The Effect of Age and Bullying on the Likelihood of Teen Marijuana Use

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Data Set and Research Questions

- Data Source
  - Centers for Disease Control 2013 Youth Risk Behavior Surveillance Survey
  - Nationally representative sample of 148 high schools with 13,583 useable survey questionnaires.
  - 68% total response ratio
  - I used a 5% SPSS randomly selected sample of cases from this survey. This was due to the extremely large number of cases and the limitations of HLM.

- Research Questions
  - RQ 1 - Controlling for age, being bullied at school and being bullied online, what is the likelihood of teen marijuana use.
  - RQ 2 – Controlling for age and being bullied online, what is the relationship between being bullied on school grounds and the likelihood of teen marijuana use.
  - RQ 3 - Controlling for age and being bullied on school grounds, what is the relationship between being bullied online and the likelihood of teen marijuana use.
  - RQ 4 – What is the effect of age on the relationship between being bullied at school or online and the likelihood of teen marijuana use.
  - RQ 5 - What is the effect of age on the relationship between being bullied at school and the likelihood of teen marijuana use.
  - RQ 6 - What is the effect of age on the relationship between being bullied online and the likelihood of teen marijuana use.

Literature Review

- Around 30% of students are involved in bullying in the United States as either a bully or being bullied in school(Hall, 2006).
- Between the genders there is a difference in bullying patterns as well. Boys seem to prefer a physical approach to bullying in a manner to possibly express their masculinity. While girls prefer to use relational aggression bullying by spreading rumors or ostracizing (Leung & To, 2009).
- The most common reason for bullying found in a study conducted by the West Virginia State Board of Education in 2015 was physical appearance followed by gender, sexual orientation, disability, and race (2015).
- Over two-fifths of all 12th graders reported having used marijuana in their lifetimes. 35% had done so in the past year and 21% had done so in the past month (Johnston, O'Malley, Bachman & Schulenberg, 2011).
- During the 2008-2009 school year 28% of students that were surveyed by US Department of Education had been bullied online (2011).
- A longitudinal study of marijuana use from 1990-1999 showed that marijuana trials of marijuana amongst African American teens had decreased during the time period, but had remained steady for white and Hispanic teens (Delaney, 2002)

Variables

- Cluster Variable = PSU (Primary Sampling Unit)
- Dependent Variable = During your life, how many times have you used marijuana?
  - A. 0 times
  - B. 1 or 2 times
  - C. 3 to 9 times
  - D. 10 to 19 times
  - E. 20 to 39 times
  - F. 40 to 99 times
  - G. 100 or more times
- Recoded to 1 = 1 or more time have smoked marijuana and 0 = never smoked marijuana.

- Independent Variables:
- I did not center these variables
- Level 1 = During the past 12 months, have you ever been bullied on school property?
  - Coded 0 = Yes
  - Coded 1 = No
- Level 1 = During the past 12 months, have you ever been **electronically** bullied? (Include being bullied through e-mail, chat rooms, instant messaging, Web sites, or texting.)
  - Coded 0 = Yes
  - Coded 1 = No

Variables Cont'd

- Level 2 = How old are you?
  - Coded 1 = 12 years old or younger
  - Coded 2 = 13 years old
  - Coded 3 = 14 years old
  - Coded 4 = 15 years old
  - Coded 5 = 16 years old
  - Coded 6 = 17 years old
  - Coded 7 = 18 years old or older
- I then aggregated the PSU (Primary Sampling Unit) by the age of the respondents to get an average age per PSU to use as the level 2 variable.
- I did not center this variable

Null Model

Level 1: $\eta_{ij} = \beta_{0j}$

Level 2: $\beta_{0j} = \gamma_{00} + \mu_{0j}$

- η_{ij} = Student Marijuana Use

Fixed Effect	Coefficient	Standard error	*t*-ratio	Approx. *d.f.*	*p*-value
For INTRCPT1, β_0 INTRCPT2, γ_{00}	-0.254001	0.096204	-2.640	53	0.011

Fixed Effect	Coefficient	Odds Ratio	Confidence Interval
For INTRCPT1, β_0 INTRCPT2, γ_{00}	-0.254001	0.775691	(0.640,0.941)

Random Effect	Standard Deviation	Variance Component	*d.f.*	χ^2	*p*-value
INTRCPT1, u_0	0.36287	0.13168	53	78.24619	0.014

Y00= -.254 = average log-odds of marijuana use among primary sampling units. This is statistically significant with a p=.011

Odds of marijuana use is .77. Confidence interval does not contain 1.

There is a statistically significant variance in the primary sampling units of the odds of marijuana use p= .014.

Models

- Level 1 Conditional Model

Level 1: $\eta_{ij} = \beta_{0j} + \beta_{1j}X_{ij}$

Level 2: $\beta_{0j} = \gamma_{00} + \mu_{0j}$

$\beta_{1j} = \gamma_{10}$

- η_{ij} = Student Marijuana Use
- X_{ij} = Student Bullied on School Property Yes/No

Fixed Effect	Coefficient	Standard error	*t*-ratio	Approx. *d.f.*	*p*-value
For INTRCPT1, β_0					
INTRCPT2, γ_{00}	-0.253865	0.096212	-2.639	53	0.011
For BULLIED slope, β_1					
INTRCPT2, γ_{10}	0.038943	0.215088	0.181	608	0.856

Fixed Effect	Coefficient	Odds Ratio	Confidence Interval
For INTRCPT1, β_0			
INTRCPT2, γ_{00}	-0.253865	0.775797	(0.640,0.941)
For BULLIED slope, β_1			
INTRCPT2, γ_{10}	0.038943	1.039712	(0.681,1.586)

γ_{00} = -0.25 = average log-odds of marijuana use of students who have been bullied on school grounds. This log-odds differs significantly from zero (p = .011) The average odds of marijuana use amongst students who had been bullied is .78.

γ_{10} = 0.04 = average log-odds of marijuana use of students who have not been bullied on school grounds. This log-odds do not differ significantly from zero (p =0.856)

Models

- Level 1 Conditional Model

Level 1: $\eta_{ij} = \beta_{0j} + \beta_{1j}X_{ij}$

Level 2: $\beta_{0j} = \gamma_{00} + \mu_{0j}$

$\beta_{1j} = \gamma_{10}$

- η_{ij} = Student Marijuana Use
- X_{ij} = Student Bullied Online Yes/No

Fixed Effect	Coefficient	Standard error	*t*-ratio	Approx. *d.f.*	*p*-value
For INTRCPT1, β_0					
INTRCPT2, γ_{00}	-0.259416	0.100961	-2.569	53	0.013
For ONLINE_B slope, β_1					
INTRCPT2, γ_{10}	-0.832822	0.244582	-3.405	608	<0.001

Fixed Effect	Coefficient	Odds Ratio	Confidence Interval
For INTRCPT1, β_0			
INTRCPT2, γ_{00}	-0.259416	0.771502	(0.630,0.945)
For ONLINE_B slope, β_1			
INTRCPT2, γ_{10}	-0.832822	0.434820	(0.269,0.703)

γ_{00} = -0.26 = average log-odds of marijuana use of students who have been bullied online. This log-odds differs significantly from zero (p =.013)
The average odds of marijuana use amongst students who had been bullied online is .77.
γ_{10} = -0.83 = average log-odds of marijuana use of students who have not been bullied online. This log-odds differs significantly from zero (p <0.001).
The average odds of marijuana use amongst students who have not been bullied online is .44.

Intercept as Outcomes Model

- Link Function: $\eta_{ij} = \log(\frac{\varphi_{ij}}{1-\varphi_{ij}})$
- Structural Model:

Level 1: $\eta_{ij} = \beta_{0j} + \beta_{1j}X_{1j} + \beta_{2j}X_{2j}$

Level 2: $\beta_{0j} = \gamma_{00} + \gamma_{01}W_j + \mu_{0j}$

$\beta_{1j} = \gamma_{10}$

$\beta_{2j} = \gamma_{20}$

- η_{ij} = Student Marijuana Use
- X_{1j} = Student Bullied on School Property Yes/No
- X_{2j} = Student Bullied Online Yes/No
- W_j = Aggregated Age of Student by Primary Sampling Unit

Fixed Effect	Coefficient	Standard error	*t*-ratio	Approx. *d.f.*	*p*-value
For INTRCPT1, β_0					
INTRCPT2, γ_{00}	-4.674070	1.941684	-2.407	52	0.020
Q1_MEAN, γ_{01}	0.855044	0.375460	2.277	52	0.027
For BULLIED slope, β_1					
INTRCPT2, γ_{10}	0.478081	0.249995	1.912	607	0.056
For ONLINE_B slope, β_2					
INTRCPT2, γ_{20}	-1.081752	0.277110	-3.904	607	<0.001

Fixed Effect	Coefficient	Odds Ratio	Confidence Interval
For INTRCPT1, β_0			
INTRCPT2, γ_{00}	-4.674070	0.009334	(0.000,0.460)
Q1_MEAN, γ_{01}	0.855044	2.351477	(1.107,4.996)
For BULLIED slope, β_1			
INTRCPT2, γ_{10}	0.478081	1.612976	(0.987,2.635)
For ONLINE_B slope, β_2			
INTRCPT2, γ_{20}	-1.081752	0.339001	(0.197,0.584)

- Age of the respondent significantly increases the log-odds of marijuana use among students who have been bullied in school and online (p = .027)
- For each increase in age there is a corresponding increase in the odds of marijuana use.

Intercept and Slopes as Outcomes Models

- Link Function: $\eta_{ij} = \log(\frac{\varphi_{ij}}{1-\varphi_{ij}})$
- Structural Model:

Level 1: $\eta_{ij} = \beta_{0j} + \beta_{1j}X_{1j}$

Level 2: $\beta_{0j} = \gamma_{00} + \gamma_{01}W_j + \mu_{0j}$

$\beta_{1j} = \gamma_{10} + \gamma_{11}W_j + \mu_{0j}$

- η_{ij} = Student Marijuana Use
- X_{ij} = Student Bullied on School Property Yes/No
- W_j = Aggregated Age of Student by Primary Sampling Unit

Fixed Effect	Coefficient	Standard error	*t*-ratio	Approx. *d.f.*	*p*-value
For INTRCPT1, β_0					
INTRCPT2, γ_{00}	-4.364465	1.748737	-2.496	52	0.016
Q1_MEAN, γ_{01}	0.795250	0.341663	2.328	52	0.024
For BULLIED slope, β_1					
INTRCPT2, γ_{10}	-4.556647	4.267718	-1.068	52	0.291
Q1_MEAN, γ_{11}	0.892133	0.825305	1.081	52	0.285

Fixed Effect	Coefficient	Odds Ratio	Confidence Interval
For INTRCPT1, β_0			
INTRCPT2, γ_{00}	-4.364465	0.012721	(0.000,0.425)
Q1_MEAN, γ_{01}	0.795250	2.214995	(1.116,4.397)
For BULLIED slope, β_1			
INTRCPT2, γ_{10}	-4.556647	0.010497	(0.000,55.073)
Q1_MEAN, γ_{11}	0.892133	2.440330	(0.466,12.788)

- At the sample level, increases in mean age lead to decreases in the effect of being having been bullied on teen marijuana use.
- Each unit increase in mean age increases the log-odds from -4.57 to -3.67 (-4.57 + -.89).
- However, this effect is not statistically significant with p= .285.
- The confidence levels for this odds-ratio include 1.

Intercept and Slopes as Outcomes Models

- Link Function: $\eta_{ij} = \log(\frac{\varphi_{ij}}{1-\varphi_{ij}})$
- Structural Model:

Level 1: $\eta_{ij} = \beta_{0j} + \beta_{1j}X_{1j}$

Level 2: $\beta_{0j} = \gamma_{00} + \gamma_{01}W_j + \mu_{0j}$

$$\beta_{1j} = \gamma_{10} + \gamma_{11}W_j + \mu_{0j}$$

- η_{ij} = Student Marijuana Use
- X_{ij} = Student Bullied Online Yes/No
- W_j = Aggregated Age of Student by Primary Sampling Unit

Fixed Effect	Coefficient	Standard error	*t*-ratio	Approx. *d.f.*	*p*-value
For INTRCPT1, β_0					
INTRCPT2, γ_{00}	-4.567956	1.988337	-2.297	52	0.026
Q1_MEAN, γ_{01}	0.834667	0.384764	2.169	52	0.035
For ONLINE_B slope, β_1					
INTRCPT2, γ_{10}	10.001755	5.539142	1.806	52	0.077
Q1_MEAN, γ_{11}	-2.118898	1.083083	-1.956	52	0.056

Fixed Effect	Coefficient	Odds Ratio	Confidence Interval
For INTRCPT1, β_0			
INTRCPT2, γ_{00}	-4.567956	0.010379	(0.000,0.561)
Q1_MEAN, γ_{01}	0.834667	2.304048	(1.064,4.987)
For ONLINE_B slope, β_1			
INTRCPT2, γ_{10}	10.001755	22065.158720	(0.328,1485195545.739)
Q1_MEAN, γ_{11}	-2.118898	0.120164	(0.014,1.056)

- At the sample level, increases in mean age lead to decreases in the effect of being having been bullied online on teen marijuana use.
- Each unit increase in mean age increases the log-odds from 10.00 to 7.88 (10.00+ -2.12).
- However, this effect is not statistically significant with p= .056. It is close however.
- The confidence levels show that it is close to being statistically significant because for this odds-ratio barely includes 1.

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