-coding was 92 percent complete among women ages 15 to 49 with an injury-related diagnosis. This left 137,887 resident women ages 15 to 49 discharged from nonrehabilitation hospitals with an acute injury diagnosis and a valid E-code mechanism/intent. There were 7,402 assault-related discharges for a rate of 21/100,000 person-years. Pregnancy-associated cases made up 10 percent of all assaults to women ages 15 to 49.

Among injured females ages 15 to 49 with a pregnancy-associated diagnosis, 14 percent of injuries (745/5,498) were assault related (rate = 65/100,000 person-years); for all injured women, it was 5 percent (7,402/137,887, rate = 21/100,000 person-years). The rate ratio was 3.14 (95 percent *CI* = 2.04 to 3.39).

Among nonwhite injured females with a pregnancy-associated diagnosis, 21 percent of injuries (427/2,082) were assault related; among whites, 9 percent (235/2,635) were assault related. The rate of pregnancy-associated assaults was almost seven times higher in nonwhites (178/100,000 person-years) than whites (26/100,000 person-years). However, the rate ratio was elevated similarly among both whites (2.65, 95 percent *CI* = 1.41, 3.03) and nonwhites (3.34, 95 percent *CI* = 2.55, 3.69). Among nonwhites ages 15 to 19, the rate of pregnancy-associated assaults per 100,000 person-years was 341 (rate ratio = 5.54 (95 percent *CI* = 4.32, 6.73).

Those experiencing pregnancy-associated assaults were on average younger compared with all women ages 15 to 49 (mean age = 24.2 versus 30.8 years). The proportion of pregnancy-associated assaults within each age group climbed sharply after age 16, peaked at age 19, and declined slowly thereafter (see exhibit 1). The pregnancy-associated rates and rate ratios were highest in the youngest age group and declined with age (see exhibit 2).

Exhibit 1. Pregnancy-associated hospitalized assaults as a proportion of all assaults by single year of age, ages 15 to 45, 19 States, 1997 (*n* = 745 pregnancy-related cases).

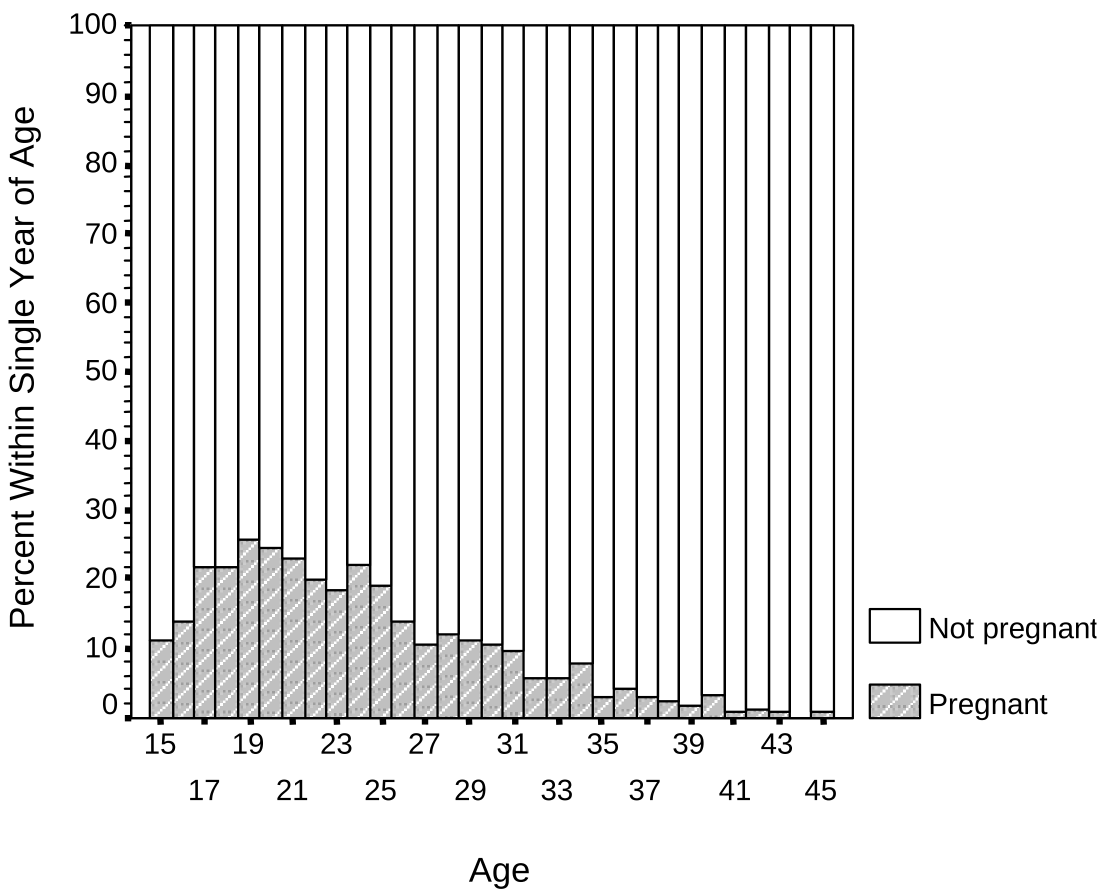
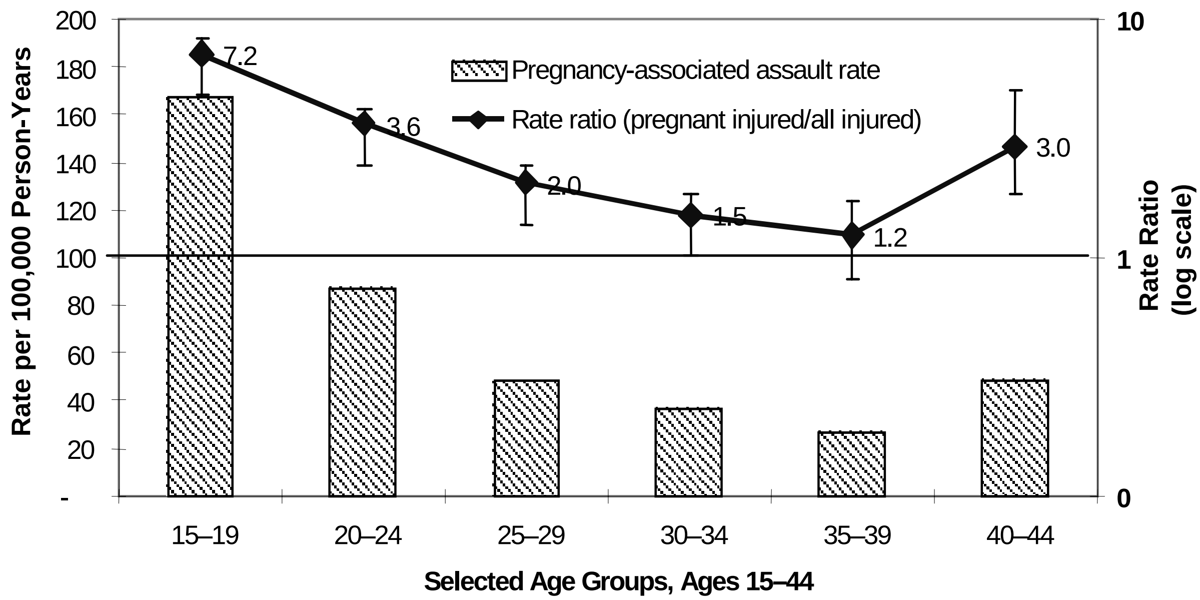


Exhibit 2. Rate of assault-related hospitalized pregnancy-associated injuries per 100,000 person-years and rate ratio (pregnant injured women/all injured women) for ages 15 to 44, 19 States, 1997 (*n* = 745 pregnancy-related cases, 95 percent *CI* shown).



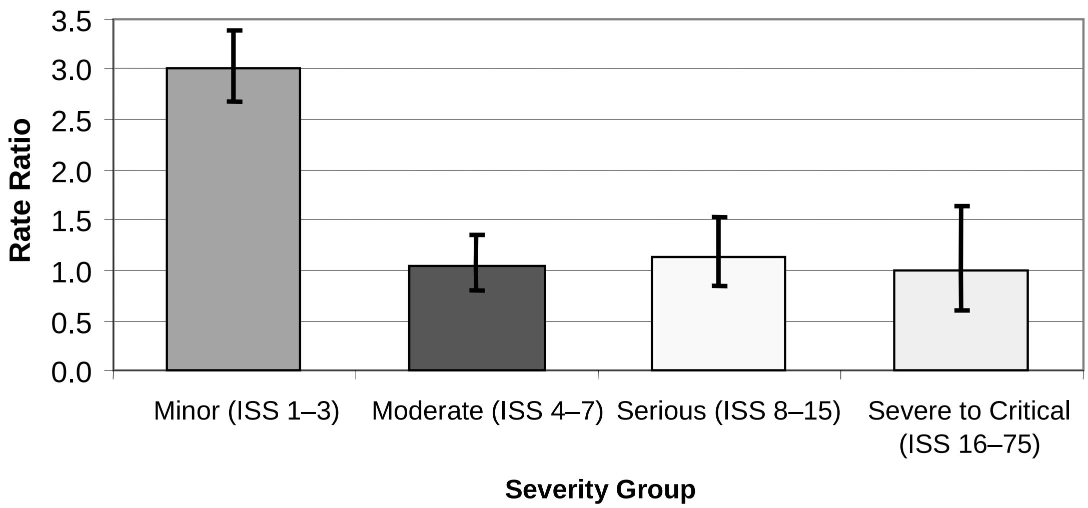
The leading mechanism of assaultive injury was “struck by or against” (46.7 percent, 348/746) with a rate ratio of 3.58 (95 percent *CI* = 3.20, 4.00). Pregnancy-associated assaults were more likely to be nonfatal (rate ratio 3.13, 95 percent *CI* = 2.93, 3.41) and to involve a short length of stay (rate ratio for 1-day length of stay = 5.02, 95 percent *CI* = 4.50, 5.60). The average length of stay was shorter for the pregnancy-associated assaulted women: 2.6 days compared with 4.0 for all women ages 15 to 49.

Pregnancy-associated cases were more likely to be paid for by Medicaid (rate ratio = 4.49, 95 percent *CI* = 4.06, 4.98). The median charge per visit was $3,351 for pregnancy-associated women and $6,775 for all women. Respective total charges for lifetime medical loss sum and lifetime monetized QALY (rounded) were $4,926,000, $6,296,162, and $71,620,000 for pregnancy-associated cases and $89,245,000, $111,545,000, and $1,689,194,000 for all assaults. Among the top three body parts targeted for assault were (pregnancy-associated rates per 100,000 person-years and rate ratios): trunk, 14.7 (rate ratio 19.6, 95 percent *CI* = 16.2, 23.7); face, 8.9 (rate ratio 2.0, 95 percent *CI* = 1.6, 2.4); and abdomen and pelvic organs, 8.2 (rate ratio 3.8, 95 percent *CI* = 3.1, 4.7).

Perpetrator coding was incomplete for both pregnancy-associated and all assaults. Among pregnancy-associated assaults, 22.6 percent were accompanied by a perpetrator-related E-code; for all assaulted women, 8.8 percent were accompanied by a perpetrator-related E-code. Among the cases that were perpetrator coded, 88 percent and 83.7 percent were spouse or partner related among pregnancy-associated and all assaults, respectively.

The mean ISS among the pregnancy-associated assaulted women was 2.5, while the mean ISS among all women was 4.9. Exhibit 3 shows the rate ratio of assault-related hospital discharges by severity group.

Exhibit 3. Rate ratio of assault-related hospitalized pregnancy-associated injuries per 100,000 person-years (pregnant injured women/all injured women) by severity group for ages 15 to 49, 19 States, 1997 (*n* = 422, with 95 percent *CI* shown).



There was a significantly increased rate ratio for minor injuries (ISS < 4) but not for the moderate, serious, and severe injuries. This finding was the basis for the severity adjustment, used below, which eliminated all assault-related cases with minor injuries from rate comparisons.

Assaults With ISS ≥ 4

Exhibit 4 details the frequency, rates, and rate ratios of selected characteristics for hospitalized assaults in the subgroup of seriously injured cases.

By proportionally eliminating the less severe pregnancy-associated cases, most rate ratios were reduced and were not significantly different from 1. The overall rate ratio fell to a nonsignificant 1.07 (95 percent *CI* = 0.57, 1.28). However, rate ratios were significantly elevated for a few subgroups, including the youngest age group (rate ratio = 2.49, 95 percent *CI* = 1.31, 3.63) and firearm-related assaults (rate ratio = 1.55, 95 percent *CI* = 1.07, 2.23).

Among the top four body parts targeted for assault (by frequency), pregnancy-associated rates per 100,000 person-years and rate ratios were as follows: abdomen and pelvic organs, 2.1 (rate ratio 1.6, 95 percent *CI* = 1.1, 2.4); skull and brain, 2.0 (rate ratio 1.0, 95 percent *CI* = 0.7, 1.5); face, 1.4 (rate ratio 0.9, 95 percent *CI* = 0.5, 1.5); and upper extremity, 1.4 (rate ratio 1.1, 95 percent *CI* = 0.7, 1.9).

Exhibit 4. Rates of pregnancy-associated hospitalized assaults and rates for all women of reproductive age (15 to 49) with ISS ≥ 4 by selected characteristics, 19 States, 1997

Variable	Value	Pregnant Women No.	Rate	All Women No.	Rate	Rate Ratio	95% *CI*
Race	White	33	4	1,341	5	0.78	(0.31, 1.10)
	Nonwhite (excludes unknown)	75	31	1,747	25	1.27	(0.85, 1.60)
	Total	108		3,088			
Hispanic	Yes	25	10	407	8	1.20	(0.61, 1.80)
	No	76	8	2,388	8	1.09	(0.54, 1.37)
	Total	101		2,795			
Age	15–19	29	23	431	9	2.49	(1.31, 3.63)
	20–24	30	12	451	10	1.12	(0.61, 1.62)
	25–29	27	8	550	11	0.76	(0.42, 1.13)
	30–34	22	8	625	11	0.68	(0.38, 1.04)
	35–39	7	5	670	11	0.45	(0.25, 0.96)
	40–44	3	*	458	8		
	45–49	–	–	272	6		
	Total	118	10	3,457	10	1.07	(0.57, 1.28)
Age/Race—White	15–19	7	8	138	4	2.08	(0.76, 4.45)
	20–24	10	5	153	4	1.13	(0.45, 2.14)
	25–29	8	3	211	5	0.58	(0.25, 1.17)
	30–34	6	3	223	5	0.51	(0.21, 1.14)
	35–39	1	*	255	5		
	40–44	1	*	230	5		
	45–49	–	–	131	3		
	Total	33	4	1,341	5	0.78	(0.31, 1.10)
Age/Race—Nonwhite	15–19	19	53	239	24	2.17	(1.46, 3.46)
	20–24	17	29	244	26	1.09	(0.75, 1.79)
	25–29	18	29	288	27	1.07	(0.73, 1.72)
	30–34	13	25	326	29	0.87	(0.60, 1.52)
	35–39	6	24	346	30	0.77	(0.54, 1.74)
	40–44	2	*	185	18		
	45–49	–	–	119	14		
	Total	75	31	1,747	25	1.27	(0.86, 1.61)
Severity	Minor (ISS 1–3)	–	–	–	–	–	
	Moderate (ISS 4–7)	59	5	1,767	5	1.04	(0.80, 1.35)
	Serious (ISS 8–15)	43	4	1,188	3	1.13	(0.83, 1.53)
	Severe to Critical (ISS 16–75)	16	1	502	1	0.99	(0.60, 1.63)
Length of stay	1 Day	31	3	1,081	3	0.89	(0.62, 1.28)
	2–3 Days	38	3	1,032	3	1.15	(0.83, 1.58)
	4–7 Days	14	1	351	1	1.24	(0.73, 2.12)
	8–14 Days	7	1	164	0	1.33	(0.62, 2.83)
	2 Weeks +	1	*	88	0	*	
Payer source	Medicare	1	*	88	0	*	
	Medicaid	65	6	1,298	4	1.56	(1.22, 2.00)
	Worker's Comp	–	–	37	0	–	
	Other Gov't	6	1	217	1	0.86	(0.38, 1.94)
	BC/Commerc/PPO	9	1	482	1	0.58	(0.30, 1.12)
	HMO	8	1	455	1	0.55	(0.27, 1.10)
	Self-Pay	22	2	687	2	1.00	(0.65, 1.52)
	Charity, NoChg	2	*	80	0	*	
	Other	2	*	38	0	*	
	Unknown	–	–	7	0	–	

*Rates and ratios not computed for cells with 5 or fewer observations.
[a]Rates are presented as discharges per 100,000 person-years.
Cells with no observations indicated by –

Discussion

Implications for Future Research

While hospital discharge data have significant advantages, they also have disadvantages. Waller and colleagues described these as they relate to violence against women (Waller, Martin, and Ornstein, 2000). They include concerns about quality and completeness of intent and perpetrator coding, difficulty detecting conditions that are not injury related (stress, depression, and other diseases), and possible duplicate counts. Although the data suggested that most hospitalized assaults were spouse or partner related, the low percentage of perpetrator-coded cases dictates interpreting this data cautiously. Regarding duplicate counts, individuals would have needed multiple admissions with both a pregnancy and an assault code, rendering multiple admissions in the study population less likely.

Other limitations stem from the etiologic nature of the study design. Individual women were not followed up, thus the study did not elucidate violence patterns before, during, or after pregnancy. The study also failed to describe the relationship of violence to pregnancy intendedness, sexual assault, gestational age, previous births, parity, prenatal care, pregnancy outcome, marital status, or relationship of the fetus to the assailant. Understanding these patterns is important, but it remains for future longitudinal research to characterize.

The assumption that population rates computed for all reproductive-age women are similar to nonpregnant women of the same age slightly lowers the power to show differences in risk between the pregnant and nonpregnant groups and has a potential for introducing bias by age, race, and other factors associated with the probability of being pregnant. Pregnancy-associated cases made up as much as 25 percent of assault cases for some age groups (10.1 percent overall). This was corrected, however, in the severely injured group, where pregnancy-associated cases did not make up such a large proportion (3.4 percent overall).

Hospital discharge data are affected by the quality of coding among contributing hospitals (Smith, Langlois, and Buechner, 1991; Sniezek, Finklea, and Graitcer, 1989; Marganitt et al., 1990). For intentional injuries, methods for screening and documentation are not always specified and may vary among locales. As long as these vagaries are consistently applied within and among hospitals, the results contrasting pregnant women may be more valid from a comparative standpoint but less so from a vantage that seeks accurate prevalence rates. Miscoding and undercounting will occur, but it is difficult to conjecture how systematic inclusions of pregnancy-associated codes among nonpregnant women—the type of error that could most affect the results—would happen. However, it is acknowledged that interhospital coding differences, combined with variation in hospital-specific rates, could lead to some confounding and clustering effects.

Another limitation is that women in early pregnancy are not likely or, at best, are much less likely than women in later pregnancy to have the pregnancy identified and coded during a hospital stay. These cases will be misclassified into the nonpregnant group. Therefore, a diagnosis-based pregnancy definition, such as that used in the current study, is biased toward detection of later gestation pregnancies and does not measure risks in early pregnancy. Future studies in this area would greatly benefit from routine pregnancy screening among young women and documentation of the results in the summary discharge record and data systems.

Implications for Practitioners

This is the first study to address the prevalence and risk of pregnancy-associated hospitalized assaults in a multi-State population. It describes a significant increase in the rate ratio for pregnancy-associated assaults but demonstrates that age-specific rate ratios are markedly reduced once adjusted for injury severity. Overall, after severity adjustment, there was no significantly elevated rate ratio, but moderate increases remained among the youngest women ages 15 to 19 and for firearm-related assaults.

Most other studies of assault and pregnancy have focused on populations from small clinics or mostly urban populations, which are often overrepresented by socially disadvantaged minorities. Because most severe injuries will be seen in a hospital, regardless of race, social, and economic class, the present findings represent demographic comparisons that cut across all ages, urban and rural areas, socioeconomic groups, insurance coverage, race, and time. Thus, a clearer picture emerges of which population groups are likely to be victims of serious assault.

In conclusion, pregnant women suffer high rates of assault, not because they are pregnant, but because they are likely to be members of a demographic group (young women) that is more vulnerable to violence in general. Pregnancy also lowers the hospital admission threshold for most traumatic injuries, including assaults. It may be helpful for practitioners to think of pregnant women as a "sensitive" population, rather than an "at-risk" population. As a sensitive population, whose extra care means substantially increased health care costs, pregnant women make up a group worth addressing for preventive efforts in conjunction with broader efforts aimed at reducing the differential of the rate of assault during pregnancy by socioeconomic status and race. Although the poor use of perpetrator codes in the data clouds the issue of separating intimate partner violence from stranger assaults, it can also challenge practitioners to improve medical record documentation and screening. Overall, these findings can be used to better prioritize and target effective injury prevention efforts (McFarlane et al., 1998) aimed toward young women for the benefit of both the mother and the fetus.

Note

[1] Reprinted from *Obstetrics and Gynecology*, 100(4) (2002): 773–780, with permission from the American College of Obstetricians and Gynecologists. Portions of this study were presented at the National Institute of Justice Violence Against Women Conference, Washington, D.C., October 2000, and the National Association of Injury Control Research Centers, National Research Symposium, Pittsburgh, Pennsylvania, May 25, 2001.

References

Ballard, T., Saltzman, L.E., Gazmararian, J., Spitz, A.M., Lazorick S., and Marks, J.S. (1998). "Violence During Pregnancy: Measurement Issues." *American Journal of Public Health*, 88(2), 274–276.

Berenson, A., Wiemann, C., Wilkinson, G., Jones, W., and Anderson, G. (1994). "Perinatal Morbidity Associated With Violence Experienced by Pregnant Women." *American Journal of Obstetrics and Gynecology,* 170(6), 1760–1769.

Berrios, D.C., and Grady, D. (1991). "Domestic Violence: Risk Factors and Outcomes." *Western Journal of Medicine,* 155(2), 133–135.

Bullock, L., and McFarlane, J. (1989). "The Birth-Weight/Battering Connection." *American Journal of Nursing,* 1153–1155.

Campbell, J., Torres, S., Ryan, J., King, C., Campbell, D.W., Stallings, R.Y., and Fuchs, S.C. (1999). "Physical and Nonphysical Partner Abuse and Other Risk Factors for Low Birth Weight Among Full Term and Preterm Babies: A Multiethnic Case-Control Study." *American Journal of Epidemiology,* 150(7), 714–726.

Campbell, J.C. (2001). "Abuse During Pregnancy: A Quintessential Threat to Maternal and Child Health—So When Do We Start To Act?" *Canadian Medical Association Journal,* 164(11), 1578–1579.

Campbell, J.C., Moracco, K.E., and Saltzman, L.E. (2000). "Future Directions for Violence Against Women and Reproductive Health: Science, Prevention, and Action." *Maternal and Child Health Journal,* 4(2), 149–154.

Campbell, J. (1998). "Abuse During Pregnancy: Progress, Policy, and Potential." *American Journal of Public Health,* 88(2), 185–187.

Campbell, J., Pugh, L., Campbell, M., and Visscher, M. (1995). "The Influence of Abuse on Pregnancy Intention." *Women's Health Issues,* 5(4), 214–223.

Cokkinides, V.E., Coker, A.L., Sanderson, M., Addy, C., and Bethea, L. (1999). "Physical Violence During Pregnancy: Maternal Complications and Birth Outcomes." *Obstetrics and Gynecology,* 93(5 Pt 1), 661–666.

Dannenberg, A., Carter, D., Lawson, H., Ashton, D., Dorfman, S., and Graham, E. (1995). "Homicide and Other Injuries as Causes of Maternal Death in New York City, 1987 Through 1991." *American Journal of Obstetrics and Gynecology,* 172(5), 1557–1564.

Dye, T., Tolivert, N., Lee, R., and Kenney, C. (1995). "Violence, Pregnancy and Birth Outcome in Appalachia." *Paediatric and Perinatal Epidemiology,* 9, 35–47.

Eisenberg, S., and Micklow, P. (1997). "The Assaulted Wife: 'Catch 22 Revisited.'" *Women's Rights Law Reporter*, 3, 138–161.

Gazmararian, J.A., Petersen, R., Spitz, A.M., Goodwin, M.M., Saltzman, L.E., and Marks, J.S. (2000). "Violence and Reproductive Health: Current Knowledge and Future Research Directions." *Maternal and Child Health Journal,* 4(2), 79–84.

Gazmararian, J., Adams, M., Saltzman, L., Johnson, C., Bruce, F., Marks, J., Zahniser, S., and Prams Working Group. (1995). "The Relationship Between Pregnancy Intendedness and Physical Violence in Mothers of Newborns." *Obstetrics and Gynecology,* 85(6), 1031–1038.

Gazmararian, J., Lazorick, S., Spitz, A., Ballard, T., Saltzman, L., and Marks, J. (1996). "Prevalence of Violence Against Pregnant Women." *JAMA,* 275 (24), 1915–1920.

Gelles, R. (1974). *The Violent Home: A Study of Physical Aggression Between Husbands and Wives.* Beverly Hills, CA: Sage Publications.

Gelles, R. (1988). "Violence and Pregnancy: Are Pregnant Women at Greater Risk of Abuse?" *Journal of Marriage and Family,* 50, 841–847.

Gold M., and Siegel, J. (1996). *Cost-Effectiveness in Health and Medicine.* New York: Oxford University Press.

Greenblatt, J.F., Dannenberg, A.L., and Johnson, C.J. (1997). "Incidence of Hospitalized Injuries Among Pregnant Women in Maryland, 1979–1990." *American Journal of Preventive Medicine,* 13(5), 374–379.

Lawrence, B.A., Miller, T.R., Jensen, A.F., Fisher, D.A., and Zamula, W. (2000). "Estimating the Costs of Non-Fatal Consumer Product Injuries in the United States." *Injury Control and Safety Promotion,* 7(2), 97–113.

MacKenzie, E. (1984). "Injury Severity Scales: Overview and Directions for Future Research." *American Journal of Emergency Medicine,* 2, 537–549.

Marganitt, B., MacKenzie, E., Smith, G., and Damiano, A.M. (1990). "Coding External Causes of Injury "E-codes" in Maryland Hospital Discharges 1979–88: A Statewide Study to Explore the Uncoded Population." *American Journal of Public Health,* 80, 1463–1466.

McFarlane, J., Parker, B., and Soeken, K. (1996). "Abuse During Pregnancy: Associations With Maternal Health and Infant Birth Weight." *Nurse Researcher,* 45(1), 37–42.

McFarlane, J., Parker, B., Soeken, K., Silva, C., and Reel, S. (1998). "Safety Behaviors of Abused Women After an Intervention During Pregnancy." *Journal of Obstetrics, Gynecology, and Neonatal Nursing,* 27(1), 64–69.

Murphy, C.C., Schei, B., Myhr, T.L., and Du Mont, J. (2001). "Abuse: A Risk Factor for Low Birth Weight? A Systematic Review and Meta-Analysis." *Canadian Medical Association Journal,* 164(11), 1567–1572.

National Center for Health Statistics, Centers for Disease Control and Prevention, U.S. Department of Health and Human Services. (1999). 1997 Natality data set. Series No. 21 (9) compact disc.

Parker, B., McFarlane, J., and Soeken, K. (1994). “Abuse During Pregnancy: Effects on Maternal Complications and Birth Weight in Adult and Teenage Women.” *Obstetrics and Gynecology*, 84(3), 323–328.

Poole, G., Martin, J., Perry, K., Griswold, J., Lambert , C., and Rhodes, R. (1996). “Trauma in Pregnancy: The Role of Interpersonal Violence.” *American Journal of Obstetrics and Gynecology*, 174(6), 1873–1878.

Rosner, B. (1994). *Fundamentals of Biostatistics.* 4th ed. Belmont, CA: Duxbury Press.

Smith, G., Langlois, J., and Buechner, J. (1991). “Methodological Issues in Using Hospital Discharge Data to Determine the Incidence of Hospitalized Injuries.” *American Journal of Epidemiology*, 134, 1146–1158.

Sniezek, J., Finklea, J., and Graitcer, P.L. (1989). “Injury Coding and Hospital Discharge Data.” *JAMA*, 262, 2270–2272.

Waller, A.E., Martin, S.L., and Ornstein, M.L. (2000). “Health Related Surveillance Data on Violence Against Women.” *Violence Against Women*, 6(7), 868–903.

Weiss, H. (1999). “Pregnancy-Associated Injury Hospitalizations in Pennsylvania, 1995.” *Annals of Emergency Medicine*, 34(5), 626–636.