

ABSTRACT

BACKGROUND: For youth between the ages of 10 and 24, suicide is the third leading cause of death, and results in approximately 4600 lives lost each year. Body weight status and bullying is associated with increase mental health disorders.

METHODS: We analyzed data from the 2015 Youth Risk Behavior Survey, consisting of 15,506 students in grades 9-12. Logistic regression analysis was performed using STATA13 to estimate the independent association of perceived weight status and bullying experienced at school and electronically to suicidal behaviors measured as - considered suicide, made a suicide plan, attempted suicide and injurious suicide attempt, after controlling for socio-demographics.

RESULTS: Considered suicide and attempted suicide were significantly associated with very overweight, slightly overweight, very underweight, and slightly underweight weight perceptions. Made suicide plan was significantly associated with slightly and very overweight perceptions. Injurious suicide attempt was significantly associated with very underweight or very overweight perceptions. Bullying, at school and electronically was significantly associated with all suicidal behaviors.

CONCLUSIONS: Examination of not just body weight status but body weight perceptions held by adolescent students, and the experience of not just in-person bullying but also electronic bullying on youth suicidal behaviors is crucial.

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For youth aged 10-14 years suicide is the third leading cause of death,¹ and among adolescents aged 15-19 years suicide is the second leading cause of death.² Whereas more male adolescents commit suicide, female adolescents are more likely to have suicidal thoughts,^{3,4} plan and attempted suicide.^{4,5} Population-based studies indicate that 20% to 30% of school children are frequently involved in bullying as bullies and or victims.⁶ In addition, research indicates that being obese and overweight as an adolescent increases the chance of being bullied.⁷ Among adolescents aged 12 to 19 years, approximately one in 5 (20.6%) are obese;⁸ furthermore, being obese has shown to be a significant risk factor for depression and low self-esteem.^{7,9}

Adolescents who are overweight and /or victims of bullying are at an increased risk for suicidal ideation as well as suicide attempts.^{10,11} Although youth are frequently bullied about their weight, research indicates that an individual's weight perception of being overweight or obese is more strongly associated with suicidal thoughts and behaviors than their actual weight or body mass index (BMI).^{4,5,12} Adolescents who accurately perceive themselves as being overweight or obese puts them at a higher risk of having depression and lower self-esteem compared to peers who do not perceive themselves as having excess weight.^{7,13}

Adolescents who accurately perceived themselves as being overweight or obese reported greater frequency of being bullied, attempting suicide, and had more episodes of prolonged sadness as compared to their peers who underestimated their weight status; regardless of their trying to lose weight, bullying victimization, and suicide attempts as compared to obese students underestimating their weight status. Boys who accurately self-identified their body weight status

reported higher experiences of being bullied and sadness, whereas girls who accurately self-identified their body weight status reported a decreased risk of being bullied, having attempted suicide or experience prolonged sadness.¹⁴ One study found that after adjusting for demographics and feelings of sadness and hopelessness, adolescents who were obese or extremely obese and identified as being only overweight had significantly greater odds of suicidal ideation compared to normal weight peers; however, youth who were physically overweight but did not identify themselves as being overweight had similar results to average weight peers.¹⁵

Few studies have found significant gender differences regarding the relationship between weight status and/or weight perception and suicidal behaviors. Lee and Seo¹⁶ reported, after controlling for demographic and physical characteristics, psycho-behavioral covariates, and depressive symptoms; they found that suicidal ideation was higher in girls than boys (14.4% vs. 7.9%), girls were more likely than boys to perceive themselves as overweight (40% vs. 23.4%), and boys were more likely to perceive themselves as underweight (22% vs. 10.7%). Furthermore, girls who perceived themselves as overweight were 1.41 times more likely to have suicidal ideation one year later as compared to girls who identified themselves as being of average weight; these statistics include controlling for depression.¹⁶ Due to the fact that this study was longitudinal, this may indicate that girls are more affected in the long-term by perceived weight status compared to boys. It should be noted that one study found that for male adolescents, being underweight was significantly associated with thinking, planning, and attempting suicide.⁴ However, a longitudinal study found that both male and female youth who

perceive themselves as being underweight did not have a significant relationship with suicidal ideation.¹⁶ The American society puts a great deal of pressure on females to achieve unrealistic body standards; which may be part of the reason why girls have greater body dissatisfaction compared to boys.^{17,18} Study by Kim, Moon and Kim¹⁹ found that unrealistic body image and weight-control behaviors (such as dieting) are significantly related to suicidal behaviors. Similarly, girls are more likely than boys to partake in extreme weight control behaviors such as fasting, vomiting, taking laxatives, and using diet pill, powders, or liquids.²⁰

Therefore, adolescents who perceive themselves to be overweight or obese are at a greater risk for having suicidal thoughts and behaviors in comparison to peers who do not perceive themselves to have excess weight. However, other studies have found that weight status does indeed contribute to suicidal behaviors, regardless of weight perception. More research should therefore be conducted in order to make more conclusive statements of whether weight perception or weight status has a bigger impact on suicide ideation and behaviors in youth. Fortunately, although many studies have confirmed that females are more sensitive to their body image and weight status, a study by authors Lee and Seo¹⁶ indicated that the relationship between perceived weight status and suicide ideation decreased as participants aged.

The primary hypothesis of this study was to investigate the relationship of varied perceptions of body weight status to suicidal behavior (considered suicide, made a suicide plan, attempted suicide and had an injurious suicide attempt), after controlling for the effects of other risk factors, including sadness, weight control practices, and socio-demographics in a national

survey of 9th through 12th grade students. Second research hypothesis was to investigate the relationship of bullying experiences at school and electronically to suicidal behavior (considered suicide, made a suicide plan, attempted suicide and had an injurious suicide attempt) among adolescents in a national survey of 9th through 12th grade students.

METHODS

Procedures and Participants

We analyzed data from the 2015 Youth Risk Behavior Survey. The YRBS is administered by the US Centers for Disease Control and Prevention (CDC) and monitors priority health-risk behaviors among youth. It is a cross-sectional survey that uses a 3-stage cluster design to produce a sample representative of 9th through 12th grade students in the 50 states and the District of Columbia. Student participation in the survey is anonymous and voluntary, and local parental permission procedures are used. Students record their responses directly on a self-administered computer-scannable questionnaire. A weighting factor is applied to each record to adjust for nonresponse and the oversampling of black and Hispanic students. The 2015 YRBS has data from 15,506 students from across 125 schools nationally available for analysis.

Instrument – Dependent Variable

Considered suicide was measured by the question, “During the past 12 months, did you ever seriously consider attempting suicide?” Response choices were yes, or no. *Suicide attempt*

was measured by the question, “During the past 12 months, how many times did you actually attempt suicide?” For this study, responses were categorized as either 0 attempts or 1 or more attempts. *Planning to commit suicide* was measured with the question, “During the past 12 months, did you make a plan about how you would attempt suicide?” Response choices were yes or no. *Injurious suicide attempt* was measured by the question, “If you attempted suicide during the past 12 months, did any attempt result in an injury, poisoning, or overdose that had to be treated by a doctor or nurse?” Response choices were yes or no.

Independent Variables

Weight perceptions held by the students was measured by the following question, “How do you describe your weight?” Response options included – very underweight, slightly underweight, about the right weight, slightly overweight, and very overweight.

Bullying in-person that occurred at school was measured by the following question, “During the past 12 months, have you been bullied on school property?” Response choices were yes or no. *Electronic bullying* was measured by the following question, “During the past 12 months, have you ever been electronically bullied? (Count being bullied through e-mail, chat rooms, instant messaging, websites, or texting). Response choices were yes or no.

Covariates

Depressive symptoms was measured by the question, “During the past 12 months, did you ever feel so sad or hopeless almost every day for 2 weeks or more in a row that you stopped doing some usual activities?” Responses were either yes or no. *Attempting to lose weight* was measured by the question, “Which of the following are you trying to do about your weight?” Response choices were to lose weight, gain weight, stay the same weight or I am not trying to do anything about my weight. *Socio-demographics* information was self-reported by students, included age, sex (male / female), race/ethnicity (white, black, Hispanic, Asian, and others), and school grade (9th–12th grade).

Data Analysis

Descriptive statistics were used to describe the students’ demographic characteristics and risk behaviors. Logistic regressions were conducted to estimate the direct and independent association of key independent variables including in-person school and electronic bullying and weight perceptions to suicidal behaviors measured as considered suicide, attempted suicide, made plan to commit suicide and injurious suicide attempt, after controlling for the contribution of depression, trying to lose weight, and socio-demographic factors. Statistical significance was set at $p \leq .05$. This study incorporates sampling weights in all analyses. All analyses were performed using STATA 13.

RESULTS

Demographics

Using the 2015 YRBS, the CDC surveyed 15,506 students nationally: 7749 (49.97%) boys and 7757 (50.03%) girls. Most students self-identified as white, reported their age being 15 through 17 years, and their sexual identity as heterosexual. However, more girls reported trying to lose weight (61.9%) versus boys (34.4%), and also reported depression (40.9%) versus boys (20.9%). Regarding weight perception, almost equal number of boys and girls identified themselves as being normal weight (54.7% versus 50.1%), but for other groups of weight perceptions differences in frequencies were observed (Table 1).

Correlations of Suicidal Behaviors and Independent Variables

Table 2 depicts the correlations of suicidal behavior, bullying at school and electronically, weight perceptions, and other key variables in the study. Suicidal behavior risk of considered suicide and made a suicide plan were statistically and significantly correlated with all key variables including age, race / ethnicity, gender, education, trying to lose weight, weight perception, in person school and electronic bullying and depression. However, suicidal behavior of attempted suicide and injurious suicide attempt were statistically and significantly correlated with all key variables except race / ethnicity.

Logistic Regression of Independent Variables on Suicidal Behaviors

Table 3 reports the logistic regression analysis of socio-demographic characteristics and key independent variables on suicidal behaviors. Model 1 shows a statistically significant positive association between considered suicide and weight perceptions of being very underweight ($b = .66$, $SE = .16$, $p \leq .001$), slightly underweight ($b = .34$, $SE = .09$, $p < .001$), very overweight ($b = .65$, $SE = .11$, $p < .001$), and slightly overweight ($b = .35$, $SE = .07$, $p < .001$) when compared to those who had normal body weight perception, after controlling for socio-demographics and other control variables. In addition, statistically significant positive association was observed between those who reported experiencing bullying at school ($b = .63$, $SE = .07$, $p < .001$), experiencing electronic bullying ($b = .63$, $SE = .07$, $p < .001$) and considered suicide when compared to those who did not report either bullying, after controlling for socio-demographics and other control variables. Girls, when compared to boys ($b = .27$, $SE = .06$, $p < .001$) and having depressive symptoms versus none ($b = 2.38$, $SE = .06$, $p < .001$), were more likely to report considering suicide. Students who identified as Hispanic ($b = -.18$, $SE = .08$, $p < .021$) versus who identified as white were less likely to report considering suicide.

Model 2 shows a statistically significant positive association between made a suicide plan and weight perceptions of being very overweight ($b = .73$, $SE = .11$, $p < .001$), and slightly overweight ($b = .30$, $SE = .07$, $p < .001$) when compared to those who had normal body weight perception, after controlling for socio-demographics and other control variables. In addition, statistically significant positive association was observed between those who reported experiencing bullying at school ($b = .61$, $SE = .07$, $p < .001$), electronic bullying ($b = .52$, $SE =$

.05, $p < .001$) and made a suicide plan when compared to those who did not report either bullying, after controlling for socio-demographics and other control variables. Girls, when compared to boys ($b = .25$, $SE = .06$, $p < .001$) and having depressive symptoms versus none ($b = 2.24$, $SE = .07$, $p < .001$), were more likely to report making a suicide plan. Students who identified as Asian ($b = .31$, $SE = .15$, $p < .04$) versus who identified as white were more likely to report making a suicide plan.

Model 3 shows a statistically significant positive association between attempted suicide and weight perceptions of being very underweight ($b = .87$, $SE = .19$, $p < .001$), slightly underweight ($b = .38$, $SE = .12$, $p < .001$), very overweight ($b = .57$, $SE = .13$, $p < .001$), and slightly overweight ($b = .24$, $SE = .09$, $p \leq .008$) when compared to those who had normal body weight perception, after controlling for socio-demographics and other control variables. In addition, statistically significant positive association was observed between those who reported experiencing bullying at school ($b = .52$, $SE = .08$, $p < .000$), electronic bullying ($b = .78$, $SE = .09$, $p < .001$) and attempted suicide when compared to those who did not report either bullying, after controlling for socio-demographics and other control variables. Girls, when compared to boys ($b = .25$, $SE = .08$, $p < .001$) and having depressive symptoms versus none ($b = 2.30$, $SE = .09$, $p < .001$), were more likely to report attempted suicide. Students who identified as black ($b = .73$, $SE = .15$, $p < .04$), Hispanic ($b = .29$, $SE = .15$, $p < .007$), Asian ($b = .56$, $SE = .15$, $p < .01$), and others ($b = .45$, $SE = .15$, $p < .001$) versus who identified as white were more likely to

report attempted suicide. Students who reported actively trying to lose weight ($b = .19$, $SE = .90$, $p < .04$) versus not trying were more likely to report attempted suicide.

Model 4 shows a statistically significant positive association between injurious suicide attempt and weight perceptions of being very underweight ($b = 1.00$, $SE = .25$, $p < .001$), and very overweight ($b = .51$, $SE = .20$, $p < .012$) when compared to those who had normal body weight perception, after controlling for socio-demographics and other control variables. In addition, statistically significant positive association was observed between those who reported experiencing bullying at school ($b = .67$, $SE = .13$, $p < .001$), electronic bullying ($b = .79$, $SE = .14$, $p < .001$) and injurious suicide attempt when compared to those who did not report either bullying, after controlling for socio-demographics and other control variables. Students in 11th grade ($b = -.70$, $SE = .24$, $p < .003$) and 12th grade ($b = -1.32$, $SE = .32$, $p \leq .001$) compared to students in 9th and 10th grade and having depressive symptoms versus none ($b = 2.24$, $SE = .07$, $p < .001$), were more likely to report injurious suicide attempt. Students who identified as black ($b = .91$, $SE = .18$, $p < .04$) and others ($b = .44$, $SE = .14$, $p < .001$) versus who identified as white were more likely to report injurious suicide attempt.

DISCUSSION

Similar to previous studies, our research findings support our first hypothesis that there is a significant relationship between weight perception and suicidal behaviors among 9th through 12th graders after controlling for sadness, weight control practices, and socio-demographics.

Having considered suicide as well as having attempted suicide was significantly associated with the perception of being very overweight, slightly overweight, slightly underweight and very underweight. Having made a suicide plan was significantly associated with the perception of being very overweight or slightly underweight. Finally, having made an injurious suicide attempt was significantly associated with the perception of being very overweight and very underweight. These findings are consistent with research supporting that perceived weight status is associated with greater odds of committing suicide,⁴ and that the perception of being overweight is associated with considering suicide.²¹

Study findings also strongly supported our second hypothesis that there is a significant relationship between being bullied at school or electronically and suicidal behaviors among 9th through 12th graders after controlling for sadness, weight control practices, and socio-demographics. Every suicidal behavior, from considered suicide to, made an injurious suicide attempt, was significantly associated with being bullied at school and being bullied electronically. Previous research^{6,22,23} supports our finding that being bullied increases an individual's risk for considering suicide.

Girls were more likely to report partaking in every suicidal behavior except made an injurious suicide attempt. This finding is consistent with other studies supporting that girls have a higher risk of suicidal behavior compared to boys.^{24,25} Individuals who identified as being a race or ethnicity other than white were more likely to report having made a suicidal behavior; Blacks and those identifying as "other" were more likely to have made an injurious suicide attempt.

Previously literature supports our finding that black adolescents have higher rates of making a suicide attempt compared to their white peers.²⁶ Additionally, another study found that indigenous adolescents, such as Native Americans and Alaskan Natives, have a higher risk of suicidal behavior compared to white youth.²⁷ Adolescents who reported having depressive symptoms were more likely to have all suicidal behaviors. Surprisingly, those who reported they were actively trying to lose weight were more likely to report having attempted suicide, but none of the other suicidal behaviors had any significant association. Those in 11th and 12th grades are more likely to have made an injurious suicide attempt; this makes sense considering the fact that these students are predominately older than 9th and 10th graders and have had more time to think and plan out a suicide attempt.

IMPLICATIONS FOR SCHOOL HEALTH

School administrators, teachers, and parents should be aware of the risk that poor body image and weight status pose to suicidal thoughts and behaviors, especially among girls. Based on the results of this study, students who perceive their weight as being above or below normal have an increased risk for suicide ideation and completion. Therefore, parents and teachers should be mindful if a child is mentioning dissatisfaction with his or her weight and image, regardless of their actual weight. Teachers should consider referring these students to resources such as, school nurse to ensure their mental health is stable or if counseling is necessary.

Increasing educational efforts to discuss body image among young girls and boys at this crucial

physical and mental developmental phase of their growth may serve as a protective factor against suicidal behaviors and committing suicide in youth.

Attention needs to be paid to various sources and kinds of bullying behavior that may occur inside and outside the school premise due to the popularity and excessive use of social media by the youth. Therefore, parents' involvement at preventing or minimizing bullying at home and outside school is just as important as the efforts of school administrators and teachers. Research has shown that a positive climate at school diminishes the relationship between bullying and suicidal behaviors.²⁸ Parental involvement has been found to be a protective factor against suicidal behaviors in adolescents, particularly among girls.²⁸ This finding suggests that parent focused workshops that include information, tips, and resources on minimizing their child's risk of being bullied in person or electronically can help reduce the chances of adolescents partaking in suicidal behaviors.

Additionally, school administrators should consider offering training sessions for teachers that would help them develop skills in preventing, addressing and resolving bullying concerns at school. Training sessions should also include information on current social media platforms and trends so that teachers have a better understanding of potential bullying channels.

Limitations

Our study, however had a few limitations. First, the use of a secondary data with a cross-sectional design hindered our ability to make cause-effect inferences. Second, because all

participants were high school students, the findings do not reflect the experiences of adolescents who have dropped out of school. Self-reported survey data may not be able to prove a comprehensive picture of all the dimensions of weight perception and bullying experience, it may be beneficial to conduct qualitative data collection, such as, focus groups and in-depth interviews to elicit deeper insights on the issues of risk factors of suicidal behavior among the adolescent youth.

Conclusions

This study highlights the importance of examining not just body weight, rather perceived weight status, as a significant risk factor for suicidal behaviors among the youth. Bullying at school has been rigorously addressed at schools, such as increased educational opportunities for students, administrators and teachers; however, with increasing use of electronic medium and constant new additions of social media platforms, this study emphasizes the detrimental impact of electronic bullying behavior as a significant risk factor for suicidal behavior.

Human Subjects Approval Statement

Preparation of this paper did not involve primary research or data collection involving human subjects, and therefore, no institutional review board examination or approval was required.

Conflict of Interest

All authors of this article declare they have no conflicts of interest to declare.

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Table 1. **Demographics of Study Variables in YRBS 2015**

VARIABLES	Men % N = 7749	Women % N = 7757	Total % N = 15,506
Age			
12 years old or younger	0.3	0.2	7.2
13 years old	0.1	0.1	--
14 years old	10.0	11.7	8.7
15 years old	24.3	24.8	24.6
16 years old	25.9	25.9	26.1
17 years old	24.5	24.8	21.7
18 years old or older	14.9	12.5	11.6
Education			
9th Grade	25.5	26.2	25.0
10th Grade	25.5	25.3	30.0
11th Grade	25.7	25.1	21.7
12th Grade	23.2	23.3	18.3
Race/Ethnicity			
White	44.5	45.3	32.8
Black	11.0	10.8	15.5
Asian	4.2	4.0	--
Hispanic/Latino	15.5	15.5	13.8
Other	27.1	24.3	37.8
Depressive symptoms			
Sad or Hopeless	20.9	40.9	35.2
Bullying			
Electronic	9.4	19.9	18.7
At school	15.7	22.5	19.6
Suicidal Behavior			
Considered Suicide	12.2	24.1	19.2
Made a Suicide Plan	10.3	20.4	20.6

Attempted Suicide	5.9	13.1	14.1
Injurious Suicide Attempt	2.1	4.3	1.3
Perception of Weight			
Very Underweight	3.8	2.1	4.7
Slightly Underweight	15.0	8.8	19.8
Normal Weight	54.7	50.1	47.2
Slightly Overweight	22.4	32.2	20.8
Very Overweight	4.2	6.8	7.5
Trying to Lose Weight	34.4	61.9	43.0

Table 2. Correlation Matrix of Study Variables in YRBS 2015

	Considered Suicide	Made a Suicide Plan	Attempted Suicide	Injurious Suicide Attempt	Age	Race / Ethnicity	Sex	Education	Depressive symptoms	Trying to lose weight	Perception of Weight	Bullied at School	Bullied Electronically
Considered Suicide	1												
Made a Suicide Plan	0.67**	1											
Attempted Suicide	-.52**	-.51**	1										
Injurious Suicide Attempt	-.58**	-.54**	0.80**	1									
Age	0.02**	0.03**	-.04**	-.05**	1								
Race / Ethnicity	-.02**	-.02*	0.01	0.01	0.00	1							
Sex	0.15**	0.14**	-.11**	-.12**	0.03**	-.02*	1						
Education	0.18*	0.02**	-.04**	-.05**	0.85**	-.001	0.006	1					
Depressive symptoms	0.49**	0.43**	-.32**	-.33**	-.004	-.06**	0.22**	-.001	1				
Trying to lose Weight	0.09*	0.08**	-.07**	-.08**	-.006	-.05**	0.17**	-.008	0.12**	1			
Weight Perception	-.06***	-.07**	0.03**	0.03**	0.02*	0.06**	-.15**	0.02**	-.06**	-.34**	1		
Bullied at School	0.27**	0.25**	-.21**	-.19**	0.08**	-.01	0.09**	0.09**	0.25**	0.07**	-.05**	1	
Bullied Electronically	0.28**	0.26**	-.22**	-.21**	0.05**	-.007	0.15**	0.04**	0.27**	0.07**	-.03**	0.47**	1

Note:

** Correlation is significant at the .01 level (2-tailed).

* Correlation is significant at the .05 level (2-tailed).

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VARIABLES	Model 1 Considered suicide Coefficient (SE)	Model 2 Made a suicide Plan Coefficient (SE)	Model 3 Attempted Suicide Coefficient (SE)	Model 4 Injurious Suicide Attempt Coefficient (SE)
Age	-.06(.05)	-.06(.05)	-.03(.06)	.32(.09)***
Sex				
Male	Ref	Ref	Ref	Ref
Female	.27(.06)***	.25(.06)***	.25(.08)**	.10(.13)
Grade				
9 th Grade	Ref	Ref	Ref	Ref
10 th Grade	.07(.09)	-.05(.09)	-.06(.11)	-.30(.18)
11 th Grade	.12(.11)	-.07(.12)	-.15(.15)	-.70(.24)**
12 th Grade	.09(.15)	.01(.15)	-.39(.20)	-1.32(.32)***
Race/ Ethnicity				
White	Ref	Ref	Ref	Ref
Black	-.03(.09)	.15(.09)	.73(.12)***	.91(.18)***
Hispanic	-.18(.08)*	-.15(.08)	.29(.11)**	.16(.18)
Asian	.17(.13)	.31(.15)*	.56(.17)***	.43(.30)
Other	.01(.07)	.12(.07)	.45(.09)***	.44(.14)***
Depressive symptoms				
No	Ref	Ref	Ref	Ref
Yes	2.38(.06)***	2.24(.07)***	2.30(.09)***	2.29(.17)***
Tried to lose weight				
No	Ref	Ref	Ref	Ref
Yes	.09(.07)	-.01(.07)	.19(.09)*	.27(.15)
Weight perception				
Normal average weight	Ref	Ref	Ref	Ref
Very Underweight	.66(.16)***	.11(.09)	.87(.19)***	1.00(.25)***
Slightly Underweight	.34(.09)***	.32(.17)	.38(.12)***	.17(.20)
Slightly Overweight	.35(.07)***	.30(.07)***	.24(.09)**	.07(.15)
Very Overweight	.65(.11)***	.73(.11)***	.57(.13)***	.51(.20)*
Bullying				
At School	.63(.07)***	.61(.07)***	.52(.08)***	.67(.13)***
Electronically	.63(.07)***	.52(.05)***	.78(.09)***	.79(.14)***

Table 3. **Logistic Regression of Demographics, Bullying and Weight Perceptions on Suicidal Behavior**

Note.

***p < .001, **p < .01, *p < .05; Ref: reference group

Coefficient = Regression Coefficient; SE = Standard Error

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