Pregnancy-Associated Assault Hospitalizations

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OBJECTIVE: To determine the rate of pregnancy-associated hospitalized assaults in a multistate population and whether they have any increased assault risk versus nonpregnant counterparts.

METHODS: An International Classification of Diseases, 9th Revision (ICD-9-CM) pregnancy and injury criterion was applied to 1997 statewide hospital discharge data from 19 states (52% of the female population age 15–49 years). Cases were classified as assault-related with and without pregnancy-associated diagnoses. Pregnancy-associated and all women were compared using demographic specific rate ratios and severity stratification.

RESULTS: There were 7402 assault-related injuries among all women ages 15–49; 745 (10%) were pregnancy-associated. The incidence of assaults involving hospitalizations was 65 per 100,000 person-years for pregnant women versus 21 per 100,000 for all women (rate ratio 3.14; 95% confidence interval [CI] 2.04, 3.39). Pregnant women were younger (mean age 24.2 versus 30.8 years), their average length of stay was shorter (2.6 versus 4.0 days), their mean injury severity score was less (2.5 versus 4.9), and the median charge per stay was lower ($3351 versus $6775). Unadjusted age-specific rate ratios (pregnant versus all women) for assaults were significantly higher for younger women 15–19 (rate ratio 7.22; 95% CI 4.81, 8.38), but when restricted to cases with injury severity scores of at least 4, most differences in rate ratios disappeared, except in the youngest women.

CONCLUSION: While pregnant women were more likely to be hospitalized for assaults, most of the increase is associated with their lower hospital admission threshold and increased rates of both pregnancy and assaults among young and nonwhite women. Practitioners should perhaps think of pregnant women more as a "sensitive" rather than a "high-risk" group. (Obstet Gynecol 2002;100:773–80.

The National Institute of Justice has estimated that 79,000 women a year, mostly young, are hospitalized because of physical assault, usually perpetrated by male acquaintances.[1] Many of these women are pregnant at the time of the assault, adding a host of concerns for the woman, her fetus, and clinicians. Violence against women during pregnancy is an issue that stirs broad interest and concern. It is disturbing to even imagine that violence can intrude upon this poignant period in a woman's life, yet intimate partner violence, if it exists in a relationship prior to pregnancy, does not always stop because a woman becomes pregnant. Whether it is more likely to increase or decrease during pregnancy is not known.

The issue of violence against pregnant women has received attention in the literature through three perspectives. The most common addresses issues related to fetal outcome. These studies have examined the impact of violence on fetal outcomes such as low birth weight, prematurity, or mortality.[2–10] Complementing these studies are those that explore the impact of violence on maternal health, looking at physical, reproductive, and psychological parameters of health and disease.[11–15]

Both fetal and maternal perspectives benefit from a third focus that measures the prevalence of violence against pregnant or recently pregnant women to answer the question of whether pregnancy changes the risk or nature of violence. Older literature often reported higher rates of violence toward pregnant women.[16–18] However, these findings began to be questioned when it was pointed out that both violence and pregnancy rates are higher in younger women.[19] 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 versus violence during pregnancy), and a lack of severity adjustment and comparison populations, have left the question of pregnancy assault risk unanswered.[3,12,15,20,21]

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While most subjects of violence against women are not hospitalized, concentrating on hospitalized cases has several advantages. First, it focuses on serious injury. These are 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 prevalence and construct comparisons. Third, hospital data are comparable across states, making large-scale aggregation feasible. Fourth, discharge data contain charge information that can be used for modeling cost estimates. Finally, unlike clinic and emergency department settings where the encounter is brief, inpatients have more time to confide in and relate the abusive nature of the injuries to health care personnel.

The first population-based study of hospitalized maternal injury was conducted by Greenblatt et al.[22] They looked at Maryland hospital discharge data for the period 1979–1990. Among 80,311 injured women aged 15–45 years, 2.7% were reported to be pregnant. By examining assault E-codes (E970-E969) in computerized discharge data (E-codes are part of the International Classification of Diseases-Clinical Modification, 9th Revision, or ICD-9-CM, dealing with injury mechanisms and intent) they reported that 10% of the hospitalized injuries involving pregnant women were assault-related and that the rate ratio (comparing pregnant patients to all women aged 15–45) for assault-related hospitalization was 1.14 (not statistically significant). While this study brought creative methodological approaches, it contained drawbacks including incomplete E-coding, use of diagnosis codes for screening that were not as refined or as expansive as desired, and it 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 by a study by Weiss, which borrowed from the Greenblatt methods, applying them to Pennsylvania's 1995 hospital discharge data.[23] This study, with more diagnosis fields to search and an improved search algorithm, found 761 (4.6%) of injury discharges to women of reproductive age were associated with pregnancy. Rate ratios were significantly higher for assaults (rate ratio 3.04; 95% confidence interval [CI] 2.45, 3.78), with the increased risk concentrated in young women. This pilot study recognized the challenge of differentiating how much of the observed increases were due to increased injury rates versus increased hospitalization rates because of evidence that pregnant injured women are more likely than nonpregnant women to be hospitalized for less serious conditions.[22,24] However, the small numbers of pregnancy-associated assaults in that study ($n = 89$) limited the utility of adjusting for this concern. In addition, there were no perpetrator codes in 1995 with 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, multistate hospital discharge database.

MATERIALS AND METHODS

The study examined the hypothesis that the hospitalization rate for assault is higher among pregnant women than all women of reproductive age (ages 15–49), once controlled for age, race, 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. This study was given expedited review and approved by the University of Pittsburgh Institutional Review Board.

Data were solicited from states that mandated E-coding for 2 years or more or exhibited an E-code completeness rate of 90% or better and at least five diagnosis fields to search for pregnancy-associated codes. Three states with large populations and fairly good completeness (> 60%) but not mandated E-coding were also included. 1997 data was chosen as it was the first year that perpetrator-specific codes were used and it was followed by 2 years national regulations regarding hospital screening for domestic violence.

States were contacted and arrangements made to receive nonconfidential versions of statewide discharge data. Data were received from 19 states (Arizona, California, Florida, Maine, Maryland, Massachusetts, Michigan, Nebraska, New Hamphire, New Jersey, New York, Pennsylvania, Rhode Island, South Carolina, Utah, Vermont, Virginia, Washington, and Wisconsin) whose population made up 51.9% of US women aged 15–49. The 19 states represented the hospitalization experience of 36 million women who were residents of those states and 1.9 million resident births.[25] The combined dataset covered complete counts from about 2000 hospitals reporting 176,267 injuries to women aged 15–49.

The data underwent extensive editing, filtering, groupings, and development of derived variables to enhance compatibility, coding validity, and usability. Detailed algorithms were applied to identify injuries and to exclude cases of noninjury (eg, surgical and medical care, place of injury codes, adverse drug effects, and late effects).

Costs, estimated in 1996 dollars, were input 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, the National Health Interview Survey, the Civilian Health and Medical Program of the Uniformed Services, and from 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. Cost methods are detailed elsewhere.[26,27]

Injury severity was calculated using ICDMAP-90 (Tri-Analytics Inc., Bel Air, MD), a computerized injury coder that assigns injury severity scores based on ICD-9-CM injury diagnoses. Injurity severity score is a widely used score based on an anatomically based threat-to-life scale that ranges from 1 (minor) to 75 (unsurvivable).[28]

Pregnancy association was defined by examining diagnosis fields for ICD-9-CM diagnostic codes including complications of pregnancy and childbirth, certain conditions originating in perinatal period, and "V" codes for normal and high-risk pregnancy, postpartum care after delivery, outcome of delivery, and antenatal screening.

The above steps were applied to all age and gender injury discharges from the 19 states (n = 1,220,506) progressively limiting the data to females 15–49 years (n = 176,267), with acute care visits (n = 156,713), with valid injury E-code assignments (n = 144,260), who were residents of the state (n = 137,887), with assault-related hospitalizations (n = 7402).

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 the pregnancies would not be detectable in the hospital discharge data during the first 2 months of pregnancy.

Rate ratios were constructed between pregnant and all women for different comparison groups. This comparison, rather than a pregnant versus "nonpregnant" group contrast, was done for several reasons. After subtracting pregnancy-associated 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. Secondly, because the desire was to compare pregnant women with nonpregnant women, the comparison takes into account the 5-month period of every pregnancy year in which pregnant women are not detectably pregnant (ie, pregnant women contribute person-years to both groups because they are not pregnant over an entire year).

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. Point and 95% CI estimates of the rate ratio, comparing the pregnant and all injured women aged 15–49, were computed per standard methods.[29]

Assaults to women of reproductive age were analyzed to present prevalence rates and rate ratios for specific subgroups. Next, to adjust for the increased propensity of pregnant women to be hospitalized because they are pregnant, assaults were reanalyzed only for cases with an injury severity score of four or greater.

RESULTS

E-coding was 92% complete among women 15–49 years with an injury-related diagnosis. This left 137,887 resident women aged 15–49 discharged from nonrehabilitation hospitals with an acute injury diagnosis and a valid mechanism/intent E-code. There were 7402 assault-related discharges for a rate of 21 per 100,000 person-years. Pregnancy-associated cases made up 10.0% (745/7402) of all assaults to women aged 15–49.

Among injured females 15–49 years with a pregnancy-associated diagnosis, 14% (745/5498) were assault-related (65 per 100,000 person-years), for all injured women it was 5% (7402/137,887, 21 per 100,000 person-years). The rate ratio was 3.14 (95% CI 2.04, 3.39).

Among nonwhite injured females with a pregnancy-associated diagnosis, 21% (427/2082) were assault-related, while for whites it was 9% (235/2635). The rate of pregnancy-associated assaults was almost seven times higher in nonwhites (178 per 100,000 person-years) than whites (26 per 100,000 person-years). However, the rate ratio was elevated similarly among both whites (2.65; 95% CI 1.41, 3.03) and nonwhites (3.34; 95% CI 2.55, 3.69). Among nonwhites aged 15–19, the rate of pregnancy-associated assaults per 100,000 person-years was 341 (rate ratio 5.54; 95% CI 4.32, 6.73).

Pregnancy-associated assault victims were younger compared to all women 15–49 years (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 (Figure 1). The pregnancy-associated rates and rate ratios were highest in the youngest age group, declining with age (Figure 2).

The leading mechanism of assaultive injury was "struck by or against" (46.7%, 348/746) with a rate ratio of 3.58 (95% CI 3.20, 4.00). Pregnancy-associated assaults were more likely to be nonfatal (rate ratio 3.13; 95% CI 2.93, 3.41) and of short length of stay (rate ratio for 1 day length of stay 5.02; 95% CI 4.50, 5.60). The average length of stay was shorter for the pregnancy-

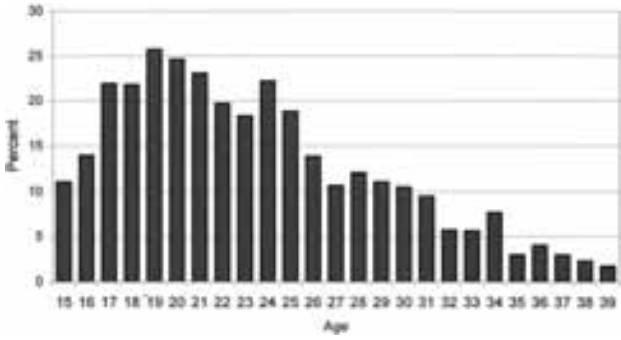

Figure 1. Pregnancy-associated hospitalized assaults as a proportion of all assaults by single year of age, ages 15–39, 19 states, 1997 (n = 745 pregnancy-related cases).
Weiss. Pregnancy-Associated Assaults. Obstet Gynecol 2002.

associated assaulted women, 2.6 days compared with 4.0 for all women aged 15–49.

Pregnancy-associated assault cases were more likely to be paid for by Medicaid (rate ratio 4.49; 95% CI 4.06, 4.98). The median charge per visit was $3351 for pregnancy-associated assaults versus $6775 for all assaulted women. Respective total costs for lifetime medical loss sum and lifetime monetized quality-adjusted life years (rounded) were $4,926,000, $6,296,162, and $71,620,000 for pregnancy-associated assault cases and $89,245,000, $111,545,000, and $1,689,194,000 for all assaults.

Among the top three body part groupings, pregnancy-associated assault rates per 100,000 person-years and rate ratios were: trunk 14.7 (rate ratio 19.6; 95% CI 16.2, 23.7), face 8.9 (rate ratio 2.0; 95% CI 1.6, 2.4), and abdomen and pelvic organs 8.2 (rate ratio 3.8; 95% CI 3.1, 4.7).

Perpetrator coding was incomplete for both pregnancy-associated and all assaults. Among pregnancy-associated assaults, 22.6% were accompanied by a perpetrator-related E-code; for all assaulted women the figure was 8.8%. Among the cases that were perpetrator coded, 88.0% and 83.7% were spouse or partner related among pregnancy-associated and all assaults, respectively.

The mean injury severity score among the pregnancy-associated assaulted women was 2.5, while the mean injury severity score among all women was 4.9. Figure 3 shows the rate ratio of assault-related hospital discharges by severity group. There was a significantly increased rate ratio for minor injuries (injury severity score less than 4) but not for the moderate, serious, and severe injuries. This finding was used as the basis for the severity adjustment, which eliminated assault-related cases with minor injuries from rate comparisons.

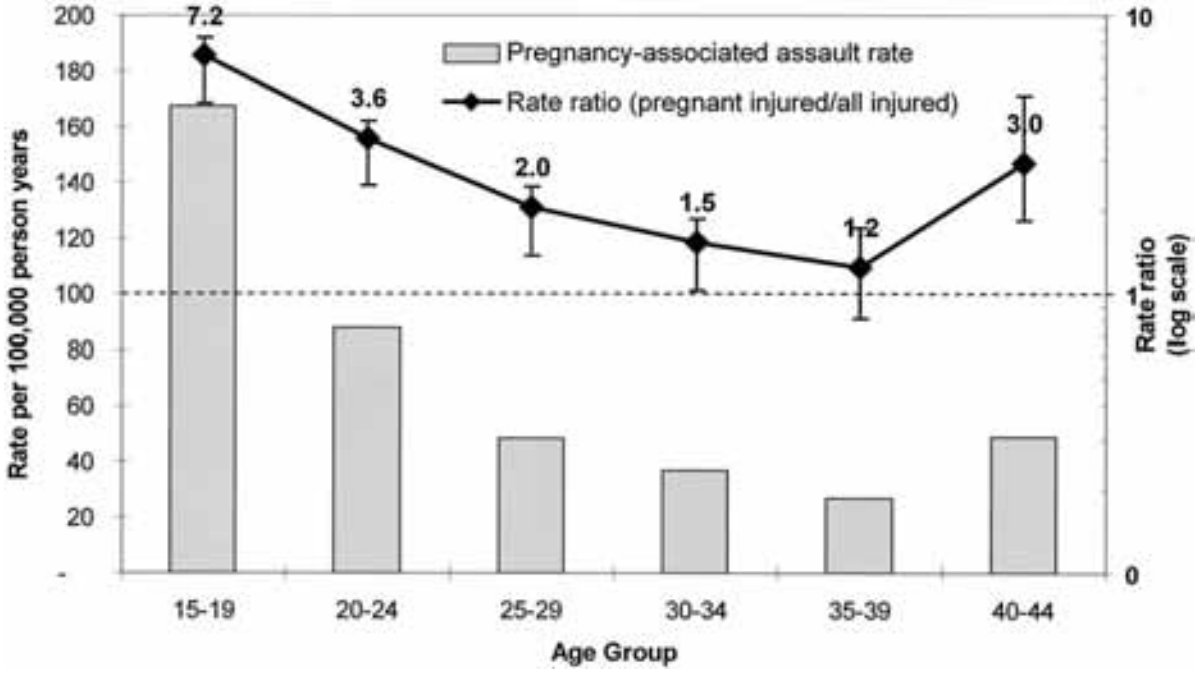

Figure 2. Rate of assault-related hospitalized pregnancy-associated injuries per 100,000 person-years and rate ratio (pregnant injured women/all injured women) for ages 15–44, 19 states, 1997 (n = 745 all severity pregnancy-related cases, 95% confidence interval shown).
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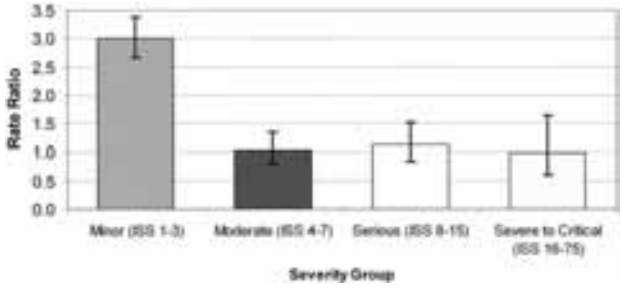

Figure 3. Rate ratio of assault-related hospitalized pregnancy-associated injuries per 100,000 person-years (pregnant injured women/all injured women) by severity group for ages 15–49, 19 states, 1997 (n = 422, with 95% confidence interval shown).

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Table 1 details the frequency, rates, and rate ratios of selected characteristics for hospitalized assaults in the subgroup of seriously injured cases. Proportionally eliminating the less severe pregnancy-associated cases reduced most of the rate ratios to values not significantly different from one. The overall rate ratio fell to a nonsignificant 1.07 (95% CI 0.57, 1.28). However, rate ratios were significantly greater than one for a few subgroups, including the youngest age group (rate ratio 2.49; 95% CI 1.31, 3.63) and for firearm-related assaults (rate ratio 1.55; 95% CI 1.07, 2.23).

Among the top four (by frequency) body part groupings, 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% CI 1.1, 2.4) skull and brain 2.0 (rate ratio 1.0; 95% CI 0.7, 1.5), face 1.4 (rate ratio 0.9; 95% CI 0.5, 1.5), and upper extremity 1.4 (rate ratio 1.1; 95% CI 0.7, 1.9).

DISCUSSION

This is the first study to address the prevalence and risk of pregnancy-associated hospitalized assaults in a large multistate population. Most other studies of assault and pregnancy have focused on small clinic or urban populations, often overrepresented by socially disadvantaged minorities. Because most severe injuries will be seen in hospitals, regardless of race and social class, this study provides more representative findings of the risk patterns for serious assaults among women of reproductive age.

While this study described a significant increase in the nonage and nonrace stratified rate ratio for pregnancy-associated assaults, it showed the importance of examining the issue of pregnancy risk by: Age, because assaults against women occur most often in the young and young women are most likely to be pregnant; race, because rates of assaults are much higher in nonwhites and pregnancy rates are higher among nonwhites; and severity, because pregnancy-associated cases are much more likely to be admitted for less serious injuries.

This study demonstrated that both age and race-specific rate ratios were markedly reduced once adjusted for injury severity. For both whites and nonwhites overall, after severity adjustment, there was no significantly elevated rate ratio. Moderate increases in the rate ratio remained among the 15–19 years age group (significant in nonwhites, not significant for whites) and for firearm-related assaults.

While hospital discharge data have significant advantages, they also have disadvantages. Waller and colleagues recently described these as they relate to violence against women.[30] 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.

Like all secondary data analyses, hospital discharge data are affected by the quality of the data.[31–33] For intentional injuries, methods for screening and documentation are not always specified or consistently applied. 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 seeking accurate rates. Miscoding and undercounting will occur, but it is difficult to conjecture how systematic inclusions of pregnancy-associated codes among nonpregnant assaulted women, the type of error that could most affect the results, would happen. While the data suggested that most hospitalized assaults were spouse or partner related, the low percentage of perpetrator coded cases dictates caution with this interpretation. Regarding duplicate counts, individuals would have needed multiple admissions with both a pregnancy and an assault code, rendering multiple admissions in our 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 could not describe the relationship of violence to pregnancy intent, sexual assault, gestational age, previous births, parity, prenatal care, pregnancy outcome, marital status, amount of time spent with an intimate partner (exposure), or relationship of the fetus to the assailant. Understanding the roles these factors play remains for future longitudinal research to characterize. Finally, women in early pregnancy are not likely, or at best, much less likely, than

Table 1. Rates of Pregnancy-Associated Hospitalized Assaults and Rates for All Women of Reproductive Age (15–49) With ISS ≥ 4 by Selected Characteristics, 19 States, 1997

Variable	Value	Pregnant women		All women		Rate ratio	95% CI
		n	Rate	*n*	Rate		
Race	White	33	4	1341	5	0.78	(0.31, 1.10)
	Nonwhite (excludes unknown)	75	31	1747	25	1.27	(0.85, 1.60)
		108					
Hispanic	Yes	25	10	407	8	1.20	(0.61, 1.80)
	No	76	8	2388	8	1.09	(0.54, 1.37)
		101					
Age (y)	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	3457	10	1.07	(0.57, 1.28)
Age/race (y)							
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	1341	5	0.78	(0.31, 1.10)
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	1747	25	1.27	(0.86, 1.61)
Severity	Minor (ISS 1–3)	–	–	–	–	–	
	Moderate (ISS 4–7)	59	5	1767	5	1.04	(0.80, 1.35)
	Serious (ISS 8–15)	43	4	1188	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 (d)	1	31	3	1081	3	0.89	(0.62, 1.28)
	2–3	38	3	1032	3	1.15	(0.83, 1.58)
	4–7	14	1	351	1	1.24	(0.73, 2.12)
	8–14	7	1	164	0	1.33	(0.62, 2.83)
	>2 wk	1	*	88	0	*	
Payer source	Medicare	1	*	88	0	*	
	Medicaid	65	6	1298	4	1.56	(1.22, 2.00)
	Worker's compensation	–	–	37	0	–	
	Other government	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, no charge	2	*	80	0	*	
	Other	2	*	38	0	*	
	Unknown	–	–	7	0	–	

ISS = injury severity score; CI = confidence interval; BC = Blue Cross; PPO = private payer organization; HMO = health maintenance organization.
Rates are presented as discharges per 100,000 person-years.
Cells with no observations indicated by –.
* Rates and ratios not computed for cells with 5 or less observations.

women in later pregnancy, to have the pregnancy identified and coded during a hospital stay and would be misclassified into the nonpregnant group. Therefore, a diagnosis-based pregnancy definition, such as that used in the current study, does not measure early pregnancy-associated assault risks very well, whether it ends in spontaneous or induced abortion or progresses to birth.

It may be helpful for practitioners to think of pregnant women as a "sensitive" rather than a "high-risk" population. They are sensitive to being hospitalized because the hospitalization threshold appears to be considerably lower for pregnant women with trauma than their nonpregnant counterparts. The perceived increase in risk is mostly fostered by a combination of this lower threshold and higher rates of both pregnancy and assaults among young and nonwhite women. As a sensitive population, pregnant women may be a special group worth addressing for preventive efforts. However, such attention should probably take place in conjunction with broader efforts aimed at reducing the differential of the rate of assault by age, socioeconomic status, and race, regardless of current pregnancy status.

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