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## Physical activity and overweight among adolescents on the Texas-Mexico border

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### Abstract

**Objective**—To investigate differences in associations between physical activity and overweight for students in two adjacent areas on the border between Mexico and the United States of America: students in the city of Matamoros, Mexico, and Mexican-American students in the Lower Rio Grande Valley (LRGV) area of southern Texas. Since the extremely high prevalence of overweight among Mexican-American adolescents is well-recognized, we wanted to determine whether overweight has become a problem among Mexican adolescents.

**Methods**—Students from 6 schools ( $n = 669$ ), representing 12% of the ninth-grade students in Matamoros during 2002-2003, and students from 13 high schools ( $n = 4\ 736$ ), representing 22% of the ninth-grade students in the LRGV during 2000-2001, completed questionnaires. Polytomous logistic regression was performed to estimate the risk of being at risk of overweight ( $\geq 85$ th percentile to  $< 95$ th percentile of body mass index (BMI) for age and sex) and the risk of being overweight ( $\geq 95$ th percentile of BMI-for-age and sex) versus normal weight associated with measures of physical activity. For simplicity normal weight includes underweight.

**Results**—A higher percentage of adolescents in the LRGV were at risk of overweight (17.2%) in comparison with adolescents from Matamoros (14.8%). The percentages of LRGV and Matamoros adolescents who were overweight were identical (16.9%). LRGV adolescent boys (OR = 0.87, 95% CI = 0.77-0.98) who participated in team sports were less likely to be at or above the 85th percentile of BMI-for-age and sex. Although of borderline significance, Matamoros and LRGV adolescent boys who participated in physical education classes were less likely to be at risk of overweight. Neither in Matamoros nor LRGV students were any of the various physical activity categories or levels associated with being at risk of overweight or being overweight.

**Conclusions**—Nearly one-third of the students in both Matamoros and the LRGV are at risk of overweight and are overweight. Implementation of interventions on healthful dietary choices and

participation in physical education classes and sports teams are essential for reducing the extremely high prevalence of overweight among students on both sides of the Texas/Mexico border.

ABSTRACT. Spanish.

**Objetivo:** Investigar si hay diferencias en las asociaciones entre la actividad física y el sobrepeso observadas en estudiantes de dos zonas colindantes en la frontera mexicanoestadounidense: estudiantes de la ciudad de Matamoros, México, y estudiantes mexicanoestadounidenses del valle a lo largo de la desembocadura del Río Bravo (VRB) en la parte sur del estado de Texas. Dada la consabida prevalencia extremadamente alta de sobrepeso en adolescentes mexicanoestadounidenses, los autores queríamos determinar si el sobrepeso también se ha convertido en un problema entre adolescentes mexicanos.

**Métodos:** Estudiantes de 6 escuelas (n = 653), que comprenden 11% de los estudiantes de noveno grado en Matamoros durante 2002–2003, y estudiantes de 13 bachilleratos (n = 4 736), que comprenden 22% de los estudiantes de noveno grado del VRB durante 2000–2001, contestaron cuestionarios. Se llevó a cabo una regresión logística polinómica a fin de calcular el riesgo de estar en riesgo de tener sobrepeso ( $\geq 85.^{\circ}$  percentil a  $< 95.^{\circ}$  percentil de índice de masa corporal (IMC) para la edad y el sexo) y el riesgo de tener sobrepeso ( $\geq 95.^{\circ}$  percentil de índice de masa corporal (IMC) para la edad y el sexo), frente a un peso normal, que se asociaban con distintos grados de actividad física. En aras de la sencillez, en la clasificación del peso normal también se abarcó la insuficiencia de peso.

**Resultados:** Un mayor porcentaje de adolescentes estaban en riesgo de sufrir sobrepeso en el VRB (17%) que en Matamoros (15%). Los porcentajes de adolescentes de VRB y de Matamoros que tenían sobrepeso fueron idénticos (17%). Los varones adolescentes en el VRB (razón de posibilidades [RP] = 0,87; IC95% = 0,77 a 0,98) que participaron en deportes en equipo tuvieron una menor probabilidad de estar en riesgo de tener sobrepeso. No se encontraron asociaciones entre ninguna de las demás categorías de actividad física por un lado, y estar en riesgo de sufrir sobrepeso o tener sobrepeso por el otro, ni en estudiantes de Matamoros ni en los del VRB.

**Conclusiones:** Casi una tercera parte de los estudiantes tanto en Matamoros como en el VRB está en riesgo de tener sobrepeso o tiene sobrepeso. La puesta en práctica de intervenciones para fomentar hábitos alimentarios sanos y la participación en clases de educación física y en deportes en equipo es una medida esencial para reducir la prevalencia extremadamente alta de sobrepeso observada en estudiantes a ambos lados de la frontera entre México y Estados Unidos.

## Keywords

Overweight; physical fitness; adolescent; Mexican-Americans; Mexico; Texas

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Health risk behaviors established during childhood create behavioral patterns that extend into adulthood and contribute to leading causes of morbidity and mortality (1). For example, low levels of physical activity established in childhood have been shown to contribute to overweight and obesity among adults (2). In recent years, an extremely high prevalence of being at risk of overweight or being overweight among adolescents has been reported in the United States and other nations (2-4). Food consumption, particularly of calorie-dense foods, and lack of physical activity have been associated with obesity, coronary artery disease, and type 2 diabetes(5-8).

Objective 22-6 of the *Healthy People 2010* publication (9) established guidelines for moderate physical activity among adolescents in the United States, and the *2005 Dietary Guidelines for Americans* (10) provided consistent recommendations for children and adolescents. *Healthy People 2010* (9) suggests that adolescents engage in moderate physical activity for at least 30 minutes per day on five or more days per week, and in vigorous physical activity that promotes cardio-respiratory fitness for at least 20 minutes per day three or more days per week. Based

on United States national data from the Youth Risk Behavior Survey, the prevalence of moderate physical activity among ninth-grade schoolchildren of all ethnicities was 28.3% for males and 22.3% for females (1). These prevalences of moderate physical activity were lower among Hispanic adolescent boys (23.3%) and girls (20.6%)(1). A similar pattern was seen for the prevalence of vigorous physical activity, where male (73.1%) and female (63.6%) ninth-grade schoolchildren of all ethnicities had higher prevalences than Hispanic males (66.7%) and females (51.8%) (1). Limited information has been found concerning the prevalence of physical activity in Mexico. Hernández et al. (11;12) reported 1.8 hours per day( $\pm 1.3$  hours per day standard deviation) as the average of moderate and vigorous physical activity combined in Mexico City 12 years old ( $\pm 1.3$  years old) schoolchildren.

Our study investigated patterns of specific risk behaviors among Mexican-American and Mexican youths by gender. The objective of the research was to determine whether an association exists between physical activity and overweight among ninth-grade students in the city of Matamoros, Tamaulipas, Mexico, which is in northeastern Mexico, on the border with the United States. Additionally, we wanted to compare the results from Matamoros with the results for Mexican-American youth living directly across the border in the Lower Rio Grande Valley (LRGV) area of the state of Texas. A strength of this comparison is that most of the students in the LRGV are of Mexican descent and are live in close proximity to Matamoros, thus minimizing cultural and acculturation differences between the two areas studied. Since the extremely high prevalence of overweight among Mexican-American adolescents is well-recognized, we wanted to determine whether overweight has become a problem among Mexican adolescents.

## MATERIALS AND METHODS

### Lower Rio Grande Valley survey and participants

During the 2000-2001 school year, the Lower Rio Grande Valley Youth Risk Behavior Survey (LRGV-YRBS) was conducted. The primary objective of the LRGV-YRBS was to determine health risk behaviors that contribute to adolescent morbidity and mortality in the four southernmost counties of Texas (Cameron, Hidalgo, Starr, and Willacy). This survey was not part of the national YRBS in the United States. A full description of the LRGV-YRBS study design, participants, and sample has been provided previously (13;14), so only a brief summary will be given here. Specifically, this survey measured behaviors that contribute to (a) unintentional injuries and violence, (b) tobacco use, (c) drug and alcohol use, (d) sexual behaviors, (e) diet and physical activity, (f) sleep and work patterns, (g) suicidal thoughts, (h) suicidal behaviors, (i) depression and (j) anxiety. Unintentional injuries, violence, tobacco use, drug and alcohol use, sexual behaviors, diet and physical activity questions were based on the national Youth Risk Behavior Survey (1), conducted by the Centers for Disease Control and Prevention (CDC) of the United States.

In the 2000-2001 school year, there were over 21 500 ninth-graders enrolled in the 40 public high schools in LRGV area. A sample of 18 public high schools of ninth-grade schoolchildren representative of the LRGV population was selected using a stratified multistage probabilistic sampling design. Five public high schools refused to participate. The sample included 5 118 respondents from 13 public high schools, representing 24% of the ninth-grade students. For this manuscript, we restricted our analysis to 4 736 students who reported they were Mexican-American and did not have missing values on sex, age and the adjustment variables students' marital status and family's standard of living (see statistical analysis). This study was approved by the University of Texas Health Science Center at Houston's Committee for the Protection of Human Subjects. Passive parental permission was obtained by the school districts prior to conducting the survey. Under the supervision of a moderator, the students answered the self-administered survey questionnaire during regularly scheduled classes. Students had the

opportunity to refuse participation or could have been absent the day of the survey, which may have resulted in an overall response rate was 67%. Self-reported height and weight, from two of the survey questions, were used to compute body mass index (BMI).

### **Matamoros survey, participants, and measurement of height and weight**

For the Matamoros survey, we forward-translated the English-language LRGV-YRBS questionnaire into Spanish and then back-translated it into English in order to ensure that the Spanish and English versions of the questionnaire were comparable. The Spanish questionnaire was also adapted using the Mexican cultural idiom. The Secretariat of Education of the state of Tamaulipas (Secretaría de Educación de Tamaulipas) added questions on (a) family support, (b) school support and empowerment; (c) religiosity; and (d) housing arrangements. A pilot study was conducted in two schools, and minor modifications were made to improve the readability of the instrument. This instrument is available upon request from the authors.

Matamoros is located across the Rio Grande River from the sister city of Brownsville (Cameron County), Texas. During the 2002-2003 school year there were a total of 28 public and private high schools in Matamoros, with 5 762 students in the ninth grade (*tercero de secundaria* in the Mexican school system). The secretariat of education of Tamaulipas provided the sampling frame used to select a representative sample of ninth-grade students. Unlike the LRGV-YRBS, the sampling frame included both public schools and private schools.

High schools were stratified using the total number of ninth-grade classes in each high school; those with 10 or more ninth-grade classes, and those with fewer than 10 ninth-grade classes. The sampling design implemented for this cross-sectional survey was a two-stage stratified cluster design. The sample size required for this survey was estimated using as main outcomes of interest the prevalence of violent behavior and drug use among students. These behaviors, estimated to have a prevalence of 10%, were chosen because they were expected to have the lowest prevalence of risky behaviors. Thus, if the sample size was sufficient to detect differences in these risky behaviors it would be sufficient to detect differences in all risky behaviors. Assuming a type I error level of 0.05% and a precision level of 25% from the true population value, we required a minimum of 623 students.

Using an estimated participation rate of 68%, we randomly selected six high schools that had fewer than 10 ninth-grade classes and two high schools that had 10 or more ninth-grade classes. Seeking to obtain similar weights across strata of classes, we selected all ninth-grade classes from the high schools with fewer than 10 ninth-grade classes. Two high schools with fewer than 10 ninth-grade classes refused to participate. The sample included 669 respondents, from 6 of the 28 high schools, representing 12% of ninth-grade students in Matamoros during 2002-2003. For this manuscript, we restricted our analysis to 653 students who did not have missing values on age and the adjustment students' marital status and family's standard of living (see statistical analysis).

The consent form for participation in this study was approved by the Committee for the Protection of Human Subjects at the University of Texas Health Science Center at Houston. The form required the active consent of a parent or guardian. Students who did not receive parental authorization or who forgot to bring the signed consent form to school were given other written activities (e.g., crossword puzzles) to do while the students who had consent completed the survey. Under the guidance of a trained moderator, the students answered the self-administered questionnaire during a regularly scheduled class. The overall response rate was 58%.

Using a standard protocol, trained project staff measured the height and weight of each student in a predesignated area in each school. The adolescents removed any heavy clothes and their

shoes before being measured. Height was measured to the nearest 0.1 cm with the portable PE-AIM-101 stadiometer unit (Perspective Enterprises, Portage, Michigan, U.S.). Weight was measured to the nearest 0.1 kg with a portable BWB-800S digital scale with remote display (Tanita, Arlington Heights, Illinois, U.S.) calibrated to 250 lb (113.4 kg) before each series of measurements. Project staff wrote both measures directly on the student questionnaires.

For quality control, we randomly selected 7% of the students to remeasure. The Lin concordance correlation coefficient for agreement (15;16) was 0.976 for height and 0.993 for weight. The Pearson correlation coefficient, a measure of precision, was 0.977 for height and 0.994 for weight. The bias correction factor, a measure of accuracy, was 0.998 for height and 0.999 for weight. For all survey respondents in Matamoros, body mass index (BMI) was calculated using the standard equation of weight in kilograms divided by the square of the height in meters.

### **LRGV and Matamoros BMI classification, questions about personal life situation, physical activity and attempted weight control**

Using the current United States BMI-for-age and sex growth charts (<http://www.cdc.gov/growthcharts/>), adolescents were classified as normal weight (<85th percentile), at risk of overweight ( $\geq$ 85th percentile to <95th percentile) and overweight ( $\geq$ 95th percentile). For simplicity normal weight includes underweight.

Two questions on personal life situation were examined. Students' marital status was asked as "Some people get married before they turn 18. Which of the following best describes you?". We used the following categories of response: (a) single, never married; (b) living with a partner or significant other, but not married; (c) married; and (d) separated, divorced or widowed. Family's standard of living was asked as "What best describes your family's standard of living? Economically, would you say your family is...". We used the following categories of response: (a) very well off; (b) living very comfortably or just getting along; and (c) nearly poor or poor.

Five measures of physical activity were examined and dichotomized as physically active or inactive. The criteria for active were: (a) vigorous-intensity physical activity in three or more sessions lasting at least 20 minutes each per week, (b) moderate-intensity physical activity in five or more sessions lasting at least 30 minutes each per week, (c) strength training in three or more sessions per week, (d) enrollment in physical education classes, and (e) participation on one or more sports teams.

One question was used to assess television viewing: "On an average school day, how many hours do you watch TV?". We dichotomized it as three or more hours per day during an average school day versus less than three hours per day.

Six measures of attempted weight control were examined with a time frame of "during the past 30 days." The six questions used for assessment were: (a) "Did you exercise to lose weight or to keep from gaining weight?(yes/no)"; (b) "Did you eat less food, fewer calories, or foods low in fat to lose weight or to keep from gaining weight? (yes/no)"; (c) "Did you go without eating for 24 hours or more (also called fasting) to lose weight or to keep from gaining weight? (yes/no)"; (d) "Did you take any diet pills, powders, or liquids without a doctor's advice to lose weight or to keep from gaining weight? (Do not include meal replacement products such as Slim-Fast) (yes/no)"; (e) "Did you vomit or take laxatives to lose weight or to keep from gaining weight? (yes/no)"; and (f) "Which of the following are you trying to do about your weight? (lose weight, gain weight, stay the same weight, or I am not trying to do anything about my weight)".

## Data management and statistical analysis for LRGV and Matamoros

LRGV students completed Scantron forms that were scanned for data entry. The Matamoros questionnaires were scanned using Snap version 6.0 software (17). Verification and inconsistencies were assessed using SAS version 9.1 software (18). We computed probabilistic sampling weights to account for differential inclusion probabilities in the cluster sampling at the school level. Sampling weights were the inverse of the selection probability for the sampling ratio at each stage of selection. In the LRGV, ratio adjustment for ninth-grade students enrolled in all public high schools was implemented using the total school enrollment. In Matamoros, nonresponse adjustment and ratio adjustment for ninth-grade students enrolled in all public and private high schools were implemented using the sampling frame provided. Nonresponse adjustment accounts for students who refused to complete the questionnaire and students who were absent the day of the survey. The ratio adjustment was to ensure that the gender composition of the samples was the same as that of the total school enrollment in the LRGV and Matamoros. Sample design characteristics, including the clustering of students within schools and stratification of the sample, were accounted for using the sampling weights. Weighted percentages, weighted means, weighted standard errors, and weighted test statistics were calculated using SUDAAN version 9.0.0 software (19). Polytomous logistic regression analyses were performed to estimate the risk of at risk of overweight ( $\geq 85$ th percentile to  $< 95$ th percentile of BMI-for-age and sex) and to estimate the risk of overweight ( $\geq 95$ th percentile of BMI-for-age and sex) versus normal weight. Exposures investigated included physical activity, watching television, and attempted weight control. We reported associations for girls and boys separately. All estimates were adjusted for students' perceptions of their family standard of living and the student's marital status. The proportional odds ratio assumptions (20) held for these data in the LRGV and Matamoros. For this reason, only one set of odds ratios are presented in our results. For example, this model assumes that the odds of being at risk of overweight compared to being normal weight is proportional to the odds of being overweight compared to being at risk of overweight or being normal weight for a particular independent variable.

## RESULTS

Table 1 presents demographic characteristics, BMI classification, types and levels of physical activity, number of hours of television watched, and attempts to lose weight among students in Matamoros and in the LRGV. The median age of the adolescents in Matamoros was 14 years, and it was 15 years in the LRGV. There were statistically significant differences between LRGV girls and LRGV boys in marital status ( $P = 0.002$ ). In the LRGV, we observed a greater proportion of adolescents married, living with a partner or significant other but not married, separated, divorced or widowed than in Matamoros. There was no a significant difference in marital status between the Matamoros girls and the Matamoros boys. There were statistically significant differences in the family's standard of living between girls and boys in Matamoros ( $P = 0.0174$ ) and in the LRGV ( $P = 0.01$ ).

The LRGV boys were more likely to be at or above the 85th percentile of BMI-for-age than were the LRGV girls ( $P = 0.002$ ) (Table 1). The difference between Matamoros girls and Matamoros boys was not significant ( $P = 0.072$ ) (Table 1). The overall prevalence of at risk of overweight was 15% in the Matamoros students and 17% in the LRGV students. The overall prevalence of overweight was 17% in both the Matamoros students and the LRGV students.

Of the Matamoros students, 97.7% were classified as active in one or more of the physical activity measures compared with 85.4% of the LRGV students (Table 1). Just over 7% of the Matamoros students and just over 9% of the LRGV students were classified as active on all five measures of physical activity. In both Matamoros and the LRGV, students were the least likely to engage in moderate intensity physical activity of any other measure of physical

activity. In both Matamoros and the LRGV, adolescent boys were more likely to engage in four measures of physical activity (vigorous, moderate, strength training, and sports-team participation) than were the girls ( $P < 0.025$  for all).

Fifty-seven percent of the students in Matamoros and 50% of the students in the LRGV watched television three or more hours per day during an average school day (Table 1). About 46% of the students in Matamoros and 64% of the students in the LRGV had exercised to lose weight or to keep from gaining weight during the 30 days preceding the survey. During the past 30 days, the LRGV girls were significantly more likely than were the LRGV boys to have done the following to try to control their weight: (a) exercised to lose weight or to keep from gaining weight ( $P = 0.011$ ); (b) eaten less food, fewer calories, or foods low in fat ( $P < 0.001$ ); (c) gone without eating for 24 hours or more ( $P = 0.001$ ); (d) taken diet pills, powders, or liquids without a doctor's advice ( $P = 0.036$ ); and (e) vomited or taken laxatives ( $P = 0.001$ ). The LRGV girls were significantly more likely than were the LRGV boys to try losing weight, while the LRGV boys were more likely than were the LRGV girls to try gaining weight ( $P = 0.002$ ). This gender difference on trying to lose and gain weight was not significant among the Matamoros students.

Table 2 presents the adjusted odds ratios (ORs), with 95% confidence intervals (CIs) from polytomous logistic regression for being at risk of overweight ( $\geq 85$ th percentile to  $< 95$ th percentile BMI for age and sex) and being overweight ( $\geq 95$ th percentile of BMI-for-age and sex) versus normal weight associated with measures of physical activity, watching television, and attempted weight control. Adolescent boys in the LRGV who participated in sport teams were less likely (OR = 0.87; 95% CI = 0.77-0.98) to be at or above the 85th percentile of BMI-for-age. Although of borderline significance, adolescent boys in the LRGV (OR = 0.80; 95% CI = 0.63-1.02) and in Matamoros (OR = 0.40; 95% CI = 0.15-1.08) were also less likely to be at or above the 85th percentile of BMI-for-age if they participated in physical education classes. None of the remaining physical activity measures was associated with being at risk of overweight or with being overweight among Matamoros students.

In comparison with normal weight girls, adolescent girls in both Matamoros and the LRGV who were at risk of overweight and overweight were more likely to try to lose weight by exercising, eating less food, or taking diet pills, powder, or liquids without a doctor's advice during the 30 days preceding the survey (Table 2). Adolescent girls in the LRGV who were at risk of overweight or overweight consistently reported that they were less likely to try to gain weight (OR = 0.10; 95% CI = 0.03-0.38).

On the other hand, adolescent boys in Matamoros who were at risk of overweight and overweight were more likely than normal weight boys to exercise and to eat less food in order to lose weight during the 30 days preceding the survey (Table 2). Adolescent boys in the LRGV who were at risk of overweight or overweight were more likely to perform all five of the measures for attempted weight control. These same boys consistently reported that they were less likely to try to gain weight (OR = 0.29; 95% CI = 0.15-0.58) and more likely to try to lose weight (OR = 6.40; 95% CI = 4.10-9.98). Watching television three or more hours per day on average during the school day was not statistically associated with being at risk of overweight or overweight among the girls and boys in either Matamoros or the LRGV.

## DISCUSSION

This is the first study to describe overweight, physical activity, watching television, and attempted weight control among adolescents in the city of Matamoros. In addition, we compared the results from Matamoros with those from the LRGV region across the border from Matamoros. Nearly one-third of the students in Matamoros and in the LRGV are at risk of overweight or overweight. The prevalence of at risk of overweight and overweight was based on United States criteria (21).

Using nationwide data for Mexico collected in 2000 with measured heights and weights and applying the same CDC criteria that we did in our study, del Río-Navarro et al. (22) found that 18.3% of 14-year-old Mexican girls and 12.5% of 14-year-old Mexican boys were at risk of overweight. When restricting the analysis to the northern region of Mexico where Matamoros is located, the prevalence of at risk of overweight was 17.2% for girls and 14.7% for boys (22). In Matamoros we found a lower prevalence of at risk of overweight among ninth-grade girls (15%) and a similar prevalence of at risk of overweight among ninth-grade boys (14.5%) in comparison with their counterparts in northern Mexico (24).

In the LRGV, the prevalence of overweight among girls (11%) and among boys (23%) was lower than previously reported data for Hispanic adolescents in Texas (26). In 2000-2002, Hoelscher et al. (23) reported a prevalence of 16% overweight among Hispanic eighth-grade girls and a prevalence of 33% overweight among Hispanic eighth-grade boys in Texas. A possible explanation for the lower estimates of overweight found in the LRGV compared to Texas (23) may have been the self-reported heights and weights in LRGV students, while Texas students' heights and weights were measured directly. Another explanation for the lower estimates of overweight found in the LRGV compared to Texas (23) may be the small size of the LRGV (sampling frame 21 500 students) relative to Texas (sampling frame 288 584 students).

The prevalence of overweight in the Matamoros girls (13.6%) and in the Matamoros boys (20.8%) are consistent with previously reported data(22;24). In particular, in the northern region of Mexico, del Río-Navarro et al.(22) reported overweight prevalence of 13% for girls and 14.7% for boys, 10-17 years of age. The prevalence of overweight in the LRGV girls (10.8%) were higher than in the LRGV boys (23%) and this is consistent with previously reported data (23).Hoelscher et al. (23) reported overweight prevalence of 16.2% for Hispanic girls and 32.6% for Hispanic boys eighth-grade schoolchildren in Texas. Our estimate of the prevalence of overweight in boys in Matamoros was lower when compared with Hispanic boys in Texas (23).

It is not surprising that physical education enrollment was similar for boys and girls in Matamoros and higher than it was for the LRGV students, given that the Mexican school curriculum requires a minimum of two class sessions during the school week for at least 45 minutes each. Boys in Matamoros were more likely to participate in physical activities than were Matamoros girls. However, the Matamoros girls had a lower prevalence of overweight, which may be due to the girls' higher prevalence of attempting to maintain ideal weight through dieting. Our findings indicate that current physical activities do not decrease the likelihood of being at risk of overweight or overweight. In the LRGV and in Matamoros we observed similar prevalences of having participated in vigorous and moderate physical activities as Hispanic and ninth-grade schoolchildren in the United States. Dietary education combined with physical activity intervention programs has shown promising results for school-based approaches to reducing overweight among youth (25-29).

Our data do not support some previous studies (30-33) where a substantial amount of time watching television was found to be a risk factor for at risk of overweight among adolescents. Our results are consistent with a meta-analysis of United States studies (34) that found that the relationship between TV viewing and body fatness among adolescents is likely to be too small to be of clinical relevance (34). Our results are also consistent with data from adolescents in Mexico City (11).

There are limitations to the approach that we used in this study. First, the use of cross-sectional data did not allow us to evaluate increasing or decreasing trends in this region; surveillance efforts are required to evaluate possible increasing rates of overweight. Data indicate that it is



likely that overweight adolescents remain overweight as they enter adulthood (11), and adulthood overweight has been shown to be associated with markedly increased risks of cardiovascular disease and type 2 diabetes (11;35;36). Current data from Mexican adolescents indicate that overweight could be the basis for an escalating problem of adult chronic disease (22).

A second limitation was that we conducted the survey in Matamoros during the 2002-2003 school year, two years after the survey done in the LRGV. In spite of this, the results could be comparable. We did not expect any significant changes in the behavior of schoolchildren in Matamoros because of the lack of interventions during these two years. We did not expect any significant bias in this population on the prevalence of overweight, physical activities, watching television, or measures attempting to control weight also because of the lack of interventions during these two years. In addition, the data from Matamoros allowed us to adjust for nonresponse, which was not possible with the LRGV data.

Our biggest limitation was the different methods for collecting information on heights and weights in the LRGV and Matamoros. However, self-reported and direct measures of heights and weights have been found to be highly correlated (37).

In summary, we determined that overweight has become as big a problem among Mexican adolescents as among Mexican-American adolescents. The challenge of overcoming the extremely high prevalence of overweight or at risk of overweight among adolescents in the Texas/Mexico border region is immense. Intervention programs on diet, diet education and physical activities, as well as evaluations of these interventions, need to be implemented. These interventions are essential for reducing the extremely high prevalence of overweight among students in this region.

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**TABLE 1**

Weighted percentage estimates (standard error [SE]) of demographic characteristics, physical activities, watching television, and attempting to control weight of ninth-grade school children in Matamoros (Tamaulipas, Mexico), 2002-2003, and in the Lower Rio Grande Valley (Texas, United States of America), 2000-2001<sup>a, b</sup>

	Matamoros Girls ( <i>n</i> = 357) (N = 3 074)		Matamoros Boys ( <i>n</i> = 296) (N = 2 574)		Lower Rio Grande Valley Girls ( <i>n</i> = 2 378) (N = 9 976)		Lower Rio Grande Valley Boys ( <i>n</i> = 2 358) (N = 9 870)	
	Weighted %	SE	Weighted %	SE	Weighted %	SE	Weighted %	SE
Students' marital status								
Single, never married	94.48		92.63		80.90		75.18	
Living with a partner or significant other but not married	0.93	0.44	2.75	1.14	5.75	0.75	8.54	1.27
Married	3.20	0.77	3.18	0.89	11.82	0.41	13.41	1.13
Separated, divorced, or widowed	1.40	0.41	1.45	1.30	1.54	0.79	2.88	0.83
Family's standard of living								
Very well-off	3.54	0.53	4.72	0.59	15.65	0.35	18.99	0.67
Living very comfortably or just getting along	91.77	0.96	84.29	1.39	81.43	1.48	76.75	1.29
Nearly poor or poor	4.69	0.81	11.00	2.23	2.92	1.48	4.26	1.30
BMI classification								
Normal	71.37	0.47	64.73	2.16	71.26	0.32	60.68	0.49
At risk of overweight	15.04	1.90	14.53	3.15	17.99	0.77	16.29	1.21
Overweight	13.59	1.51	20.75	2.15	10.75	1.22	23.03	1.44
Physical activity								
Vigorous	39.45	1.36	61.17	2.94	56.03	1.06	63.52	1.57
Moderate	11.78	5.08	20.52	5.01	19.55	1.99	24.34	2.15
Strength training	24.58	1.30	43.84	2.35	50.69	0.98	62.72	0.90
Physical education class enrollment	95.72	1.93	94.84	2.55	55.24	1.84	62.01	1.57
Sports team participation	48.39	1.51	63.36	1.68	50.69	3.76	64.38	2.29
All of the five activities	3.51	3.13	12.25	1.36	6.85	1.73	12.10	0.88
Watching television an average of three or more hours per day on a school day	57.12	1.93	57.89	1.97	48.96	0.54	50.76	0.44
Attempted weight control during the past 30 days								
Exercise to lose weight	47.24	1.31	45.88	3.75	66.77	0.72	61.64	0.90
Eat less food	43.48	2.58	35.24	2.38	51.02	1.49	30.01	1.21
Go without eating for 24 hours or more	14.57	1.23	10.06	3.84	21.55	0.94	10.15	0.91
Take any diet pills, powder, or liquids	3.60	2.49	3.41	1.74	10.30	0.95	6.74	1.21
Vomit or take laxatives	6.40	1.26	1.71	1.78	10.95	1.03	5.50	0.72
Trying to do something about weight during the past 30 days								
Lose weight	26.31	1.90	29.27	1.55	62.55	0.73	41.26	0.76
Stay in the same weight	35.15	0.70	35.68	3.91	14.97	1.03	22.28	0.79
Gain weight	13.49	4.17	10.55	3.99	8.66	0.65	20.23	0.95
		0.71		2.16		0.77		0.75

	<b>Matamoros Girls (<i>n</i> = 357) (N = 3 074)</b>		<b>Matamoros Boys (<i>n</i> = 296) (N = 2 574)</b>		<b>Lower Rio Grande Valley Girls (<i>n</i> = 2 378) (N = 9 976)</b>		<b>Lower Rio Grande Valley Boys (<i>n</i> = 2 358) (N = 9 870)</b>	
	<b>Weighted %</b>	<b>SE</b>	<b>Weighted %</b>	<b>SE</b>	<b>Weighted %</b>	<b>SE</b>	<b>Weighted %</b>	<b>SE</b>
Not trying to do anything	25.05	2.42	24.50	5.49	13.83	0.55	16.23	0.76

<sup>a</sup>The *n* values are the sample size, and the N values in the table represent the total estimated student population using the sampling weights

<sup>b</sup>The median age (standard error) for Matamoros girls was 14.03 (0.08) and for Matamoros boys was 14.26 (0.08). The median age (standard error) for LRGV girls was 14.48 (0.04) and for LRGV boys was 14.61 (0.06).

**TABLE 2**

Adjusted odds ratios (ORs) and 95% confidence intervals (CIs) for being at risk of overweight ( $\geq$  85th percentile to  $<$ 95th percentile of body mass index [BMI] for age and sex) and for being overweight ( $\geq$  95th percentile of BMI-for-age) versus normal weight associated with measures of physical activity, watching television, and attempted weight control in ninth-grade school children in Matamoros (Tamaulipas, Mexico), 2002-2003, and in the Lower Rio Grande Valley (Texas, United States of America), 2000-2001.<sup>a</sup>

	Matamoros				Lower Rio Grande Valley			
	Girls		Boys		Girls		Boys	
	OR	95% CI	OR	95% CI	OR	95% CI	OR	95% CI
Physical activity								
Vigorous	2.22	0.67-7.43	0.92	0.53-1.61	1.15	0.85-1.56	1.06	0.94-1.19
Moderate	1.15	0.56-2.37	1.25	0.40-3.95	1.03	0.86-1.25	0.93	0.73-1.18
Strength training	1.58	0.70-3.55	0.83	0.29-2.34	0.96	0.76-1.22	1.06	0.84-1.34
Physical education enrollment	2.79	0.16-49.35	0.40	0.15-1.08	0.94	0.69-1.29	0.80	0.63-1.02
Sports team participation	1.26	0.59-2.70	0.51	0.22-1.19	0.79	0.62-1.01	0.87	0.77-0.98
Watching television an average of three or more hours per day on a school day	1.03	0.72-1.47	0.95	0.39-2.32	1.12	0.77-1.64	0.99	0.86-1.15
Attempted weight control during the past 30 days								
Exercise to lose weight	2.40	1.15-5.04	5.03	3.10-8.15	2.39	1.57-3.63	2.97	2.13-4.15
Eat less food	3.13	1.29-7.64	5.11	3.96-6.58	2.54	2.06-3.12	3.75	2.97-4.73
Go without eating for 24 hours or more	2.03	1.24-3.31	1.73	0.68-4.36	1.16	0.84-1.60	2.09	1.42-3.08
Take any diet pills, powder, or liquids	8.44	1.26-56.66	1.00	0.24-4.14	2.10	1.45-3.04	3.33	2.00-5.56
Vomit or take laxatives	3.45	0.77-15.51	2.13	0.60-7.54	1.41	0.94-2.11	1.73	1.30-2.32
Trying to do something about weight during the past 30 days								
Lose weight	2.61	1.22-5.61	2.77	0.76-10.11	3.20	2.37-4.32	6.40	4.10-9.98
Stay in the same weight	0.81	0.49-1.34	0.83	0.42-1.64	0.62	0.34-1.13	0.94	0.62-1.44
Gain weight	0.70	0.31-1.59	0.11	0.01-1.56	0.10	0.03-0.38	0.29	0.15-0.58

<sup>a</sup> Adjusted by students' marital status and family's standard of living.