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EDITORS' CHOICE

Maternal-perinatal morbidity and mortality associated with adolescent pregnancy in Latin America: Cross-sectional study

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KEY WORDS

Adolescent pregnancy
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Objective: This study was undertaken to determine whether adolescent pregnancy is associated with increased risks of adverse pregnancy outcomes.

Study design: We studied 854,377 Latin American women who were younger than 25 years during 1985 through 2003 using information recorded in the Perinatal Information System database of the Latin American Center for Perinatology and Human Development, Montevideo, Uruguay. Adjusted odds ratios were obtained through logistic regression analysis.

Results: After an adjustment for 16 major confounding factors, adolescents aged 15 years or younger had higher risks for maternal death, early neonatal death, and anemia compared with women aged 20 to 24 years. Moreover, all age groups of adolescents had higher risks for postpartum hemorrhage, puerperal endometritis, operative vaginal delivery, episiotomy, low birth weight, preterm delivery, and small-for-gestational-age infants. All adolescent mothers had lower risks for cesarean delivery, third-trimester bleeding, and gestational diabetes.

Conclusion: In Latin America, adolescent pregnancy is independently associated with increased risks of adverse pregnancy outcomes.

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Adolescents aged 15 to 19 years gave birth to 17 million infants in 1997, of which 16 million were born in the developing world where 15% to 20% of all births are to adolescent mothers.¹ Moreover, 85% of adolescent women are in the developing world² and 25% of all maternal deaths occur in such age group.¹ Although birth rates have dropped for adolescents in most de-

veloped countries, in sub-Saharan Africa, Latin America, and the Caribbean, only modest declines have been reported.² Thereby, adolescent pregnancy continues to be a challenging public health issue around the world, mainly in developing countries.

Adolescent pregnancy has been associated with an increased incidence of several adverse maternal and perinatal outcomes such as low birth weight (LBW), preterm delivery, small-for-gestational-age (SGA) infants, perinatal death, eclampsia, operative vaginal

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delivery, and maternal death.³ Nevertheless, research in this area has many methodologic limitations such as small sample size, especially that of mothers aged 15 years or younger, studies not designed specifically to test associations between both maternal and perinatal complications and young maternal age, no uniform definitions for complications evaluated, and lack of control for potential confounding factors that may be related to both young maternal age and adverse pregnancy outcomes. In addition, few studies⁴ have addressed this topic among Latin American pregnant adolescents.

The aim of this study was to determine whether young maternal age was associated with increased risks of adverse pregnancy outcomes, adjusting for many potentially confounding factors.

Material and methods

This research is based on the Perinatal Information System database in Montevideo, Uruguay, which was designed by the Latin American Center for Perinatology and Human Development (CLAP) in 1983, and consists in the basic perinatal clinical record, its complementary forms and charts, the perinatal card, and a software package for personal computers. Detailed descriptions of the database have been published elsewhere.⁵ From 1985 through 2003, the Perinatal Information System database has recorded pregnancies of women from Uruguay (25.3%), Argentina (24.1%), Peru (9.4%), Colombia (8.6%), Honduras (8.2%), Paraguay (6.9%), El Salvador (4.2%), Chile (2.8%), Bolivia (2.3%), Costa Rica (2.2%), Panama (1.4%), Dominican Republic (1.3%), Nicaragua (1.2%), Brazil (0.8%), Ecuador (0.6%), Mexico (0.4%), Belize (0.1%), and Venezuela (0.1%).

Inclusion in the study group was restricted to women aged between 10 and 24 years who had a singleton birth of at least 20 weeks' gestation or at least 400 g birth weight.

Maternal age was defined as the age of the mother in completed years at time of delivery and was categorized into 4 groups: less than 16, 16 to 17, 18 to 19, and 20 to 24 years. This last group was the reference group in all comparisons. Gestational age at birth was defined as the number of completed weeks' gestation from the first day of the last menstrual period to delivery date. Parity was defined as the number of previous births, including stillbirths. The mother's education was categorized into none, and appropriate or inappropriate for her age. Mothers older than 19 years were considered to have an age-appropriate educational level if they had completed at least the secondary education (11 or more years), whereas younger mothers had to have completed the minimal number of years for their age. Marital status was dichotomized between those who did and did not

have partner. Maternal height and prepregnancy weight were recorded by recall at the woman's first antenatal visit in centimeters and kilograms, respectively. The prepregnancy body mass index (weight [kg]/height[m]²) was categorized as follows: underweight (body mass index <19.8), normal (19.8-26.0), overweight (26.1-29.0), and obese (>29.0). Weight gain during pregnancy (kg/wk) was grouped into slow (<0.25), average (0.25-0.44), and rapid (\geq 0.45). Information on cigarette smoking was also recorded at the time of first attendance for antenatal care, and categorized into non-smoker and smoker. For parous women, interpregnancy interval was defined as the time elapsed between the woman's last delivery and the date of the last menstrual period for the index pregnancy. Interpregnancy intervals were categorized as less than 12, 12 to 23, 24 to 47, and 48 months or more.

Adverse maternal outcomes were classified according to the International Classification of Diseases, tenth revision (ICD-10). Preeclampsia and eclampsia were coded O14 and O15, respectively. Third-trimester bleeding included placenta previa with hemorrhage (code O44.1) and placental abruption (code O45). Cesarean delivery was coded O82 and operative vaginal delivery as code O81. Episiotomy was coded O70.9. Anemia, urinary tract infection, premature rupture of membranes, gestational diabetes, postpartum hemorrhage, and puerperal endometritis were coded O99.0, O23, O42, O24.4, O72, and O85, respectively. Maternal death was defined as the death of a woman while pregnant or within 42 days after delivery from any cause related to or aggravated by the pregnancy or its management, but not from accidental or incidental causes.

Perinatal outcomes evaluated were LBW (live infant weighting <2500 g at birth), very LBW (live infant weighting <1500 g at birth), preterm delivery (live infant delivered at <37 weeks' gestation), very preterm delivery (live infant delivered at <32 weeks' gestation), SGA (live infant with birth weight below the 10th percentile for the gestational age and gender, according to the Williams et al⁶ reference curve), fetal death (delivery of a dead infant at or after 20 weeks' gestation), early neonatal death (neonatal death occurring during the first 7 days of life), and low Apgar scores at 5 minutes (<7).

Rates of adverse pregnancy outcomes were calculated for each maternal age group. Estimates of crude odds ratio (OR) with 95% CI were computed as measures of association between each maternal age group and adverse pregnancy outcomes considered. Adjusted ORs were derived through logistic regression models. The estimates were adjusted for the following potential confounding factors: parity, mother's education, marital status, cigarette smoking, interpregnancy interval, prepregnancy body mass index, weight gain during pregnancy, history of miscarriage, LBW, perinatal death, and chronic hypertension, gestational age at first attendance

Table I Study group characteristics

Characteristic	Maternal age (y)			All adolescents	
	≤15 (n = 33,498)	16-17 (n = 119,723)	18-19 (n = 191,405)	≤19 (n = 344,626)	20-24 (n = 509,751)
Parity					
0	94.6	83.8	67.3	75.7	41.6
1	4.4	14.9	26.5	20.3	32.2
≥ 2	1.0	1.3	6.2	4.0	26.2
Mother's education					
None	4.6	3.9	3.6	3.8	3.5
Age inappropriate	48.2	51.0	51.7	51.1	48.9
Age appropriate	47.2	45.1	44.7	45.1	47.6
Marital status					
With partner	45.1	61.5	68.6	63.8	78.5
Without partner	54.9	38.5	31.4	36.2	21.5
Cigarette smoking					
Yes	7.5	9.4	10.0	9.5	9.0
No	92.5	90.6	90.0	90.5	91.0
Interpregnancy interval (mo)					
< 12	45.6	42.4	38.7	40.7	21.3
12-23	41.8	40.1	36.9	38.4	33.9
24-47	11.4	15.9	21.6	18.6	32.1
≥ 48	1.2	1.6	2.8	2.3	12.7
Weight gain (kg/wk)					
< 0.25	20.6	19.8	19.5	19.7	19.4
0.25-0.44	63.6	65.3	65.8	65.4	65.5
≥ 0.45	15.8	14.9	14.7	14.9	15.1
Prepregnancy body mass index (kg/m ²)					
< 19.8	10.9	10.4	9.7	10.1	7.7
19.8-26.0	72.2	68.1	65.3	66.9	61.1
26.1-29.0	10.9	14.6	18.0	16.1	18.5
> 29.0	6.0	6.9	7.0	6.9	12.7
History of miscarriage					
Yes	2.5	4.9	7.7	6.2	14.1
No	97.5	95.1	92.3	93.8	85.9
History of LBW					
Yes	0.9	1.6	2.6	2.1	4.3
No	99.1	98.4	97.4	97.9	95.7
History of perinatal death					
Yes	0.5	1.6	2.4	1.9	3.7
No	99.5	98.4	97.6	98.1	96.3
History of chronic hypertension					
Yes	0.4	0.5	0.6	0.5	1.2
No	99.6	99.5	99.4	99.5	98.8
Gestational age at first antenatal visit (wk)					
1-13	19.6	20.8	21.3	21.0	26.7
14-26	43.8	47.1	48.4	47.5	44.8
≥ 27	36.6	32.1	30.3	31.5	28.5
Number of antenatal visits					
0	23.5	23.6	23.7	23.6	22.0
1-4	37.5	35.1	34.8	35.2	32.8
≥ 5	39.0	41.3	41.5	41.2	45.2

Values are percentage of women.

Table II Rates of adverse maternal outcomes

Outcome	Maternal age (y)			All adolescents	
	≤15 (n = 33,498)	16-17 (n = 119,723)	18-19 (n = 191,405)	≤19 (n = 344,626)	20-24 (n = 509,751)
Preeclampsia	5.9	4.9	4.3	4.7	4.2
Eclampsia	1.1	0.6	0.4	0.5	0.2
Gestational diabetes	0.9	1.0	1.2	1.1	2.9
Urinary tract infection	4.3	4.4	4.3	4.3	4.0
Premature rupture of membranes	4.9	6.4	7.0	6.6	7.2
Third-trimester bleeding	0.2	0.5	0.6	0.5	0.9
Anemia	8.8	7.2	6.2	6.8	6.2
Cesarean delivery	15.3	14.0	13.9	14.1	17.6
Operative vaginal delivery	4.1	3.8	3.3	3.5	2.7
Episiotomy	75.7	71.0	67.2	69.3	53.7
Postpartum hemorrhage	7.0	5.6	5.0	5.4	4.2
Puerperal endometritis	16.7	9.7	7.2	9.0	4.7
Maternal death*	18.5	4.0	4.0	5.4	4.1

Values are percentage of women unless stated otherwise.

* Rate per 10,000 women.

for antenatal care, number of antenatal visits, geographic area, hospital type, and year of delivery. Early neonatal death and low Apgar scores at 5 minutes were additionally adjusted for birth weight and gestational age. The effects of maternal age on adverse pregnancy outcomes were evaluated separately for nulliparous and parous women. All analyses were performed with the SPSS 8.0 program package (SPSS Inc, Chicago, Ill).

Results

Over the 19-year period, 2,073,968 pregnancies were recorded in our database, of which we excluded 36,917 multiple pregnancies, 1,039,863 to mothers older than 24 years, and 142,811 for whom information on adverse pregnancy outcomes or interpregnancy intervals was missing. The remaining 854,377 women constituted the study population of which 344,626 were adolescents. There were no significant differences between the women excluded because of incomplete information and those with complete information with regard to maternal age, parity, education, and marital status. Overall, adolescents accounted for 18.4% of all deliveries in our database.

Table I shows the maternal demographic and obstetric characteristics of the study groups. Compared with women aged 20 to 24 years, adolescent mothers were more likely to be nullipara, without permanent partner, to have lower body mass index before pregnancy and shorter interpregnancy intervals, to begin prenatal care later, to have lower number of prenatal visits, and to have a lower proportion of previous miscarriages, LBW infants, perinatal deaths, and chronic hypertension.

There were no striking differences with regard to weight gain during pregnancy, cigarette smoking, and mother’s education.

There was a clear trend toward increasing rates of preeclampsia, eclampsia, anemia, operative vaginal delivery, episiotomy, postpartum hemorrhage, and puerperal endometritis as maternal age decreased (Table II). Rates of gestational diabetes, third-trimester bleeding, and premature rupture of membranes, increased progressively with increasing maternal age. Overall, the rate of cesarean delivery was lower in adolescents than in women aged 20 to 24 years. There were 397 maternal deaths in the study population. The youngest adolescents (≤15 years) had the highest maternal fatality rate, whereas the rates for older adolescents were similar to that of adult women.

The rates of LBW, very LBW, preterm delivery, very preterm delivery, SGA, and early neonatal death consistently increased with decreasing maternal age and were always highest among infants born to mothers aged 15 years or younger (Table III). Adolescents did not differ from reference group in the rates of fetal death and low Apgar scores at 5 minutes.

Adjusted ORs for the association between maternal age and adverse maternal outcomes are shown in Table IV. Compared with mothers aged 20 to 24 years, adolescent mothers had higher risks of operative vaginal delivery, episiotomy, postpartum hemorrhage, and puerperal endometritis. The youngest mothers faced the highest risks, whereas mothers aged 16 to 17 and 18 to 19 years had smaller increases in risks. Mothers aged 15 years or younger had about a 40% increased risk of anemia compared with women aged 20 to 24 years. When adolescents were considered as a whole, they were

Table III Rates of adverse perinatal outcomes

Outcome	Maternal age (y)			All adolescents	
	≤15 (n = 33,498)	16-17 (n = 119,723)	18-19 (n = 191,405)	≤19 (n = 344,626)	20-24 (n = 509,751)
LBW	12.8	10.3	9.6	10.2	8.1
Very LBW	1.7	1.6	1.4	1.5	1.3
Preterm delivery	14.6	11.0	10.0	10.8	8.9
Very preterm delivery	2.8	2.3	2.1	2.2	1.5
SGA	17.0	15.9	14.8	15.4	11.6
Fetal death*	17.0	15.0	16.0	15.7	16.1
Early neonatal death*	15.2	12.0	9.8	11.1	8.6
Low Apgar scores at 5 min	1.0	1.0	1.2	1.1	1.1

Values are percentage of infants unless stated otherwise.

* Rate per 1000 infants.

Table IV Adjusted OR (95% CI) for the association between maternal age and adverse maternal outcomes

Outcome	Maternal age (y)			All adolescents	
	≤15 (n = 33,498)	16-17 (n = 119,723)	18-19 (n = 191,405)	≤19 (n = 344,626)	20-24* (n = 509,751)
Preeclampsia	1.08 (0.98-1.19)	1.04 (0.99-1.08)	1.00 (0.96-1.04)	1.01 (0.97-1.06)	1.00
Eclampsia	1.61 (0.86-2.42)	1.36 (0.89-1.85)	1.17 (0.91-1.45)	1.20 (0.97-1.44)	1.00
Gestational diabetes	0.34 (0.29-0.40)	0.35 (0.31-0.40)	0.44 (0.41-0.48)	0.39 (0.37-0.42)	1.00
Urinary tract infection	1.03 (0.95-1.12)	1.01 (0.96-1.07)	1.00 (0.96-1.05)	1.01 (0.98-1.04)	1.00
Premature rupture of membranes	0.95 (0.90-1.01)	0.98 (0.95-1.02)	1.01 (0.98-1.04)	0.99 (0.97-1.01)	1.00
Third-trimester bleeding	0.24 (0.17-0.32)	0.59 (0.53-0.66)	0.70 (0.64-0.77)	0.66 (0.62-0.71)	1.00
Anemia	1.41 (1.33-1.50)	1.05 (1.00-1.10)	1.00 (0.97-1.03)	1.04 (1.00-1.09)	1.00
Cesarean delivery	0.87 (0.83-0.92)	0.80 (0.78-0.82)	0.83 (0.81-0.85)	0.83 (0.81-0.85)	1.00
Operative vaginal delivery	1.44 (1.32-1.57)	1.29 (1.21-1.38)	1.16 (1.11-1.21)	1.24 (1.20-1.28)	1.00
Episiotomy	2.36 (2.27-2.46)	1.98 (1.93-2.04)	1.55 (1.52-1.59)	2.09 (2.06-2.12)	1.00
Postpartum hemorrhage	1.59 (1.50-1.70)	1.31 (1.24-1.39)	1.18 (1.13-1.24)	1.23 (1.19-1.27)	1.00
Puerperal endometritis	3.81 (3.64-4.00)	2.08 (2.01-2.15)	1.52 (1.46-1.59)	2.00 (1.95-2.05)	1.00
Maternal death	4.09 (3.86-4.34)	0.98 (0.66-1.32)	1.00 (0.72-1.30)	1.12 (0.87-1.37)	1.00

* Reference group.

not at significantly increased risk of death. Nevertheless, adolescent mothers under 16 years were 4 times more likely to die than mothers aged 20 to 24 years. With respect to gestational diabetes, third-trimester bleeding, and cesarean delivery, all age groups of adolescents had decreased risks compared with adult women. There were no significant differences in the effect of adolescent pregnancy on preeclampsia, eclampsia, urinary tract infection, and premature rupture of membranes.

Table V depicts adjusted ORs for the association between maternal age and adverse perinatal outcomes. Risks of LBW, very LBW, preterm delivery, very preterm delivery, and SGA increased with decreasing maternal age. Compared with infants of mothers aged 20 to 24 years, those born to women aged 15 years or younger faced a 50% increase in risk of early neonatal death. Notwithstanding, this association disappeared when it was adjusted for birth weight and gestational age (OR

1.16, 95% CI 0.95-1.43) suggesting the increased risk of early neonatal death among the youngest adolescents was almost entirely explained by the high rates of preterm delivery and LBW in this group. We found no statistically significant differences in the effect of low maternal age on fetal death and low Apgar scores at 5 minutes.

When the data were analyzed separately for nulliparous and parous women, the results were similar to those obtained in the analyses of the entire population. However, the adjusted ORs of adverse pregnancy outcomes were slightly higher in nulliparous adolescents compared with parous ones (data not shown).

Comment

With the Perinatal Information System database we were able to establish that adolescent pregnancy in Latin

Table V Adjusted OR (95% CI) for the association between maternal age and adverse perinatal outcomes

Outcome	Maternal age (y)			All adolescents	
	≤15 (n = 33,498)	16-17 (n = 119,723)	18-19 (n = 191,405)	≤19 (n = 344,626)	20-24* (n = 509,751)
LBW	1.62 (1.54-1.71)	1.27 (1.23-1.32)	1.20 (1.17-1.24)	1.25 (1.22-1.28)	1.0
Very LWB	1.25 (1.12-1.39)	1.24 (1.16-1.33)	1.10 (1.05-1.15)	1.15 (1.10-1.21)	1.0
Preterm delivery	1.66 (1.59-1.74)	1.25 (1.20-1.31)	1.15 (1.11-1.19)	1.22 (1.19-1.25)	1.0
Very preterm delivery	1.51 (1.37-1.67)	1.35 (1.26-1.45)	1.31 (1.25-1.37)	1.40 (1.35-1.45)	1.0
SGA	1.50 (1.45-1.56)	1.41 (1.37-1.46)	1.27 (1.24-1.31)	1.35 (1.32-1.38)	1.0
Fetal death	1.03 (0.92-1.15)	0.98 (0.91-1.06)	1.00 (0.95-1.06)	0.99 (0.95-1.04)	1.0
Early neonatal death	1.50 (1.33-1.70)	1.05 (0.95-1.16)	1.01 (0.93-1.10)	1.02 (0.95-1.09)	1.0
Low Apgar scores at 5 min	0.97 (0.85-1.10)	0.98 (0.91-1.06)	1.01 (0.94-1.09)	1.00 (0.95-1.05)	1.0

* Reference group.

America is independently associated with increased risks of adverse pregnancy outcomes. On the basis of our findings, it appears that adolescence encompasses at least 2 maternal age groups. Although both adolescent age groups had poorer pregnancy outcomes than adult women, the youngest mothers (<16 years) had substantially higher risks for maternal and perinatal morbidity and mortality than the late adolescent age group (16-19 years). The large sample size that confers sufficient power to evaluate the relation between young maternal age and rare adverse pregnancy outcomes such as maternal, fetal, and early neonatal deaths, the possibility to control for many confounding factors, and the relatively homogeneous population of women studied support the findings of our study.

The prominent finding in this large hospital-based retrospective cross-sectional study is the risk of dying from pregnancy-related causes is 4 times higher for adolescents under 16 years than for women in their early twenties. The increased risks of anemia, postpartum hemorrhage, and puerperal endometritis may have contributed to the increased risk of maternal death among young adolescents. In general, this result agrees with previous studies from developing⁷⁻⁹ and developed countries.^{10,11} Most of these studies, however, did not adjust for confounding factors. A nested case-control study from Bangladesh¹² evaluated risk factors for 390 maternal deaths and found that, compared with women aged 20 to 29 years, mothers aged 15 to 19 years had a 65% increased risk of death (OR 1.65, 95% CI 1.12-1.45) after adjustment for interpregnancy interval, area of residence, maternal education, religion, and year of birth. In contrast, a study from Ethiopia¹³ that controlled for the effect of antenatal care, income, occupation, marital status, and parity did not find statistically significant increase in the risk of maternal death among young adolescents compared with mothers aged 25 to 29 years (adjusted OR 2.0; 95% CI 0.4-10.3). A report evaluating the maternal deaths in the United Kingdom

showed that adolescents younger than 18 years had an increased risk of maternal death.¹⁰ Nevertheless, these studies included a small number of adolescent maternal deaths. A recent national population-based report summarizing surveillance data for pregnancy-related deaths in the United States for the period 1991 through 1997 showed that, compared with women aged 20 to 24 years, the pregnancy-related mortality ratio was higher for adolescents younger than 15 years (9.4 and 15.6 maternal deaths per 100,000 live births, respectively).¹¹

Our study found that adolescent mothers, mainly those younger than 16 years, are at increased risk of several adverse maternal outcomes. Consistent with previous reports from developed^{14,15} and developing countries,^{3,16} we observed that young adolescents had anemia more frequently than older women. Regarding to complications of labor, delivery, and the puerperium, we found that adolescent mothers are at increased risks of episiotomy, operative vaginal delivery, and puerperal endometritis in agreement with several published studies.^{16,17} It has been suggested that in young adolescents, the pelvic bones and the birth canal may still be in the process of growth, increasing the risk of prolonged and obstructed labor, episiotomy, use of forceps and ventouse, and puerperal endometritis.¹⁷ If this theory of biologic immaturity accounted for the greatest proportion of delivery complications, we would expect the rates of cesarean delivery to be higher in this population. However, our study found that adolescent mothers are at decreased risk of cesarean delivery corroborating the findings from previous reports.^{3,14,18-20} The reasons for this association are unclear. Contrary to our finding of increased risk of postpartum hemorrhage among adolescents, Jolly et al¹⁴ found the risk of postpartum hemorrhage was lower in adolescents younger than 18 years. In accordance with previous studies,^{14,21} we found that gestational diabetes was less common in adolescents than in adult women, which supports the recommendation that screening for

gestational diabetes of pregnant adolescents be performed only on the basis of risk factors.²¹

With regard to adverse perinatal outcomes, we found a higher risk of LBW, very LBW, preterm delivery, very preterm delivery, and SGA among infants of adolescent mothers, with the youngest age groups running the highest risks. Although there are several reports indicating that adolescent pregnancy is not associated with increased risks of adverse perinatal outcomes,^{19,22} most studies from both developed and developing countries have consistently reported that pregnant adolescents are at increased risk for preterm delivery^{3,14,15,23} and LBW.^{15,17,18,23} The relation between adolescent pregnancy and SGA is less clear in the literature. An increased incidence of SGA infants in adolescent mothers has been reported by some authors²³ but not by others.^{14,22} Previous investigations of perinatal mortality in adolescent pregnancy have yielded conflicting results. Some studies have found increased risk of neonatal mortality among infants born to adolescent mothers,^{17,24} whereas others found no increase.^{18,20} In our study, infants of adolescent mothers had a higher risk of early neonatal death mainly associated to problems of preterm delivery and LBW. In accordance with several studies, we confirmed that adolescents were at no greater risk of fetal death than adult women.^{14,18,22,24}

Controversy exists in the literature about the factors responsible for higher rates of adverse pregnancy outcomes in adolescent pregnancy. Socioeconomic factors associated with young age, such as inadequate prenatal care, poverty, unmarried status, low educational levels, psychological stress, and illicit drug use have generally been put forward as the most important determinants of the adolescents' increased risks of adverse pregnancy outcomes.^{19,22} However, there are also studies indicating that young maternal age, independent of socioeconomic factors, increases the risks of poor pregnancy outcomes.^{14,18,23,24} The biologic mechanisms underlying the association between decreasing maternal age and a greater risk of adverse pregnancy outcomes remain speculative. It has been attributed to the factor that young adolescent mothers who themselves continue to grow during pregnancy could compete with the developing fetus for nutrients.^{3,23} Other biologic factors such as low prepregnancy weight and height, parity, contracted pelvis, and low pregnancy weight gain have been implicated in the poorer pregnancy outcomes in adolescents.³

Our results could have been influenced by the fact that we were unable to evaluate the effect of some of the above mentioned socioeconomic factors known to affect the risk of adverse pregnancy outcomes because these data were not available from the database. However, because the use of alcohol and illicit drugs is lower among adolescent mothers compared with adult women^{3,15} and that some authors¹⁵ have found young maternal age and race/ethnicity do not appear to

interact in a manner that produces a differential effect on pregnancy outcomes, it is unlikely these factors influenced our results. Other potential constraints of our study must be considered. The accuracy of specific diagnoses registered in this large database has not been extensively checked, but it is unlikely inaccuracies are more or less frequent in adolescents compared with other age groups. Moreover, Uruguay and Argentina contributed almost 50% of births registered at the database. Thus, our results may not be generalized to the whole of the Latin American adolescents. Finally, it should be emphasized that our study is based on a population coming from developing countries and its findings may not be generalized to other populations.

In conclusion, results of this study provide support that adolescent pregnancy, mainly in mothers younger than 16 years, increases the risk of adverse pregnancy outcomes. By reducing the number of adolescent pregnancies and by providing better prenatal and obstetric care to those adolescents who become pregnant, maternal and perinatal morbidity and mortality in the developing world could be reduced. Currently, we do not yet have a clear solution to the problem of high pregnancy rates among adolescents. A recent systematic review showed that primary prevention strategies do not reduce the rate of pregnancies in adolescent women, delay the initiation of sexual intercourse, or improve use of birth control among adolescent men and women.²⁵ Thus, interventions to reduce unintended pregnancies among adolescents need to be designed and evaluations of these interventions that follow the adolescents into adulthood should be performed.

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