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A Meta-Analysis of Sex Differences in Cyber-Bullying Behavior: The Moderating Role of Age

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The current research used meta-analysis to determine whether (a) sex differences emerged in cyber-bullying frequency, (b) if age moderated any sex effect, and (c) if any additional moderators (e.g., publication year and status, country and continent of data collection) influenced the sex effect. Theoretically, if cyber-bullying is considered a form of traditional bullying and aggression, males are likely to cyber-bully more than females. Conversely, if cyber-bullying is considered relational/indirect aggression, females will be slightly more likely to cyber-bully than males. Results from 122 effect size estimates showed that males were slightly more likely to cyber-bully than females; however, age moderated the overall effect. Specifically, females were more likely to report cyber-bullying during early to mid-adolescence than males, while males showed higher levels of cyber-bullying during later adolescence than females. Publication status and year and continent and country of data collection also moderated the overall effect. Aggr. Behav. 40:474–488, 2014. © 2014 Wiley Periodicals, Inc.

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INRODUCTION

The Internet is useful to share ideas, communicate with others, and gather information. However, some people use the Internet as a tool to cause harm. One example of such behavior is cyber-bullying, defined as, "… any behavior performed through electronic or digital media by individuals or groups that repeatedly communicates hostile or aggressive messages intended to inflict harm or discomfort on others" (Tokunaga, 2010, p. 278).

The majority of research on cyber-bullying has focused on the consequences to the cyber-victim (see Beran & Li, 2005; Patchin & Hinduja, 2010; Rivers & Noret, 2009; Tokunaga, 2010). Recently, Barlett and Gentile (2012) suggested that in order to help inform interventions to reduce cyber-bullying, research needs to study variables that predict this "newer" form of aggression. One such predictor that warrants continued study is participant sex. The current research used meta-analytic techniques to synthesize the relevant research testing (a) whether there are sex differences in cyber-bullying frequency, (b) whether age moderated these findings, and (c) whether other methodological artifacts (e.g., publication status, publication year, and country and continent the data were collected) moderated the overall effect. Overall, the current meta-analysis aims to combine the studies in this field to examine sex differences in cyber-bullying.

EXPLORING SEX DIFFERENCES

Physical Aggression

Research in the aggression domain has reliably demonstrated the importance of examining sex differences. In one study, Gentile and Bushman (2012) found that being a male increased the odds of being in a physical fight from 33% to 45% (odds ratio = 1.66). Indeed, several meta-analytic reviews show that males are more physically aggressive (e.g., harming others through physical means, such as punching or kicking) than females (e.g., Archer, 2004). Related, the traditional bullying domain (e.g., pushing kids down stairs, shoving kids in lockers, etc.) has also shown that males are more likely than females to bully their peers (e.g., Smith, Cowie, Olafsson, & Liefooghe, 2002). The importance of understanding such sex differences has important implications for interventions aimed at reducing aggression or school bullying. It is our contention that if risk

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factors for aggressive behaviors can be reliably found (such as participant sex), then interventions can be designed to curb these antisocial behaviors. Indeed, several aggression-reducing interventions have only targeted male participants (e.g., Hudley & Graham, 1995).

Relational, Indirect, and Verbal Aggression

Despite the robust finding that males are more likely to be physically aggressive, sex differences observed for other forms of aggression are not as strong and reliable. For example, two separate meta-analyses (Archer, 2004; Card, Stucky, Sawalani, & Little, 2008) have shown very little evidence for sex differences in relational or indirect aggression (e.g., harming others through damaging relationships, such as gossiping, rumor spreading, and social exclusion) or verbal aggression.

Cyber-Bullying

Overall, the past research suggests that sex differences in aggression and bullying may be dependent upon the specific type of aggressive or bullying behavior measured. It is unclear whether there are sex differences in cyber-bullying behavior. Research in this domain has been largely mixed. For instance, Erdur-Baker (2009) found that males engage in cyber-bullying more than females; Gorzig and Olafsson (2013) found females to be more active in cyber-bullying behaviors; and some studies have found no difference between males and females in cyber-bullying behavior (e.g., Hinduja & Patchin, 2008; Perren et al., 2010; Slonje & Smith, 2008). However, if cyber-bullying is a more specific form of traditional bullying (as suggested by Olweus, 2012) and aggressive behavior (as suggested by Barlett & Gentile, 2012) and males are more likely to be both traditional bullies (Veenstra et al., 2010) and more physically aggressive (Archer, 2004), then males should cyber-bully more than females.

However, unlike traditional bullying, cyber-bullying does not allow physical contact between the bully and victim. Traditional bullies can harm their victims using both physical and/or non-physical (verbal, relational) methods; however, cyber-bullies can only harm their victims using non-physical methods online. Therefore, if cyber-bullying is viewed as a special form of relational or indirect aggression (that occurs online), sex differences should be nonexistent or only slightly higher for females (Archer, 2004; Card et al., 2008).

In summary, the literature on sex differences in cyber-bullying frequency has been mixed. At a theoretical level, if cyber-bullying is seen as a form of bullying and aggressive behavior, males will be likely to cyber-bully more than females. However, if cyber-bullying is conceptualized as a form of indirect or relational aggression then we would expect females to cyber-bully more than males or no sex differences to emerge. It is likely that moderator variables will help to disentangle these competing hypotheses.

AGE AS A POTENTIAL MODERATOR

Age may moderate any sex differences in cyber-bullying behavior. From a developmental lens, children typically start out being physical aggressive since they do not have the verbal abilities to hurt others any other way (Coyne, Nelson, & Underwood, 2010). When verbal skills are developed in early childhood, verbal aggression becomes more common and physical aggression decreases. During preschool, relational or indirect aggression becomes more common as children begin to have more peer relationships. The form of relational or indirect aggression also develops as children mature through childhood and adolescence, becoming more subtle and complex as individuals become better at manipulating their peers and reading the social setting as a whole. Cyber-bullying, developmentally, does not become common until individuals become technologically sophisticated enough to use multiple media to hurt others, typically around late childhood to early adolescence.

If we view cyber-bullying as a particularly advanced form of relational or indirect aggression, females may be slightly more likely to engage in cyber-bullying given that they mature earlier than males and may be more developmentally "ready" to start using advanced aggressive tactics earlier. Accordingly, we would expect sex differences to diminish during later adolescence when boys "catch up" with girls in maturity and ability to aggress in this manner (Coyne et al., 2010). In their meta-analysis, Card et al. (2008) found very few gender differences in relational or indirect aggression. Indeed, there was no sex difference in any age measured, except during adolescence, where females were very slightly more likely to engage in relational or indirect aggression than males.

Conversely, since males tend to be more technologically advanced than females in late adolescence (e.g., Huffman, Whetten, & Huffman, 2013) we may expect males to cyber-bully more frequently than females. Furthermore, research has shown that traditional bullying trends to increase in early adolescence (6th grade) to middle adolescence (9th grade; Scheithauer, Hayer, Petermann, & Jugert, 2006), which may suggest that males will eclipse females in cyber-bullying frequency around this age, as well.

Research has shown mixed results regarding sex differences in cyber-bullying across different age groups. For instance, Erdur-Baker and Tanrikulu (2010) sampled

10, 11, 12, 13, and 14 year olds and found that males were more likely to report being a cyber-bully at ages 11, 12, and 13, whereas females at age 10 and 14 reported higher cyber-bullying scores than males. Conversely, research by Kowalski and Limber (2007) found that females were more likely to cyber-bully in 7th (approximate age 13) and 8th grade (approximate age 14), but males were slightly higher in 6th grade (approximate age 12). The current meta-analysis synthesizes all the relevant research that samples participants as young as 10 (e.g., Erdur-Baker & Tanrikulu, 2010; Schoffstall & Cohen, 2011) to college-ages (e.g., Barlett & Gentile, 2012; MacDonald & Roberts-Pittman, 2010; Özçınar and Aldağ, 2012) so as to assess the moderating effects of age as a continuous variable on sex differences in cyberbullying.

For the purposes of the current research, age of participant is the most interesting moderator to examine. This will enable us to test whether any observed sex differences in cyber-bullying change over developmental periods. We are aware of only a few studies testing whether the interaction of participant age and sex influenced cyber-bullying behaviors. Slonje, Smith, and Frisen (2012) sampled boys and girls in elementary and late middle school and found that females were slightly more likely to cyber-bully at young ages, whereas males and females were similar in their cyber-bullying during late ages. Meta-analysis can examine age as a moderator assuming the primary literature has sampled such ages (and allowed for effect sizes to be calculated).

ADDITIONAL POSSIBLE MODERATORS

Because meta-analytic procedures involve sampling studies that meet a certain inclusionary criteria (see below in the Method section for our criteria) it is common to aggregate effect sizes from studies that have different characteristics. Therefore, we coded each effect size for additional moderators that could influence the results. The first is country (and continent) that the participants were sampled from. Indeed, cyber-bullying frequency has been observed all over the world including the United States (e.g., Schnurr et al., 2013), Turkey (e.g., Dilmac, 2009), England (O'Brien & Moules, 2013), Australia (e.g., Robson & Witenberg, 2013), Taiwan (e.g., Chang et al., 2013), and Spain (Calvete et al., 2010). Although cultural differences are not the primary focus of the current research, we were still able to test whether sex differences in cyber-bullying behavior differed between the various countries and continents from which participants were sampled.

Finally, we also coded whether or not the effect size was associated with a published or unpublished study and the year that the data were disseminated. A significant effect of year of dissemination would determine whether any sex differences in cyber-bullying are changing over time, as is suggested by popular media (e.g., Kefauver, 2013).

OVERVIEW OF THE CURRENT RESEARCH

The literature testing the predictors of cyber-bullying is growing; however, the findings are mixed regarding (a) whether there are sex differences in cyber-bullying, (b) if age moderates the overall effect, and (c) if other moderators are influencing the overall effect. The current meta-analysis addresses these three points to present a clearer picture of whether sex is a risk factor for cyber-bullying behavior and if moderator variables influence these effects. Such findings could help elucidate the subtle similarities and differences between cyber-bullying behavior with traditional bullying, relational aggression, and physical aggression.

METHOD

Literature Search Procedures

At the end of December 2013, PsycInfo, PubMed, ERIC, and Google Scholar were the primary search engines used to locate all relevant articles. The following search terms were used: "cyber bullying," "cybervictimization," and "electronic bullying." In addition the reference section of a recent meta-analysis by Kowalski, Guimetti, Schroeder, and Lattanner (in press) was searched for additional articles.

Methodological Criteria Assessment

Several inclusionary criteria were used to determine which articles to use. First, all articles had to measure cyber-bullying frequency, the primary dependent variable. Second, the study had to measure sex of the participant, the primary independent variable. Third, studies had to provide enough statistical information to use in a meta-analysis. Fourth, the study had to report the age of the participants, our primary moderator variable. Finally, all studies had to be written in English. All effect sizes that met our criteria were from studies that used either correlational or longitudinal designs.

Overall, 109 research articles that produced 122 effect sizes sampling 214,167 participants were included in our meta-analysis. Individual studies could contribute more than one effect size if (a) they used several different subscales of a cyber-bullying (often if multiple types of cyber-bullying were measured; e.g., Popovic-Citic, Djuric, & Cvetkovic, 2011), (b) if effect sizes could be calculated for different countries (e.g., Perren, Dooley, & Shaw, 2010), (c) if effect sizes could be calculated for

different age ranges without providing an aggregated response (e.g., Erdur-Baker & Tanrikulu, 2010), or (d) if some aspect of the questionnaire differed (e.g., asking participants how frequency they cyber-bullied others in the past year or weekly; Lindfors, Kaltiala-Heino, & Rimpela, 2012). However, we limited the number of effect sizes that any one study would produce in order to not violate independence of effect sizes. For instance, the data from Menesini, Calussi, and Nocentini (2012) was not used in the meta-analysis because they tested sex differences on 10 individual cyber-bullying items that used two response scales (e.g., last couple of months and 2–3 times a month to always; creating possibly 20 effect size estimates) rather than creating an aggregate score of the cyber-bullying items and testing sex differences (see also Lerner, 2011 for similar issues).

Coding of Moderators

Age of participant. The primary moderator coded for all effect sizes was age of the sample. Typically, the average age of a sample (or sub sample) was used as the age index. However, several studies reported an age range (rather than an average age), in which case the middle score was used (for instance, if the age range of the sample was 10–15 years, 12.5 was the imputed average age). Also, several studies reported the school grade that the participants were in, rather than an average age or range of ages. When this was the case, average age was computed using the typical age of that reported grade in the United States. For instance, 6th graders age was given a value of 12, 7th grade was 13, and so forth.

Country and continent. The second and third moderators coded were the country and the continent in which the study was conducted. For the former moderator, the first author coded the country from which the sample was collected. Inspection of the diverse number of studies revealed that this moderator was potentially problematic to analyze. Indeed, there were 22 different countries coded and several of them only contributed a single effect size (e.g., Belgium, Spain, Ireland) or two effect sizes (e.g., China), whereas others contributed over 10 effect sizes (e.g., United States, Turkey). Although the results of the analysis will be presented, caution is warranted in interpreting and comparing countries that contributed such discrepant number of effect sizes. Therefore, each effect size was coded into four categories of continent (North America, Europe, Asia, and Australia) based on the information provided about the sample (South America, Africa, and Antarctica contributed no effect sizes). For instance, American and Canadian samples were categorized as "North American," England, Finland, Spain, Germany, Greece, Switzerland, Serbia, Netherlands, Austria, Sweden, Ireland, and Italy were categorized as "European," and Turkey, Korea, Singapore, Taiwan, and China were categorized as "Asian." Australia was coded as "Australian."

Publication status. The fourth moderator coded was publication status. Effect sizes were classified by whether they were published in a journal or book or if the data was from a source where the peer review status was unknown (e.g., dissertations or theses).

Publication year. The fifth moderator coded was publication date. For papers that were published in book chapters or peer reviewed journals, the year of publication was coded. For dissertations or theses, the submission date listed on the document was recorded.

Meta-Analytic Procedures

Male and female means and standard deviations, one degree of freedom chi square, *t*-tests, one degree of freedom *F*-tests, and *p*-values were converted to the correlation coefficient, denoted by *r*. Several studies reported the number of male and female participants who were classified as cyber-bullies, cyber-victims, cyber-bully victims, or not involved. To calculate the effect sizes for such studies, a 2 (sex: male, female) × 2 (cyber-bully: yes, no) contingency table was created (the "yes" category for the cyber-bully status was computed by summing up the frequency of cyber-bullies and cyber-bully victims). A chi square value was computed (assuming the total number of males and females were reported) and then converted to *r*. If a longitudinal study provided a correlation between sex and cyber-bullying frequency at Waves 1 and 2, for example, only the correlation between sex and cyber-bullying at Wave 1 was retained, in order to reduce violating independence of effect sizes. Any effect that did not provide statistical numbers to calculate effect sizes but stated that the effect was "non-significant" was computed by assigning that effect $p = .50$, which is a conservative estimate for such effects (see Rosenthal, 1995). Finally, several studies only reported the effect of sex on cyber-bullying using logistic or multiple regression procedures with other variables in the model. Such analyses do not allow for the appropriate calculation of an effect size, because the sampling distribution of the relationship representing the effect of sex on cyber-bullying behavior is unknown due to the other variables in the model influencing the beta weight or odds ratio. Such effect sizes were not included. Comprehensive Meta-Analysis was the software package used to calculate the overall effect size estimates. A fixed effects model was used in order to assess heterogeneity across the effect sizes and within various subsets of effect sizes.

RESULTS

Overall Effect

Effect sizes were coded such that positive effect sizes indicate that males engage in more cyber-bullying behavior than females, whereas negative effect sizes indicate that females report more cyber-bullying frequency than males. Table I displays the relationship between these variables for each effect size estimate. Results showed that the overall effect was significant ($r = .04$ [95% CI: .034 to .042], $Z = 17.73$, $p < .001$, $k = 122$), indicating that males are more likely to be cyber-bully than females.[1] Although significant, this effect is rather weak; however, results also showed significant heterogeneity in the effect sizes, $Qw(121) = 752.67$, $p < .001$, suggesting the influence of moderating variables.

Publication Bias

There were several methods used to assess publication bias in this data, which is an important consideration for meta-analysis. First, the *fail-safe N* was 7,433. This suggests that 7,433 studies showing null results would need to be in "file drawers" to reduce the overall effect to non-significance. Second, we examined the funnel plot for the data, which is presented in Figure 1. Results show a largely symmetric funnel plot, suggesting a robust finding. Indeed, Duval and Tweedie's trim and fill procedure (Duval & Tweedie, 2000) showed that the overall effect would be similar if five additional studies were added to make the funnel plot perfectly symmetric ($r = .04$ [95% CI: .032 to .041]).

Age moderation Test

The age of the sample significantly moderated the overall effect. Both the slope ($B = .01$, SE = .001, [95% CI: .01 to .011], $Z = 7.65$, $p < .001$) and intercept ($B = -.09$, SE = .016 [95% CI: −.12 to −.05], $Z = -5.26$, $p < .001$) of the age effect were significant. First, the direction of the intercept shows that for younger samples, females engaged in significantly more cyber-bullying behaviors than males. The 95% confidence interval for this effect was negative and did not overlap with zero. Second, the direction of the slope suggests that as the sample aged, males engaged in more cyber-bullying behavior than females. Unfortunately, because the data are all continuous, we cannot make claims regarding the exact age when males become more aggressive than females. However, examination of Figure 2 shows that males and females reach comparable levels of cyber-bullying frequency at approximately an average age of 11 years (early adolescence). Prior to that, girls are clearly more likely to cyber-bully others than males, whereas males are more likely to be the cyber-bully in late adolescence and into college-aged years.

Country and Continent Moderation Test

The country in which the study was conducted moderated the overall sex difference, $Q_B(22) = 283.50$, $p < .001$. For interpretation purposes, only those countries that contributed five or more effect sizes will be discussed. Table II has the information for each country. Examination of the effect sizes showed that males are more likely to cyber-bully more than females in the following countries: United States ($r = .03$ [95% CI: .02 to .036], $Z = 5.52$, $p < .001$, $k = 41$), Germany ($r = .18$ [95% CI: .15 to .21], $Z = 10.89$, $p < .001$, $k = 5$), Sweden ($r = .05$ [95% CI: .04 to .07], $Z = 9.03$, $p < .001$, $k = 6$), Turkey ($r = .12$ [95% CI: .10 to .16], $Z = 8.86$, $p < .001$, $k = 13$), and Finland ($r = .04$ [95% CI: .03 to .05], $Z = 10.35$, $p < .001$, $k = 7$). Canada ($r = .01$ [95% CI: -.02 to .03], $Z = .45$, $p = .65$, $k = 9$) and Australia ($r = .02$ [95% CI: .00 to .04], $Z = 1.92$, $p = .06$, $k = 7$) show no sex difference.

The continent that the study was conducted also moderated the overall sex effect, $Q_B(3) = 67.78$, $p < .001$ (see Table II). Examination of the effect sizes showed that males were more likely to be cyber-bullies than females when the sample was from North America ($r = .02$ [95% CI: .01 to .03], $Z = 5.30$, $p < .001$, $k = 50$), Europe ($r = .04$ [95% CI: .03 to .04], $Z = 14.45$, $p < .001$, $k = 44$), and Asia ($r = .10$ [95% CI: .08 to .12], $Z = 11.90$, $p < .001$, $k = 21$). No sex difference was found when the sample was from Australia ($r = .02$ [95% CI: .00 to .04], $Z = 1.92$, $p = .06$, $k = 7$).

Publication Status Moderation Test

Publication status significantly moderated the overall effect, $Q_B(1) = 4.24$, $p < .05$ (see Table II). Published studies found a reliable sex difference in cyber-bullying ($r = .04$ [95% CI: .035 to .043], $Z = 17.78$, $p < .001$, $k = 107$); however, unpublished studies found no difference between males and females ($r = .01$ [95% CI: −.004 to .037], $Z = 1.60$, $p = .11$, $k = 15$). Even though the difference between published versus unpublished effect sizes is significant, the actual difference in effect sizes is very small.

Publication Year Moderation Test

Publication year significantly moderated the overall effect. Both the slope ($B = -.003$, SE = .001 [95% CI: −.006 to −.0003], $Z = -2.18$, $p < .05$) and the intercept ($B = 6.11$, SE = 2.79 [95% CI: .65 to 11.58], $Z = 2.19$, $p < .05$) were significant. The direction of the intercept

[1] For ease of comparison with other sex effect meta-analyses, the overall effect using Cohen's *d* was .08 (95% CI: .07 to .083), $Z = 17.51$, $p < .001$.

TABLE I. Effect Sizes, Confidence Intervals, Moderators, and Sample Size for Meta-Analysis of Sex Effects

Study	Effect Size (*r*)	95% CI	*Z*	*N*	Average Age	Country	Continent	Published
Akbulut and Eristi (2011)	+0.32	.21 to .43	5.25**	254	20.50	Turkey	Asia	Yes
Allen (2012)	−0.02	−.09 to .05	−0.68	807	16.00	USA	North America	Yes
Almeida et al. (2012)a	+0.08	.03 to .13	3.26**	1729	15.15	Portugal	Europe	Yes
Ang and Goh (2010)	+0.14	.04 to .23	2.69**	396	14.88	Singapore	Asia	Yes
Ang et al. (2010)	+0.14	.04 to .23	2.68**	392	14.88	Singapore	Asia	Yes
Aoyama et al. (2011)	+0.24	.07 to .39	2.79**	133	15.70	USA	North America	Yes
Aricak (2009)	+0.13	.05 to .20	3.33**	695	19.34	Turkey	Asia	Yes
Arslan et al. (2012)	+0.13	.03 to .23	2.54*	372	9.50	Turkey	Asia	Yes
Barlett and Gentile (2012)b	+0.11	.02 to .20	2.45*	493	19.36	USA	North America	Yes
Barlett and Gentile (2012)c	+0.20	.06 to .34	2.71**	181	19.48	USA	North America	Yes
Bauman (2010)	+0.00	−.13 to .13	0.00	221	12.00	USA	North America	Yes
Bauman et al. (2013)	+0.09	.04 to .14	3.36**	1491	16.50	USA	North America	Yes
Beckman et al. (2012)	−0.02	−.05 to .02	−1.05	3800	14.50	Sweden	Europe	Yes
Beran and Li (2007)	+0.00	−.09 to .09	0.00	432	13.00	Canada	North America	Yes
Berarducci (2009)	+0.16	−.04 to .34	1.57	103	16.42	USA	North America	No
Bonanno and Hymel (2013)	+0.00	−.10 to .10	0.00	399	14.20	Canada	North America	Yes
Brewer (2012)	−0.04	−.20 to .12	−0.46	153	12.50	USA	North America	No
Calvete et al. (2010)	+0.04	−.01 to .09	1.48	1431	14.09	Spain	Europe	Yes
Campbell et al. (2013)	+0.04	.001 to .07	1.97*	3112	13.96	Australia	Australia	Yes
Cappadocia et al. (2013)	+0.01	−.03 to .06	0.56	1972	16.00	Canada	North America	Yes
Chang et al. (2013)	+0.17	.14 to .21	9.57**	2992	16.00	Taiwan	Asia	Yes
Chin (2011)	+0.00	−.14 to .14	0.00	211	12.50	USA	North America	No
Cochrane (2008)	+0.09	−.01 to .19	1.80	393	14.00	Canada	North America	No
DeHue et al. (2008)	+0.08	.03 to .14	2.88**	1211	12.70	Netherlands	Europe	Yes
Didden et al. (2009)d	+0.00	−.18 to .18	0.00	114	15.00	Netherlands	Europe	Yes
Didden et al. (2009)e	+0.00	−.18 to .18	0.00	114	15.00	Netherlands	Europe	Yes
Dilmac (2009)	+0.09	.01 to .16	2.29*	666	19.29	Turkey	Asia	Yes
Dittrick et al. (2013)	+0.08	.02 to .14	2.62**	1000	13.60	Canada	North America	Yes
Eksi (2012)	+0.21	.13 to .29	4.79**	508	16.00	Turkey	Asia	Yes
Elledge et al. (2013)	+0.03	.02 to .05	3.87**	16634	12.91	Finland	Europe	Yes
Erdur-Baker (2009)	+0.17	.05 to .28	2.79**	276	16.00	Turkey	Asia	Yes
Erdur-Baker and Tanrikulu (2010)	−0.18	−.54 to .23	−0.85	25	10.00	Turkey	Asia	Yes
Erdur-Baker and Tanrikulu (2010)	+0.26	−.10 to .56	1.43	32	11.00	Turkey	Asia	Yes
Erdur-Baker and Tanrikulu (2010)	+0.24	−.11 to .54	1.35	33	12.00	Turkey	Asia	Yes
Erdur-Baker and Tanrikulu (2010)	+0.44	.12 to .68	2.59*	33	13.00	Turkey	Asia	Yes
Erdur-Baker and Tanrikulu (2010)	−0.30	−.55 to .01	−1.93	42	14.00	Turkey	Asia	Yes
Feldman (2012)	−0.04	−.09 to −.001	−2.02*	2186	15.78	USA	North America	No
Festl and Quandt (2013)	+0.00	−.10 to .10	0.00	408	15.40	Germany	Europe	Yes
Genta et al. (2012)	+0.05	.02 to .08	3.78**	5785	14.00		Europe	Yes
Genz (2010)	+0.03	−.07 to .13	0.60	400	13.00	USA	North America	No
Gorzig and Olafsson (2013)	−0.09	−.13 to −.05	−4.79**	2821	13.14		Europe	Yes
Gradinger et al. (2009)	+0.10	.03 to .17	2.77**	761	15.57	Austria	Europe	Yes
Gradinger et al. (2010)	−0.01	−.07 to .04	−0.49	1150	12.39	Austria	Europe	Yes
Gradinger et al. (2012)	+0.00	−.05 to .05	0.05	1461	12.31	Austria	Europe	Yes
Griezel et al. (2012)	+0.00	−.07 to .07	0.00	803	14.03	Australia	Australia	Yes
Hemphill et al. (2012)	−0.04	−.11 to .04	−0.91	696	12.90	Australia	Australia	Yes
Hinduja and Patchin (2008)	+0.00	−.05 to .05	0.00	1378	14.80	USA	North America	Yes
Holfeld and Grabe (2012)	−0.05	−.12 to .03	−1.17	665	14.50	USA	North America	Yes
Holt et al. (2011)	−0.08	−.17 to .01	−1.67	435	14.99	USA	North America	Yes
Huang and Chou (2010)	+0.02	−.07 to .10	0.44	545	14.00	Taiwan	Asia	Yes
Katzer et al. (2009)	+0.22	.17 to .27	9.21**	1700	14.09	Germany	Europe	Yes
Kowalski and Limber (2007)	+0.04	.01 to .07	2.47*	3661	13.00	USA	North America	Yes
Kowalski et al. (2012a)	+0.02	−.01 to .05	1.35	4720	15.20	USA	North America	Yes
Kowalski et al. (2012b)	+0.00	−.20 to .20	0.00	100	19.71	USA	North America	Yes
Kozlosky (2009)	+0.06	.02 to .10	2.83**	2333	14.00	USA	North America	No
Kraft and Wang (2009)	−0.03	−.10 to .05	−0.74	713	15.00	USA	North America	Yes
Kwan and Skoric (2013)	−0.07	−.12 to −.02	−2.80**	1597	15.00	Singapore	Asia	Yes
Låftman et al. (2013)	+0.07	.06 to .08	10.32**	22544	16.50	Sweden	Europe	Yes
Lam et al. (2013)	+0.03	−.03 to .08	0.97	1265	15.00	China	Asia	Yes

(*Continued*)

Study	Effect Size (*r*)	95% CI	*Z*	*N*	Average Age	Country	Continent	Published
Li (2005)	+0.01	−.11 to .13	0.11	264	14.00	Canada	North America	Yes
Li (2007)	+0.07	−.08 to .22	0.94	177	13.00	Canada	North America	Yes
Lindfors et al. (2012)f	+0.05	.03 to .08	3.79**	5516	15.60	Finland	Europe	Yes
Lindfors et al. (2012)g	+0.08	.05 to .10	5.73**	5516	15.60	Finland	Europe	Yes
Lister (2007)	+0.10	.01 to .19	2.17*	484	14.00	USA	North America	No
Low and Espelage (2013)	+0.03	−.03 to .09	0.96	1023	13.90	USA	North America	Yes
MacDonald and Roberts-Pittman (2010)	+0.07	−.02 to .16	1.46	439	22.97	USA	North America	Yes
Mark and Ratliffe (2013)	−0.07	−.19 to .05	−1.10	265	13.00	USA	North America	Yes
Marsh et al. (2010)	−0.00	−.06 to .06	−0.03	1169	15.70	Australia	Australia	Yes
McDermott (2012)	+0.06	−.12 to .23	0.68	127	16.00	USA	North America	No
Menesini et al. (2013)	+0.17	.07 to .26	3.37**	390	15.60	Italy	Europe	Yes
Mishna et al. (2012)	−0.04	−.08 to .01	−1.64	2186	13.85	Canada	North America	Yes
Mitchell (2012)	−0.07	−.14 to −.002	−2.01*	828	12.50	USA	North America	No
Monks et al. (2012)	−0.15	−.28 to −.02	−2.29*	220	9.00	England	Europe	Yes
Moore et al. (2012)	−0.11	−.18 to −.04	−3.24**	851	13.50	USA	North America	Yes
O'Brien and Moules (2013)	+0.00	−.09 to .09	0.00	473	15.00	England	Europe	Yes
O'Moore (2012)	+0.01	−.02 to .05	0.73	3004	14.00	Ireland	Europe	Yes
Özçınar and Aldağ (2012)	+0.14	.07 to .21	4.03**	800	21.00	Greece	Europe	Yes
Patchin and Hinduja (2011)	−0.01	−.05 to .04	−0.35	1963	12.80	USA	North America	Yes
Pelfrey and Weber (2013)	+0.06	.02 to .09	3.21**	3403	14.00	USA	North America	Yes
Perren et al. (2010)	+0.00	−.05 to .05	0.00	1320	14.30	Australia	Australia	Yes
Perren et al. (2010)	+0.16	.06 to .26	3.11**	374	14.30	Switzerland	Europe	Yes
Perren and Gutzwiller-Helfenfinger (2012)	−0.02	−.10 to .07	−0.33	495	15.50	Switzerland	Europe	Yes
Pettalia et al. (2013)	−0.17	−.28 to −.04	−2.67**	260	12.88	Canada	North America	Yes
Popovic-Citic et al. (2011)h	+0.13	.03 to .23	2.53*	387	13.20	Serbia	Europe	Yes
Popovic-Citic et al. (2011)i	+0.12	.02 to .22	2.35*	387	13.20	Serbia	Europe	Yes
Popovic-Citic et al. (2011)j	+0.19	.09 to .29	3.81**	387	13.20	Serbia	Europe	Yes
Pornari and Wood (2010)	−0.12	−.22 to −.01	−2.10*	333	14.00	England	Europe	Yes
Rafferty (2011)	+0.15	.02 to .28	2.19*	220	19.77	USA	North America	No
Renati et al. (2012)	+0.02	−.04 to .08	0.63	1001	16.08	Italy	Europe	Yes
Robson and Witenberg (2013)	+0.07	−.07 to .20	1.01	210	13.20	Australia	Australia	Yes
Salmivalli and Poyhonen (2012)	+0.07	.05 to .08	9.12**	17627	11.50	Finland	Europe	Yes
Schenk et al. (2013)	+0.11	.04 to .18	3.04**	799	19.82	USA	North America	Yes
Schnurr et al. (2013)	+0.13	.02 to .24	2.26*	296	20.17	USA	North America	Yes
Schoffstall and Cohen (2011)	−0.04	−.18 to .11	−0.51	192	10.00	USA	North America	Yes
Schultze-Krumbholz et al. (2012)	+0.06	−.04 to .16	1.20	412	13.35	Germany	Europe	Yes
Slonje (2011)	+0.00	−.07 to .07	0.03	829	12.60	Sweden	Europe	No
Slonje and Smith (2008)	+0.10	−.01 to .20	1.80	360	15.30	Sweden	Europe	Yes
Slonje et al. (2012)	−0.00	−.13 to .13	−0.00	243	11.12	Sweden	Europe	Yes
Slonje et al. (2012)	+0.00	−.09 to .09	0.00	516	13.85	Sweden	Europe	Yes
Smith et al. (2008)	+0.00	−.09 to .09	0.00	533	12.75	England	Europe	Yes
Sourander et al. (2010)	+0.07	.03 to .11	3.15**	1992	14.40	Finland	Europe	Yes
Sticca et al. (2013)	+0.01	−.06 to .08	0.29	835	13.20	Switzerland	Europe	Yes
Taiariol (2010)	−0.04	−.16 to .08	−0.68	257	13.50	USA	North America	No
Topcu and Erdur-Baker (2012)	+0.08	.01 to .15	2.29*	795	16.67	Turkey	Asia	Yes
Vazsonyi et al. (2012)	+0.00	−.01 to .01	0.00	25142	12.50		Europe	Yes
Wachs (2012)	+0.44	.37 to .51	10.77**	518	14.00	Germany	Europe	Yes
Wachs et al. (2012)	+0.00	−.09 to .09	0.00	518	13.50	Germany	Europe	Yes
Walgrave and Heirman (2011)	+0.00	−.05 to .05	0.00	1318	15.00	Belgium	Europe	Yes
Walker (2010)	+0.06	−.07 to .19	0.88	229	13.50	USA	North America	No
Walker (2013)	+0.05	−.05 to .15	1.02	403	21.00	USA	North America	No
Wang et al. (2009)	+0.05	.02 to .07	3.97**	7182	14.30	USA	North America	Yes
Wensley and Campbell (2012)	+0.13	.05 to .22	3.08**	528	19.52	Australia	Australia	Yes
Werner et al. (2010)	+0.04	−.06 to .15	0.81	350	13.00	USA	North America	Yes
Williams and Guerra (2007)	+0.00	−.05 to .05	0.00	1519	14.00	USA	North America	Yes
Williford et al. (2013)	+0.06	.03 to .09	4.50**	5619	11.25	Finland	Europe	Yes
Williford et al. (2013)	−0.04	−.06 to −.02	−3.65**	8331	13.98	Finland	Europe	Yes
Wright et al. (2009)	+0.03	−.16 to .21	0.29	114	13.00	USA	North America	Yes
Yang et al. (2013)	+0.09	.03 to .16	2.85**	948	12.50	Korea	Asia	Yes
Ybarra and Mitchell (2004)	+0.00	−.05 to .05	0.05	1498	14.10	USA	North America	Yes

(*Continued*)

Study	Effect Size (*r*)	95% CI	*Z*	*N*	Average Age	Country	Continent	Published
Ybarra and Mitchell (2007)	+0.04	−.01 to .09	1.53	1500	14.20	USA	North America	Yes
Yilmaz (2011)	+0.11	.04 to .18	2.96**	756	13.00	Turkey	Asia	Yes
Zhou et al. (2013)	+0.12	.06 to .17	4.41**	1438	15.91	China	Asia	Yes

Notes. a = Internet bullying only; b = Study 1; c = Study 2; d = bullying by cellular phone; e = bullying by Internet; f = cyber-bullied others last year; g = cyber-bullied others weekly; h = cyber-harassment, i = denigration; j = outing.
*$p < .05$.
**$p < .01$.

suggests that effect sizes associated with earlier years tended to show that males were more likely to cyber-bully more than females; however, the slope of this effect suggests that effect sizes became smaller as the publication date gets closer to the time the search was conducted for this meta-analysis. In other words, over time, the effect size diminishes, albeit still positive (indicating that males are more likely to cyber-bully relative to their female peers).

DISCUSSION

Overall, the results revealed that males were more likely to be cyber-bullies than females; however, this sex difference was moderated by age. Specifically, females were more likely to report cyber-bullying during early adolescence while males were more likely to be cyber-bullies during later adolescence.

The interactive effect of participant sex and age on cyber-bullying behavior best fits within the scope of the broader relational or indirect aggression field, with some important differences. First, our study found that females are more likely to use cyber-bullying at younger ages. This confirms a number of meta-analyses that find that females are more likely to use relational or indirect aggression than males only during early to mid-adolescence (Archer, 2004; Card et al., 2008), with the sex difference not being found in emerging adulthood. From a developmental perspective, females mature both physically and socially earlier than males do

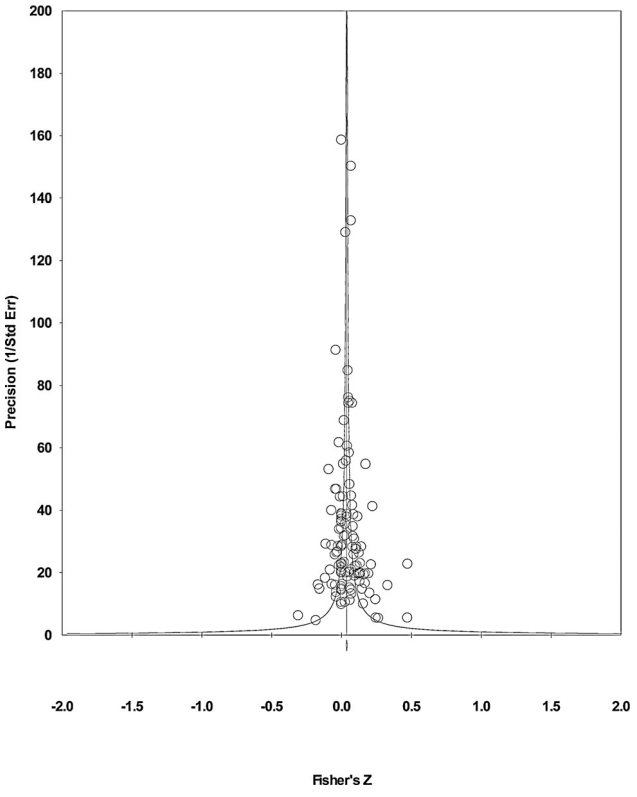

Fig. 1. Funnel Plot of Precision by Fisher's *Z*.

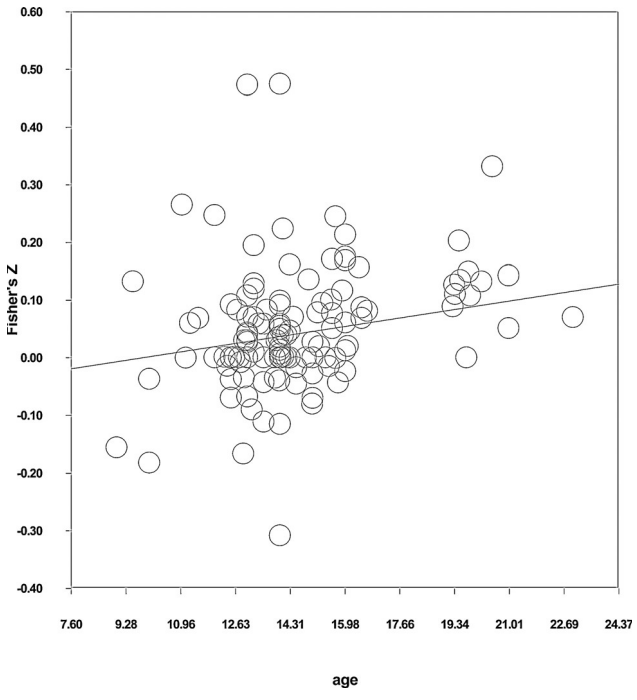

Fig. 2. Regression of age on Fisher's *Z*.

TABLE II. Categorical Moderator Analysis Results

Moderator	Q_B	Level	r	95% CI	Z	k
Country	283.50[a]**					
		United States	.03	.02 to .04	5.52**	41
		Serbia	.15	.09 to .20	5.02**	3
		Germany	.18	.15 to .21	10.89**	5
		Korea	.09	.03 to .16	2.85**	1
		Spain	.04	−.01 to .09	1.48	1
		Netherlands	.07	.02 to .12	2.65**	3
		Taiwan	.15	.12 to .18	8.97**	2
		Austria	.02	−.01 to .05	1.06	3
		Sweden	.05	.04 to .07	9.03**	6
		China	.08	.04 to .11	3.88**	
		Ireland	.01	−.02 to .05	0.73	1
		Singapore	.00	−.04 to .04	−0.12	3
		Italy	.06	.01 to .11	2.32*	2
		Belgium	.00	−.05 to .05	0.00	1
		Portugal	.08	.03 to .13	3.26**	1
		Switzerland	.04	−.01 to .08	1.48	3
		Canada	.01	−.02 to .03	0.45	9
		Australia	.02	.00 to .04	1.92	7
		Turkey	.13	.10 to .16	8.86**	13
		Finland	.04	.03 to .05	10.35**	7
		England	−.05	−.10 to .003	−1.82	4
		Greece	.14	.07 to .21	4.03**	1
		Aggregated	.00	−.01 to .01	0.18	3
Continent	67.78**					
		North America	0.02	.02 to .03	5.30**	50
		Europe	0.04	.03 to .04	14.45**	44
		Asia	0.10	.08 to .12	11.90**	21
		Australia	0.02	.00 to .04	1.92	7
Publication Status	4.24*					
		Published	0.04	.04 to .04	17.78**	107
		Not Published	0.02	−.004 to .04	1.60	15

[a]Note that there were three effect sizes that assessed sex differences in cyber-bullying across various European countries. These were coded as missing; however, the meta-analysis program computes them into the overall QB statistic. We termed them "aggregated" in this table.
*$p < .05$.
**$p < .01$.

(Steinberg, 2010). Relational or indirect aggression takes a fair amount of sophistication and knowledge of the social structure of the whole. According, females may have the slight edge for relational or indirect aggression during early-mid adolescence as a result of their earlier maturation. From this view, cyber-bullying may be viewed as a form of mediated relational or indirect aggression.

However, we also found that males were more likely to use cyber-bullying than females at older ages. As previously mentioned, we cannot pin-point the exact age when the average male surpasses the average female in cyber-bullying behavior; however, Figure 2 suggests that males begin to eclipse females in late adolescence. This does not confirm prior meta-analyses on relational or indirect aggression and suggests that cyber-bullying is a unique form of aggression in some ways. One potential explanation would be that males "catch up" to girls developmentally in later adolescence, diminishing any sex differences as a result of developmental changes. Males tend to be slightly more technologically sophisticated than females during adolescence (Huffman, Whetten, & Huffman, 2013), so this may account for the slightly higher levels of cyber-bullying that we see in late adolescence. Also, traditional bullying behavior begins to peak around middle to high-school ages (Scheithauer et al., 2006), which may also explain why males are more likely to cyber-bully in late adolescence.

Overall, we should note that any sex differences that were found were very small in nature, unlike physical aggression, which shows quite large sex differences (Archer, 2004). However, given the complex predictors of cyber-bullying and the extent to which cyber-bullying mirrors physical aggression, relational aggression, and

traditional bullying, we may not expect very large differences. Clearly more work is needed in this domain to further explore potential moderating variables that may influence whether males are more likely to cyber-bully relative to their female peers and at what age these effects occur.

We also found a number of interesting effects for the other moderators examined. For example, for country of origin, our results suggest a greater sex difference in the male direction for 13 of the 22 different countries included in the analyses. When examined by continent, sex differences were found for North America, Europe, and Asia, and not for Australia. An examination of the strength of effect sizes reveals that sex differences were largest in Asian cultures than in others. We have no theoretical reason to explain why sex differences would be larger in Asian cultures compared to others and why there were no sex differences in Australia. However, these results show that culture matters in predicting cyber-bullying, as has been found in studies of traditional forms of aggression (e.g., Lansford et al., 2012). Future research should continue to examine the role of culture in the development of cyber-bullying throughout adolescence and emerging adulthood.

Additionally, a significant sex difference in cyberbullying was only found in published and not in unpublished articles. However, this finding should be interpreted with a certain degree of caution. Indeed, there were only 15 effect sizes from theses or dissertations, and making comparisons with vastly different sample sizes is problematic. We do not believe that this suggests something of a "file-drawer" problem. Indeed, the fail safe N for this study was large and suggests a relatively robust sex effect in cyber-bullying.

Finally, the publication year moderated any sex differences found. Smaller sex differences (though still in the male direction) were found for more recent studies. This may be a true difference, where males and females are becoming more similar in their use of cyber-bullying as technology progresses. Alternatively, it may be that more recent studies are using more sophisticated measures of cyber-bullying that may capture subtypes of cyberbullying that are more common among females (e.g., Smith et al., 2008). Future research should continue to consider all these moderators when examining sex differences in cyberbullying.

Limitations and Future Research

Like all psychological research, limitations in the current research should be addressed with future work. First, because sex is a non-randomly assigned variable, causal claims regarding the effect of sex on cyber-bullying cannot be made. In addition, because the majority of the primary literature is cross-sectional, causal claims regarding the variables that may mediate the relation between sex and cyber-bullying need empirical attention. Indeed, very few longitudinal studies have been conducted to test the validity of possible mediators (e.g., Barlett & Gentile, 2012 [Study 2]; Fanti, Demetriou, & Hawa, 2012; Jose, Kljakovic, Scheib, & Notter, 2012); however, these longitudinal studies used only two administration periods, which does not allow for an accurate test of processes or mediation. Future work using highly controlled experimental procedures (to examine causality) or multi-wave longitudinal designs (to examine trajectory and mediation) is needed.

Second, as Rivers and Noret (2009) suggested, the method by which researchers measure cyber-bullying needs to be taken into account. Methodological issues arise when averaging percentages of cyber-bullies across studies that differ so greatly in terms of measurement. If the measure of cyber-bullying is reliable and valid, then the extent to which measurement differences could affect the results is minimal; however, some studies used single item measures of cyber-bullying behavior (using a yes/no format) or did not report reliability or validity information. Indeed, in their meta-analysis, Kowalski et al. (in press) excluded studies that used such a dichotomous indicator of cyber-behavior. Additionally, some studies included a definition of cyber-bullying in the questionnaire (e.g., Beran & Li, 2007) whereas others did not (e.g., Barlett & Gentile, 2012). However, most are classified, according to Kowalski et al. (in press), as "unclear" in this regard. Kowalski et al. (in press) found that including a definition of cyber-bullying (or including the word bully) reduced the correlation between cyber-bullying perpetration and cyber-victimization. Therefore, consistent with these researchers, we also suggest that researchers carefully select their measure for cyber-bullying.

Furthermore, the method by which cyber-bullying frequency is measured may have impacted the results of this meta-analysis. Some researchers categorized participants as being a cyber-bully, cyber-victim, cyber-bully-victim, or not involved (e.g., Kowalski & Limber, 2007) and others treat cyber-bullying frequency as a continuous variable (e.g., Barlett & Gentile, 2012). In terms of the data aggregation, chi-square statistics had to be performed when mutually exclusive categories were used and correlations were computed if cyber-bullying frequency was measured continuously. Future work should measure cyber-bullying and cyber-victimization frequency in a consistent manner. Indeed, several recent articles have begun to address measurement issues in cyber-bullying research to try to develop a unified definition (Tokunaga, 2010) and measures (Ybarra, Boyd, Korchmarso, & Oppenheim, 2012).

Final Remarks

Cyber-bullying, like traditional bullying, is a serious societal issue. The current research offers insight into the theoretical underpinnings of cyber-bullying behaviors by meta-analyzing the primary literature to answer several important questions. Results suggest that sex and age matter individually and interactively. Much more work is needed to further isolate the specific variables that predict cyber-bullying frequency using cross-sectional, longitudinal, and experimental research designs. Once results are found, findings replicated, and theory enhanced, intervention efforts can be successfully guided to attempt to reduce both cyber- and traditional bullying.

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* Denotes studies used in the meta-analysis.