Evolutionary Psychology

Indirect Peer Aggression in Adolescence and Reproductive Behavior

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Abstract: Evolutionary psychologists have suggested that indirect aggression during adolescence is a strategy to compete with same-sex peer rivals for resources, status, and mating opportunities. We collected survey data on 143 young adults to determine retrospectively, the amount of indirect aggressive behavior they perpetrated and the amount of indirect victimization they experienced in middle school and high school. We also collected information about reproductive opportunities such as age at first sexual intercourse and number of lifetime sex partners to determine whether aggression or victimization could be used to predict measures of reproductive opportunity. We performed a principal components analysis to develop factors from 16 aggression and victimization variables. Results indicate that females who reported indirect aggression toward peers had earlier ages at first sexual intercourse and females who were more victimized in adolescence experienced later ages at first sexual intercourse. We discuss these results in terms of intrasexual competition and evolutionary theory.

Keywords: indirect peer aggression; intrasexual competition

Introduction

Peer aggression and victimization is widespread in children and adolescents between 11 and 16 years old (Nansel, Craig, Overpeck, Saluja, and Ruan, 2004). The multi-national Health Behavior in School Aged Children Study shows that no fewer than 9% and as many as 54% of school aged children from the 25 nations studied are involved in aggressive acts toward peers, are victimized by peers, or both (Nansel et al., 2004). The apparent ubiquity of these behaviors in children and adolescents has made their study and prevention important educational and public health goals (Berger, 2007; Hawley, Little,

and Rodkin, 2007; Olweus, 1993; Smith, Pepler, and Rigby, 2004). While developmental and educational psychologists have dominated the study and interpretation of these behaviors, several researchers have proposed that these behaviors can and should be understood from the perspective of evolutionary theory (Bjorklund and Pellegrini, 2002; Hawley, 1999; Sutton, Smith and Swettenham, 1999; Vaillancourt, 2005).

Two recent studies use evolutionary principles to link peer victimization in adolescence with mating and intrasexual competition. Leenaars, Dane, and Marini (2008) found that female adolescents who considered themselves attractive were at higher risk for indirect victimization (e.g., hurtful rumor spreading) than their non-victimized peers. The authors interpret these results as a form of intrasexual competition between female adolescents whereby attractive girls become targets of victimization by other girls who are competing for mating opportunities. This interpretation follows the logic that males favor attractive females (Buss, 1988, 1989) and females compete with each other for high quality, attractive mates (Buss, 1988; Buss and Dedden, 1990). Indirect aggression may become a behavioral/functional tool to lower the competitive value of rival girls by signaling the victim's promiscuity and possible infidelity to potential male mates (Buss and Dedden, 1990). The indirect nature of the behavior reduces the chance of physical harm which is a predicted element of female aggressive competition (Campbell, 1999). Victimized females may not suffer in number of available short-term sex partners, but may be hindered in their competition for genetically superior long-term mates due to reputational damage (Buss and Schmitt, 1993).

Gallup, O'Brien, White and Wilson (2009) found that 85% of victimization in adolescence is directed toward same-sex peers as predicted by results from large school samples from Europe and Australia (Olweus, 1993; Rigby 2002). Gallup et al. (2009) showed that female victims of indirect aggression started having sex at earlier ages and had more lifetime sex partners in early adulthood than their peers who were either not victimized or less victimized in adolescence. The opposite relationship was true for males, as victimization in adolescence was negatively correlated with lifetime number of sex partners and the rate of sex partners per year.

Intrasexual aggression is one of many functional and potentially adaptive responses to competition with mating rivals and the retention of opposite-sex partners (Buss and Shackelford, 1997). From a functional point of view, researchers have found that aggressive behavior towards peers lowers self-esteem and self-regard in victimized children and adolescents (Egan and Perry, 1998; Salmivalli, Kaukiainen, Kaistaniemi, and Lagerspetz, 1999; Rigby, 2002). In adolescent females, this reduction in self-esteem could lead to (1) reduced dating/mating opportunities due to marginalization and ostracism or (2) to increased short-term sexual encounters as these teens seek short-term affairs that boost self-esteem (Greiling and Buss, 2000). Numerous short-term mating opportunities favor male reproductive strategies but may be costly to females who could be perceived as promiscuous or potentially unfaithful to males.

Other researchers have shown that self-esteem is lower in children and adolescents who are (1) victimized, (2) aggressive toward peers, or (3) considered both bullies and victims (Rigby and Cox, 1996; O'Moore and Kirkham, 2001). High self-esteem appears to protect children and adolescents from both perpetrating and being victimized by these negative social interactions with peers (O'Moore and Kirkham, 2001). Adolescents with high self-

esteem may compete with peers using more prosocial behavior and may be better able to avoid aggressive interactions. High self-esteem may play a role in the disparate reproductive strategies of males and females.

In adolescent males, aggressive behavior is employed to maintain status in the social dominance hierarchy (Hawley, 1999; Bjorklund and Pellegrini, 2002; Pellegrini and Bartini, 2000). Those who are victimized descend in the hierarchy and have less access to resources including mating opportunities. Cross-culturally, females tend to prefer high status males who control or have the potential to control resources (Buss, 1988). In adolescent females, however, the reproductive value of social dominance is the ability to be choosy about dating and mating partners and priority access to resources such as alliances, friendships, and information (Hawley, 2007). In this study we examine the interaction between reproductive opportunities in adulthood and both indirect peer aggression and indirect peer victimization during adolescence. Previous work has shown that victimization and aggression in adolescence are not mutually exclusive and therefore need to be considered together. Survey data from young adults were collected to test three hypotheses.

Hypotheses

Hypothesis 1. Females who report higher than average indirect aggression towards same-sex peers in adolescence will also report earlier ages at first sexual intercourse.

Recent research has shown that mating motivates increased intrasexual indirect aggression in young adult females (Griskevicius, Tybur, Gangestad, Perea, Shapiro, and Kenrick, 2009). If indirect aggression toward same-sex peers has an adaptive evolutionary origin by increasing social dominance or by lowering a victim's self-esteem, we expect indirectly aggressive females to achieve a measure of reproductive benefit from these behaviors. In fact, several researchers have found that girls who used indirect aggression towards peers were more likely to be nominated as potential dating partners and were more likely to begin dating at earlier ages (Connolly, Pepler, Craig, and Taradash, 2000; Pellegrini and Long, 2003; Vaillancourt, 2005). In females, the initiation of dating and sexual intercourse at an early age increases the length of the reproductive window and may subsequently increase total fertility (Wood, 1994). Therefore, we expect females who used indirect aggression during adolescence to report earlier ages at first sexual intercourse than less aggressive peers.

Hypothesis 2. Indirect victimization in adolescence will predict fewer than average sex partners and later than average ages at first intercourse in males.

We expect that males who are victimized during adolescence will suffer damage to their standing in the social hierarchy and therefore find themselves selected less often by females for mating opportunities (Buss, 1988). If indirect victimization delays the onset of sexual relations and reduces the victim's desirability to the opposite sex, it becomes an effective evolutionary strategy for the aggressor (Buss and Dedden, 1990; Gallup et al., 2009; Leenaars et al., 2008).

Hypothesis 3. Indirect victimization in adolescence will predict higher than average sex partners and earlier than average ages at first intercourse in females.

Gallup et al. (2009) demonstrated that female victims in their sample entered into sexual relationships earlier and had higher than average numbers of sex partners than less

victimized peers. This hypothesis appears counter-intuitive because it suggests that having more reproductive opportunities is detrimental to reproductive fitness. However, reputational damage can occur when females are perceived by males to be promiscuous which ultimately leads to reduced opportunities for long-term, high quality male mates. Owens, Shute, and Slee (2000) have shown that girls denigrate victims with terms such as "slut" or "whore" and focus negative attention on physical appearance and dress. These aggressive acts aim directly at the sources of male attraction; fidelity and physical attractiveness (Buss, 1989). Leenaar's et al. (2008) demonstrated that attractive girls report high levels of indirect victimization suggesting that female aggressors target rivals who are the most attractive potential mates.

It is important to note that early experience with sexual behavior may also provide victims with some evolutionary benefits by expanding the length of time that they may reproduce. However, these benefits need to be weighed in terms of the quality of mates and future resource allocations provided by what may be inferior or uncommitted male partners.

Somewhat more straightforward is the alternate hypothesis which suggests that females victimized in adolescence are also marginalized from the mating pool, and thus will have likely experienced a later onset of sexual activity and will have had fewer sexual partners in early adulthood. Since victimization in adolescence does not preclude perpetrating aggressive behavior as well, it is important to determine the effects of victimization while controlling for aggression.

Materials and Methods

Participants

Participants were recruited from introductory level psychology classes at the University at Albany. Students received class credit for their participation. The University Institutional Review Board approved this research and all participants signed informed consent agreements. Participants included 82 heterosexual males and 61 heterosexual females ranging in age from 18 to 28 years. Mean age was 18.85 years (SD =1.68) for males and 19.11 years (SD =1.89) for females.

In preparation for statistical analyses, we eliminated outlying data points that exceeded three standard deviations below the mean for age at first sex and three standard deviations above the mean for number of sex partners. We also included only sexually experienced participants. Statistical analyses were ultimately conducted on 68 male and 51 female participants.

According to the Centers for Disease Control and Prevention, the mean ages at first sexual intercourse for U.S. men and women aged 15-44 in 2002 were 17.0 years and 17.4 years respectively (Mosher, Chandra, and Jones, 2005). The participants retained in this study reported a mean age at first intercourse of $M = 16.13$, $SD = 1.61$ for males and $M = 16.75$, $SD = 1.45$ for females. The median number of opposite-sex lifetime sexual partners for Americans 20-24 years of age in 2002 was 3.8 for men and 2.8 for women. Our sample of young adults slightly exceeds this national average with males $M = 4.22$, $SD = 3.80$ and females $M = 3.41$, $SD = 3.14$, however we only included sexual experienced individuals.

Survey

Participants were asked to fill out an anonymous social experiences survey that included questions about how often they demeaned-diminished-embarrassed, teased, excluded, or isolated peers in middle school and high school and how often they were the victim of these behaviors during the same period. Although there is some debate about what these behaviors should be called, we recognize all of these behaviors as non-physical means of manipulating the social environment either through peers or other social/relational means (Björkquist, 2001; Björkqvist, Lagerspetz, Kaukainen, 1992; Vaillancourt, 2005). Middle school was defined in the survey as grades six through eight and high school as grades nine through twelve. Survey questions were modified from Newman, Holden, and Delville (2005) and used previously in Gallup, White, and Gallup (2007) and Gallup et al. (2009). Participants were also asked if they had engaged in sexual intercourse, their age at first sexual intercourse, and their number of sexual partners.

In order to better understand the level of sexual experience in our sample we calculated a ratio of partners per year of sexual activity by dividing the mean number of sexual partners by the years of sexual activity. This variable captures rate of sexual activity, and thus provides a measure of relative promiscuity. The number of years of sexual activity was calculated by subtracting from the participant's age their age at first sexual intercourse.

Indices were created using the variables above for high school and middle school indirect aggression and indirect victimization by adding the score for each of the four Likert scale responses (i.e. demeaned-diminished-embarrassed, teased, excluded, or isolated). The minimum score is four and the maximum score is 20. Pearson correlation coefficients were calculated to probe the relationship between aggression, victimization, and the measures of reproductive behavior.

We also performed a principal components analysis (PCA) on the individual aggression and victimization variables because the aggression and victimization index results were significantly correlated. We chose to perform a PCA to produce uncorrelated factors to use as independent variables. Sixteen questions in total were utilized in the PCA. Males and female PCA were performed separately based on theoretical evidence suggesting that males and females have different sexual strategies and styles of aggressive behaviors (Björkqvist, 1994; Buss, 1989; Trivers, 1972). Correlation matrices for the full male and female sample can be supplied by the first author. Statistical analysis was conducted with R (R Development Core Team, 2008). R is a high level, freely available statistical programming language and environment (Crawley, 2007).

Results

Descriptive statistics

Table 1 presents the descriptive statistics for the dependent variables in this study. Independent *t*-tests confirm that there were no statistically significant differences between the means of males and females for number of sex partners ($t = -1.364$, $df = 115.999$, $p = 0.175$), age at first intercourse ($t = 1.844$, $df = 105.927$, $p = 0.067$) or partners/year ($t = -1.568$, $df = 115.943$, $p = 0.119$).

Table 1. Descriptive statistics for reproductive opportunity variables.

	Gender	*N*	Median	*M*	*SD*	Range
Number of sex	M	68	3.00	4.22	3.80	1.00-15.00
partners	F	51	2.00	3.41	3.14	1.00-17.00
Age at first sexual	M	68	16.00	16.13	1.61	11.00-19.00
intercourse	F	51	17.00	16.75	1.45	14.00-21.00
Sex partners per	M	68	1.00	1.19	.82	.17-3.75
year	F	51	1.00	.99	.64	.17-3.40

Table 2 lists the descriptive statistics for the indirect aggression and victimization subscales by sex and age group (high school and middle school). We added an aggression and victimization question on teasing after data collection began, therefore some individuals did not respond to that question. This is reflected in the *N* below.

Table 2. Descriptive statistics for aggression and victimization indices.

	Gender	*N*	*M*	*SD*	Range
High School					
Victimization subscale	Male	62	6.43	2.10	4-13
	Female	51	7.37	2.60	4-9
Aggression subscale	Male	62	8.11	2.66	4-14
	Female	39	7.64	2.66	4-13
Middle school					
Victimization subscale	Male	67	7.81	3.41	4-18
	Female	51	8.51	2.93	4-17
Aggression subscale	Male	67	7.82	2.78	4-14
	Female	40	7.60	3.01	4-15

Statistical Results

Table 3 presents the correlation matrix for the four survey index questions and reproductive behavior variables. The correlation matrix indicates that several indirect aggression and indirect victimization variables are intercorrelated. Interestingly, in the female sample high school aggression is significantly correlated with high school victimization, middle school aggression and middle school victimization. In males, high school aggression is correlated with high school victimization, and middle school

aggression but not middle school victimization. These results add to the evidence for sex differences in indirect aggression during adolescence.

Table 3. Pearson correlations of survey indices and reproductive behavior.

	1	2	3	4	5	6	7
1. High school indirect aggression	1	.747***	.346*	.386*	.257	-.297	.051
2. Middle school indirect aggression	.555***	1	.188	.151	.106	-.301	-.108
3. High school indirect victimization	.310*	.314*	1	.789***	-.056	.094	-.107
4. Middle school indirect victimization	.134	.181	.533***	1	-.106	.106	-.010
5. Number of sex partners	.182	.174	.022	-.043	1	-.418**	.726***
6. Age at first intercourse	-.144	-.010	-.135	.048	-.543***	1	-.087
7. Partners/year	.164	.157	-.053	-.005	.737***	-.145	1

Note. Males below diagonal and females above diagonal. *$p<.05$, **$p<.01$, ***$p<.0001$

Mean values for aggression and victimization variables did not differ statistically by sex (Hotelling's T^2 for aggression variables $T^2 = 7.032$ (8,92) $p = 0.590$, Hotelling's T^2 for victimization variables $T^2 = 9.202$ (8,109) $p = .382$). Therefore we cannot conclude that one sex is more indirectly aggressive or victimized than the other in this sample.

Principal components analysis results

Table 4 lists the standard deviations and variances explained by the first two principal components as well as the loadings of each of the 16 variables on the first two principal components for both male and female participants. The first principal component explains the overall level of involvement in peer aggression as either a victim or an aggressor (Table 3). Forty-eight percent of male participants and 39% of female participants loaded negatively on PC1 which represents greater involvement in aggression, victimization or both. This rate of involvement is higher than the 29.9% rate reported for U.S. school children by Nansel, Overpeck, Pilla, Ruan, Simons-Morton, and Scheidt (2001) in their analysis of the World Health Organization Health Behavior and School-aged Children survey. However, this rate did not exceed the maximum level reported in the international study (Nansel et al., 2004) and is based on only non-virgins.

The second principal component explains the level of aggression and victimization reported by participants on a continuum from most victimized to most aggressive. The factor loadings of the first and second principal components are listed in Table 4. Table 4

Table 4. Results of principal components analysis on males and females.

| Males	PC1	PC2	Females	PC1	PC2
SD	2.280	1.729	*SD*	2.554	1.901
Proportion of variance	.325	.187	Proportion of variance	0.408	0.226
Cumulative variance	.325	.512	Cumulative variance	0.408	0.633
Loadings			*Loadings*		
Aggression			**Aggression**		
Demean High school	-0.233	0.284[a]	Exclude Middle school	-0.203	0.350
Tease High school	-0.234	0.269	Isolate Middle school	-0.214	0.347
Exclude High school	-0.255	0.265	Tease Middle school	-0.231	0.303
Tease Middle school	-0.227	0.254	Isolate High school	-0.243	0.269
Demean Middle school	-0.242	0.252	Demean Middle school	-0.275	0.247
Exclude Middle school	-0.282	0.233	Exclude High school	-0.178	0.195
Isolate High school	-0.261	0.189	Demean High school	-0.300	0.161
Isolate Middle school	-0.272	0.169	Tease High school	-0.274	0.144
Victimization			**Victimization**		
Isolate Middle school	-0.241	-0.360	Demean Middle school	-0.253	-0.273
Exclude Middle school	-0.261	-0.356	Tease Middle school	-0.257	-0.264
Tease Middle school	-0.229	-0.304	Exclude Middle school	-0.251	-0.263
Demean Middle school	-0.261	-0.254	Tease High school	-0.241	-0.249
Exclude High school	-0.238	-0.212	Exclude High school	-0.174	-0.245
Isolate High school	-0.232	-0.212	Isolate Middle school	-0.302	-0.200
Demean High school	-0.277	-0.130	Demean High school	-0.286	-0.191
Tease High school	-0.244	-0.101	Isolate High school	-0.27	-0.189

Note. Factor loadings sorted on PC2 from most extreme to least extreme.

shows that both male and female indirect aggression loaded positively on PC2 while being victimized loaded negatively on PC2. Figure 1A and 1B show male and female participants plotted on PC1 and PC2. The figures also demonstrate the relationship between age at onset of sexual intercourse and the first two principal components. We note that 82% of the females in the top left quadrant in Figure 1B had sex at or earlier than age 16 years. This quadrant represents active indirect aggression towards peers. The mean age at first sex in the active aggression quadrant ($M = 16.318$, $SD = 1.46$) is the lowest of all four quadrants, however a one-way ANOVA demonstrated no statistically significant differences between the quadrant means $F(3, 47) = .231$, $p = .874$.

As expected, Figure 1 shows that the variance along PC2 is reduced for the portion of the sample that loads positively on PC1 (i.e., overall lack of involvement in indirect aggression). That is, the sample of individuals who were actively involved in peer aggression or victimization varies widely in the frequency of perpetrating or experiencing the behaviors in our survey (e.g., teasing).

The factor loadings on PC2 indicate that there is an expected developmental decrease in the importance of indirect aggression and victimization in females from middle school to high school. The factors that load most highly in females are middle school excluding, isolating and teasing on the aggression side and being demeaned, teased and

Figure 1. Scatter plot of male and female participants on PC1 on PC2.
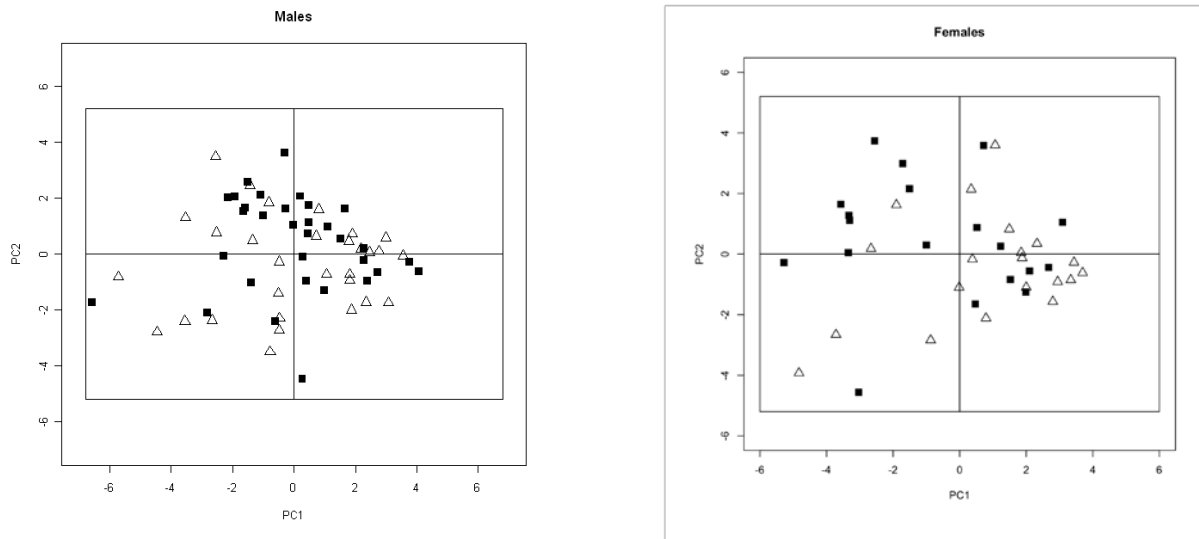
A.
B.

Note. A. Male participants. B. Female participants. Black squares represent individuals who reported ages at first sexual intercourse at 16 years (median) or less and open triangles represent individuals who reported ages at first sexual intercourse after age 16 years.

excluded in middle school on the victimization side. In males there was an unexpected reversal of the high school and middle school aggression variables indicating that high school demeaning, teasing and excluding were the most influential variables. This may be a product of the salience of mating related indirect aggression in older males. That is, older

males are more likely to be competing for mating opportunities and using indirectly aggressive tactics. The male victimization results show that middle school isolation, exclusion and teasing were the most influential variables.

Results indicate that 93% of male participants who reported being indirectly victimized by peers in high school or middle school were victimized by other boys. Similarly, females reported being victimized by other girls 72% of the time. Participants who were indirectly aggressive toward their peers indicated that the target of their aggression was most often same-sex peers (males = 97%, females = 84%). These data support the hypothesis that peer aggression is a form of intrasexual competition (Pellegrini, 2007; Pellegrini and Archer, 2005).

Hypothesis 1: Age at first intercourse and indirect aggression in females.

In order to test Hypothesis 1, we performed a multiple regression analysis on age at first sexual intercourse (dependent variable), and the first two principal components (independent variables) which are uncorrelated representations of the 16 aggression and victimization variables. The results of the multiple regression analysis are depicted in Table 5. The multiple R^2 of the model indicates that approximately 17% of the variance in age at first sexual intercourse in females can be explained by PC1 and PC2. The model can be simplified even further to include age at first sexual intercourse and PC2 as depicted in Figure 2. The Pearson correlation coefficient between age at first sexual intercourse and PC2 is $r = -.395$, $p = .013$ thus explaining 15.6% of the variance in the age at onset of sexual intercourse. In other words, the more indirect aggression a girl perpetrates the earlier she is likely to begin having sex. On the other hand, the more indirect victimization girls experience (particularly in middle school) the older the girl is predicted to be at first sexual intercourse. Hypothesis 1 is therefore supported by these data.

Table 5. Multiple regression model for age at first sexual intercourse on PC1 and PC2-females.

| Effect	Coefficient	Standard Error	*T*	*p*
Constant	16.744	.233	71.900	<.001
PC1	.065	.092	.709	.483
PC2	-.322	.124	-2.594	.014*

Note. *p<.05
Residual standard error: 1.454 on 36 degrees of freedom. Multiple R-squared: 0.167, Adjusted R-squared: 0.121, $F (2,36) = 3.616$, $p = 0.037$.

Hypothesis 2. Indirect victimization in adolescence will predict fewer than average sex partners and later than average ages at first intercourse in males.

For males, PC1 and PC2 did not predict the onset of sexual relations. The correlation between PC2 and age at first sexual intercourse was $r = -.130$, $p = .315$. The negative slope indicates that male perpetrators of indirect aggression have slightly earlier ages at first sexual intercourse and victims of indirect aggression have later ages at first sexual intercourse but the relationship is not statistically significant. Similarly, the

relationship between number of sex partners and PC2 and partners per year and PC2 are in the predicted direction but the relationships are not statistically significant (number of sex partners, $r = .210$, $p = .101$; partners per year, $r = .178$, $p = .166$).

Figure 2. Scatter plot and regression line of female PC2 and age at first sexual intercourse.
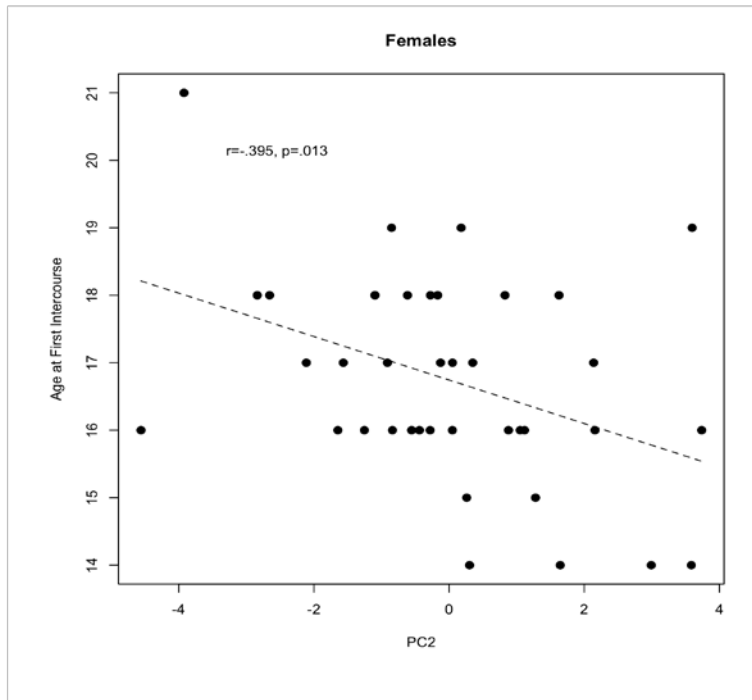
Hypothesis 3. Indirect victimization in adolescence will predict higher than average sex partners and earlier than average ages at first intercourse in females.

For females, the correlation between number of sex partners and PC2 is $r = .220$, $p = .178$ and partners per year and PC2 is $r = -.033$, $p = .844$. The slope of the line for sex partners and PC2 is not in the predicted direction suggested by Gallup et al. (2009) but larger sample sizes are needed to explore these relationships further.

These results suggest a weak relationship between male and female reproductive opportunities and indirect aggression/victimization but Hypotheses 2 and 3 are not supported statistically.

Discussion

In this study, we collected retrospective data on the level of aggression and victimization experienced by young adults to see how well these data predict reproductive opportunity and how well they support an adaptive role for indirect aggression. The study participants were mainly young adults beginning their most fecund period. Completed fertility is unknown in this group and we estimated reproductive opportunity through

measures of sexual behavior such as number of sex partners and age at first sexual intercourse. The study design is limited by the participant's ability to remember past events and their truthfulness in responding to questions, however, the majority of participants were only between one and ten years removed from the adolescent events we investigated. One further limitation is that we did not collect information about marital status and long-term relationship status. These questions will be added to future research projects.

This study's major finding is the significant relationship between age at first sexual intercourse and PC2 which represents a continuum from indirect aggression to indirect victimization in females. We show that indirect aggression is associated with earlier ages at first sexual intercourse, and thus victimization is associated with later ages at first sexual intercourse. In a natural fertility population, age at first sexual intercourse is a proximate determinant of total fertility and provides an important evolutionary advantage to females who compete successfully for mating opportunities (Wood, 1994). In the absence of contraceptive techniques, there appears to be adaptive value for indirect aggression in females during adolescence. In a population that uses contraception like the one we studied, indirect aggression and the resultant social manipulation of peers may help to train adolescent girls to compete successfully for high quality long-term mates. Future work will need to differentiate between competition for long-term and short-term mating opportunities and how these strategies relate to indirect aggression. We will also need to differentiate between high and low quality mates.

The adaptive advantage of indirect aggression may work through proximate mechanisms such as increased social dominance, attacks on self-esteem, and resource control which ultimately influence reproductive opportunities and outcomes in both males and females (Hawley, 2007). Indirect intrasexual competition through social manipulation by excluding, teasing, demeaning and isolating appears to activate phylogenetically ancient pain mechanisms in the brain (Eisenberger and Lieberman, 2004). If the pain of social exclusion is neurologically linked to the sensation of physical pain, one can easily see why indirect aggression is such a powerful and ubiquitous technique to manipulate the social environment (Masten, Eisenberger, Borofsky, Pfeifer, McNealy, Mazziotta, Dapretto, 2009).

We found that teasing and excluding were consistently among the top three loading scores on both aggression perpetrated and victimization experienced in male and female participants. Victims of adolescent aggression have been found to suffer anxiety, depression, psychosocial dysfunction and psychosomatic illness (Rigby, 2002), the effects of which may ultimately lead to lifelong reproductive disadvantage (Brown and Taylor, 2008; Fosse and Holen, 2004; Varhama and Björkqvist, 2005;). On the other hand, socially aggressive adolescents are often popular, sought after by peers, and rank high in social status (Hawley, 2007). Interestingly, these adolescents need not be well-liked to achieve these important social gains (Cillessen and Mayeux, 2007).

Unlike physical aggression, indirect aggression appears to increase from early to late adolescence as social intelligence increases and overt strategies are replaced by covert strategies (Archer and Côté, 2005; Björkqvist et al., 1992; Pellegrini and Long, 2003; Vaillancourt, Brendgen, Boivin, Tremblay, 2003). Our results indicate that although indirect aggression may increase into late adolescence, middle school demeaning, teasing

and excluding has a particularly negative impact on victims as evidenced by the relationship between age at first sexual intercourse and victimization. On the other hand, excluding, isolating, and teasing others during middle school is associated with earlier onset of sexual intercourse. Although girls may improve their competitive techniques as they grow older, the earlier that these skills are in place the more potential reproductive benefits they may reap. Therefore, the timing of aggression is of critical importance if it is to have an influence on age at first sexual intercourse. In light of research that has linked early sexual experiences with negative health outcomes such as sexually transmitted diseases and teen pregnancy, this work suggests that indirect aggression early in adolescence, if not a trigger, is a clue to early involvement in sexual activity in heterosexuals (Coker, Richter, Valois, McKeown, Garrison, Vincent, 1994).

Although the results of this work are in general agreement with those of Gallup et al. (2009) for males, we were not able to replicate their results for female victimization. Gallup et al. (2009) showed that the lifetime number of sex partners and rate of partners per year reported by females correlated positively with a middle school victimization index, however, their study did not include measures of active peer aggression. The correlation matrix in Table 3 indicates that aggressive behavior is significantly correlated with the measures of victimization collected. That is, females in the current sample often reported both victimization and aggression towards peers. In fact, Leenaar's et al. (2008) demonstrated that aggression and indirect victimization are significantly correlated ($r = .28$, $p < .001$) although this correlation was calculated with combined male and female results (see their Table 1). The PCA allowed us to analyze both victimization and aggression along a continuum which resulted in a strong negative correlation between PC2 and age at first sexual intercourse. These results support previous work showing that indirect aggression perpetrated and victimization experienced are not mutually exclusive and should be considered together (Hawley, 1999).

These results prompt the following questions about the relationship between (1) attractiveness and indirect victimization and (2) promiscuity and victimization. (1) Are attractive females who report high levels of indirect victimization also perpetrators of high levels of indirect aggression? (2) Are promiscuous victims with earlier than average ages at first sexual intercourse also promiscuous aggressors with early ages at first sex? We cannot answer these questions directly with the current dataset, however our results reveal the importance of dealing with the bully/victim phenomenon (Andreou, 2000; Juvonen, Graham, and Shuster, 2003; Olweus, 1993) as well as understanding the level at which any particular individual participates in the social milieu. As an example of this issue, we note that the correlation between age at first sexual intercourse and PC2 for the 16 females who scored below 0 on PC1 (i.e. active participation in victimization or aggression) is $r = -.559$, $p = .024$ in comparison to $r = -.395$ including the less active participants. It is therefore possible that attractive victims are also attractive aggressors (Leenaar's et al., 2008) and promiscuous victims are also promiscuous aggressors (Gallup et al., 2009).

Conclusion

Evolutionary theory is a particularly fruitful meta-theoretical framework from which to generate testable explanations for aggressive behavior in adolescence (Hawley, 2007; Pellegrini, 2007). Competition for limited environmental resources, including mates,

provides a powerful explanation for what are seemingly antisocial and "maladaptive," although ubiquitous, behaviors among adolescents (Pellegrini, 2007, Sutton et al., 1999). This research demonstrates that indirect aggression towards peers by females may have long lasting positive reproductive benefits in adulthood. Future work will need to include measures of both victimization and aggression as well as measures of long-term and short-term mating strategies to better understand indirect aggression as a tool for intrasexual competition.

This work demonstrates that adolescents who are actively involved in aggressive interactions with peers are most likely to be involved in sexual behaviors earlier than those who avoid these negative interactions.

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