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ANNUAL REVIEW OF SEX RESEARCH SPECIAL ISSUE

Adolescents and Pornography: A Review of 20 Years of Research

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The goal of this review was to systematize empirical research that was published in peer-reviewed English-language journals between 1995 and 2015 on the prevalence, predictors, and implications of adolescents' use of pornography. This research showed that adolescents use pornography, but prevalence rates varied greatly. Adolescents who used pornography more frequently were male, at a more advanced pubertal stage, sensation seekers, and had weak or troubled family relations. Pornography use was associated with more permissive sexual attitudes and tended to be linked with stronger gender-stereotypical sexual beliefs. It also seemed to be related to the occurrence of sexual intercourse, greater experience with casual sex behavior, and more sexual aggression, both in terms of perpetration and victimization. The findings of this review need to be seen against the background of various methodological and theoretical shortcomings, as well as several biases in the literature, which currently precludes internally valid causal conclusions about effects of pornography on adolescents.

Due to the easy accessibility of pornography on the Internet for adolescents, along with concerns about potentially adverse ramifications (e.g., Davis, 2012; Dombrowski, Gischlar, & Durst, 2007; Mattebo, Larsson, Tydén, & Häggström-Nordin, 2013), empirical research on adolescents' use of pornography has proliferated in recent years. Since 2005, more than 65 empirical articles have appeared, with a peak of 11 articles in 2011. In response to this rapid increase in research on adolescents and pornography, several researchers have reviewed the field (Bloom & Hagedorn, 2015; Dombrowski et al., 2007; Owens, Behun, Manning, & Reid, 2012; Springate & Omar, 2013). However, the reviews have come to opposite conclusions, notably about the question of whether pornography is related to adolescents' sexual attitudes and behavior. On the one hand, Dombrowski et al. (2007, p. 155) and Owens et al. (2012, p. 116) concluded that, except for sexual aggression, there are no clear results about whether and to what extent pornography is associated with adolescents' sexual attitudes and behavior. On the other hand, two more

recent reviews by Bloom and Hagedorn (2015, p. 88) and Springate and Omar (2013, p. 470), which dealt with a somewhat smaller selection of the literature than Owens et al., observed that adolescents' pornography use is negatively associated with their attitudes and behaviors.

Given these contradictory conclusions in existing reviews on pornography and adolescents, as well as the rapid increase of publications in the field, an up-to-date review seems timely and necessary. The first goal of our review is to give an encompassing account of the literature on pornography and adolescents from 1995 to 2015. Specifically, we revisit the question of the prevalence and predictors of adolescents' use of pornography. Moreover, we investigate whether and to what extent pornography is related to adolescents' sexual attitudes and beliefs, self-development, and sexual behavior. We chose the period 1995 to 2015 because only with the advent of the Internet in the mid-1990s did academic interest in adolescents and pornography become more widespread. Unlike earlier reviews, we pay systematic attention to methods of data gathering, study design, and sampling. In our view, the field as a whole, as well as specific results of the studies, can be evaluated meaningfully only when we consider the methodological characteristics of the studies. This is particularly true for a field in which research is ethically constrained by the protected status of its focal group, adolescents, and practically complicated by the sensitive character of its topic, pornography.

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The second goal of this review is to integrate the results of existing research in a recent theoretical model for media effects research. Previous reviews, valuable though they are, have tended to summarize the literature thematically rather than organize it theoretically. Specifically, the two dominant research lines—research on adolescents' use of pornography and research on its implications—have either not been represented adequately or have been kept theoretically separate. However, recent theories in media effects research (e.g., Slater, 2007; Valkenburg & Peter, 2013) have emphasized the need for more encompassing models to better understand when and how exposure to media content is related to individuals' attitudes and behaviors. By integrating findings about adolescents' pornography use and its implications into one theoretical model, we will be able to not only systematize the literature from a theoretical point of view but also detect theoretical shortcomings to inspire future research.

In line with earlier literature (Peter & Valkenburg, 2011d, pp. 1015–1016), we define pornography as professionally produced or user-generated pictures or videos (clips) intended to sexually arouse the viewer. These videos and pictures typically depict sexual activities, such as masturbation and oral sex, as well as vaginal and anal penetration, in an unconcealed way, often with a close-up on genitals. Most pornography is currently accessed through the Internet, which is reflected in many studies in this review. However, we do not confine this review to Internet pornography to facilitate comparison with and extension of Owens et al.'s (2012) review, which is the most comprehensive review of the topic to date. In the Appendix (in the online supplemental material), we provide information on whether a study dealt with Internet pornography or pornography in other media. By adolescents we mean youth aged 10 to 17 (or samples of adolescents who are on average younger than 18 years of age). We chose 10 years of age as lower boundary because around this age puberty starts, which is typically accompanied by an enhanced interest in sexuality (Kail & Cavanaugh, 2010, p. 296). We limit this review to people younger than 18 years of age because, in the countries in which pornography is legal, pornography typically must be distributed or shown only to individuals who are 18 or older. Finally, as previous reviews have shown that the majority of studies on adolescents and pornography are quantitative-empirical (Bloom & Hagedorn, 2015; Owens et al., 2012), our review primarily deals with this type of studies. We, therefore, also chose a methodological orientation and theoretical setup that is best suited for quantitative-empirical studies. However, we compare the results of quantitative-empirical studies with those of qualitative-empirical research.

In the next two sections, we provide a rationale for the methodological characteristics of the studies that we center on and outline the theoretical model in which we try to embed research on adolescents' pornography use and its implications. After explaining our procedure for selecting the literature, we first review the methodological characteristics of the various studies. Knowledge of the methodological state of the art of the field is crucial to assess the

validity of the results critically. Guided by our theoretical model, we subsequently summarize the findings on the prevalence and predictors of pornography use as well its relation with adolescents' sexual attitudes, their sexual self-development (i.e., concepts related to the development of the sexual self, such as sexual uncertainty and sexual satisfaction), and sexual behavior. We then compare the aggregated results with the findings from qualitative research. The review concludes with a critical evaluation of the results and suggestions for future research. In various sections of the article, we organize the literature along the terms *predictor and criterion variables*. We use these terms in a statistical rather than in a causal sense: When one reports on a correlation between a predictor and a criterion variable, one can use the predictor to forecast the criterion variable, independent of causal considerations (e.g., Hayes, 2005).

Methodological Characteristics of Quantitative Research on Adolescents and Pornography

Because experimental research on adolescents' use of pornography is ethically not possible—it is usually illegal to show pornography to minors—researchers typically rely on surveys to study the issue, similar to research on other sensitive issues (e.g., Beebe, Harrison, Mcrae, Anderson, & Fulkerson, 1998; Owens et al., 2012). When reviewing survey-based research, at least three characteristics of such research are important as they relate directly to methodological problems in surveys on sensitive issues that endanger the validity and generalizability of the results (e.g., Bradburn, Sudman, & Wansink, 2004; Tourangeau & Yan, 2007).

The first characteristic of a survey that may endanger the validity and generalizability of its findings is the survey mode (e.g., face to face, telephone, or computer mediated) along with the administration of the questionnaire (i.e., self-administered versus interviewer administered). Sensitive questions, such as questions about pornography use, are usually intrusive and involve a threat of disclosure (Tourangeau & Yan, 2007), certainly for adolescents who may feel uncomfortable revealing intimate issues, given their still developing sexual selves (Buzwell & Rosenthal, 1996; Peter & Valkenburg, 2011a). As a result, the accuracy of reporting may decrease, while item nonresponse may increase (Bradburn et al., 2004; Tourangeau & Yan, 2007). Research on the impact of the survey mode on the reporting of sensitive behavior has shown that computer-mediated modes of surveys (e.g., audio-computer-assisted self-interviews or online surveys) elicit more accurate reporting than other modes of surveys (Mustanski, 2001; Tourangeau & Smith, 1996), also in surveys among adolescents (Beebe et al., 1998; Romer, 1997). Similarly, the accuracy of reporting is higher and item nonresponse is lower when a questionnaire is self-administered than when an interviewer administers the questionnaire (Mustanski, 2001; Tourangeau & Smith, 1996), also

among adolescents (Romer, 1997). In this review, we therefore systematically compare the survey mode and the type of administration of the survey.

A second characteristic of a survey that may threaten the validity and generalizability of its results is the sampling procedure (i.e., random, quota, or convenience) along with the number of invited respondents who eventually participate in a survey (i.e., response rate). This characteristic directly relates to the generalizability of the results and, while important to all types of surveys, is particularly relevant to sex-related surveys. Methodological research has documented various self-selection biases in research on sexual issues. Individuals who voluntarily participate in sex-related research are, for example, more sexually experienced, have more progressive sexual attitudes and greater sexual esteem, and tend to be sexual sensation seekers (e.g., Wiederman, 1993, 1999). Any survey that invites self-selection (e.g., through invitation on Web sites) or has a low response rate may thus produce biased results. In this review, we therefore compare the sampling as well as the response rates of surveys. For panel surveys, we also compare attrition rates.

The third important characteristic of a survey is its design (i.e., cross-sectional versus longitudinal), along with the statistical techniques used for analysis of the data. Cross-sectional designs indicate whether, at a given point of time, pornography use is associated with a particular variable of interest. Longitudinal designs show not only whether, across at least two different points of time, pornography is associated with another variable but also what the temporal order between the two variables in the association is (i.e., whether one variable temporally precedes the other or whether the two are reciprocally related over time). However, although longitudinal designs have a higher internal validity than cross-sectional ones, they still cannot rule out alternative explanations of a relation between pornography use and certain criterion variables with the same rigor as experimental designs can. It is therefore important to take into account the extent to which statistical analyses rule out alternative explanations, for example, through particular statistical techniques or the inclusion of control variables. In this review, we thus compare the design of the studies and the data analytical techniques, along with the inclusion of control variables.

An Integrative Approach to the Literature on Pornography and Adolescents

Social-scientific research on adolescents' use of pornography is multidisciplinary, spanning studies inspired, for instance, by developmental psychology (e.g., Bonino, Ciairano, Rabaglietti, & Cattelino, 2006; Doornwaard, van den Eijnden, Overbeek, & ter Bogt, 2015), communication research (e.g., Lo & Wei, 2005; Peter & Valkenburg, 2006a), and sexology (e.g., Chen, Leung, Chen, & Yang, 2013; To, Ngai, & Iu Kan, 2012). The

diverse disciplinary origin of the studies also shows in a diverse treatment of theory. Although it would be unjustified to call the literature on adolescents' pornography use atheoretical, it is important to note that a relatively large number of studies did not rely on established theoretical frameworks. In the studies that used established theoretical frameworks, the approaches chosen varied considerably. Researchers used, for example, the media practice model (e.g., Brown & L'Engle, 2009; Peter & Valkenburg, 2006a; Vandenbosch & Eggermont, 2013b), the sexual behavior sequence (Chen et al., 2013; Peter & Valkenburg, 2008a, 2009a; To et al., 2012), social cognitive theory (Peter & Valkenburg, 2011b, 2011c; Ybarra, Mitchell, Hamburger, Diener-West, & Leaf, 2011), the theory of reasoned action (Hardy, Steelman, Coyne, & Ridge, 2013), social bonding theory, uses and gratification theory (Mesch, 2009; Mesch & Maman, 2009), the hedonic-valence model (Peter & Valkenburg, 2008a), ego-identity-status theory (Peter & Valkenburg, 2008a), consistency theories (Peter & Valkenburg, 2009a, 2010b), social comparison theory (Peter & Valkenburg, 2009b), the sexual scripts approach (Peter & Valkenburg, 2010b), and cultivation theory (Weber, Quiring, & Daschmann, 2012).

Given the theoretical diversity in the field, it seems beneficial to organize a review of the literature within a theoretical framework that can parsimoniously accommodate both research on predictors of adolescents' pornography use and research on how this use is associated with certain criterion variables, such as sexual attitudes and behavior. Preferably, the framework should integrate approaches, such as the media practice model, the sexual behavior sequence, and social cognitive theory, which are used relatively often in research on adolescents' use of pornography. Finally, the theoretical framework should help systematize existing research such that well-established knowledge, inconsistencies, and open questions become apparent in a theoretically meaningful way to inspire future research.

A theoretical framework that meets these requirements is the differential susceptibility to media effects model (DSMM; Valkenburg & Peter, 2013). In line with other media effects theories (e.g., Anderson & Bushman, 2002; Slater, 2007), the DSMM integrates predictor and criterion variables of media use into one model and thus seems suitable for systematizing research on adolescents and pornography. Moreover, the DSMM explicitly builds on theoretical frameworks, such as the media practice model and social learning theory. Specifically, the DSMM puts forward four propositions that are also relevant to studies on adolescents and pornography.

The first proposition of the DSMM is that three types of variables (i.e., dispositional, developmental, and social) predict media use (Valkenburg & Peter, 2013). Although earlier reviews of the literature dealt with adolescents' use of pornography (e.g., Bloom & Hagedorn, 2015), we still lack systematic knowledge about which types of adolescents expose themselves to pornography. In this review, we thus

compare dispositional, developmental, and social predictors of adolescents' use of pornography.

The second proposition of the DSMM is that response states (i.e., state variables that originate from media use; Valkenburg & Peter, 2013) mediate the relationship between media use and criterion variables. These response states can be cognitive (i.e., the extent to which media users selectively attend to and invest cognitive effort to comprehend media content), emotional (i.e., all affectively valenced reactions to media content), and excitative (i.e., the degree of physiological arousal in response to media). While Owens et al. (2012) deliberately preclude indirect relationships from their review, theorizing on media effects has outlined the importance of underlying processes, and thus indirect relationships, for our understanding of how the use of media content may predict criterion variables (e.g., Anderson & Bushman, 2002). We therefore compare the various cognitive, emotional, and excitative mediator variables studied in the literature on adolescents and pornography.

The third proposition of the DSMM is that dispositional, developmental, and social variables may not only predict media use but also moderate the extent to which media use predicts criterion variables (Valkenburg & Peter, 2013). Malamuth and colleagues (e.g., Malamuth, Addison, & Koss, 2000; Malamuth & Huppert, 2005) in particular have emphasized how important it is to take into account individual differences when studying pornography as a predictor of criterion variables of interest. The third proposition of the DSMM mirrors this emphasis. In this review, we therefore systematize and compare the various dispositional, developmental, and social moderator variables that have been studied in the literature.

The fourth and final proposition of the DSMM is that media use and criterion variables are related in a transactional way, that is, the notion that (changes in) criterion variables predicted by media use can themselves also predict media use (Valkenburg & Peter, 2013). Previous reviews of the literature have dealt with this notion only marginally. The media effects literature, however, has increasingly paid attention to transactional relations between media use and criterion variables because they seem to describe the implications of media use more realistically and validly than unidirectional and linear notions of media effects (Bandura, 2009; Slater, 2007). We therefore observe whether transactional relations between pornography use and criterion variables have been studied.

Method

We searched both Web of Science (SSCI database) and PsycINFO with the search terms (porn* AND adolescen*) OR (porn* AND teen*) OR (porn* AND youth) for empirical studies on adolescents and pornography published in the period 1995 to 2015 (deadline December 15, 2015). In Web of Science, the search terms could appear in *topic* (i.e., *title*, *abstract*, *author keywords*, and *keywords plus*). In PsycINFO,

we searched the fields *title*, *abstract*, *heading word*, *key concepts*, and *original title*. We limited our search to peer-reviewed journal articles. We opted for journal articles because they are typically the main source for empirical studies and ensure some minimum of comparability. We chose peer-reviewed journals because peer review usually guarantees the basic academic quality of the articles.

Our search elicited initially 349 articles in Web of Science and 271 articles in PsycINFO. First, we checked whether an article was published in English. We included English-language articles only, because they are most easily accessible for most academics, which makes our review more transparent and verifiable. We thus excluded the following articles: In the Web of Science selection, we removed eight in German, four in Spanish, two in French, one in Turkish, and one in Dutch; in the PsycINFO selection, we excluded 13 in German, eight in Spanish, seven in French, four in Chinese, two in Japanese, two in Turkish, one in Czech, one in Italian, and one in Portuguese.

Next, we excluded articles according to one or more of the following criteria. First, we excluded articles that did not deal with adolescents who were between 10 and 17 years of age. When an article also included individuals who were younger than 10 and/or older than 17 years of age (or separate adult samples), the mean age of the (adolescent) sample had to be above 10 and below 18 for a study to be included; 113 articles in Web of Science and 43 articles in PsycINFO were excluded. Second, we excluded articles that did not present original empirical results: 31 articles in Web of Science and 49 articles in PsycINFO. Third, we excluded articles that focused exclusively on a special population of adolescents (e.g., delinquents, clinical samples): 14 articles in Web of Science and 17 articles in PsycINFO. Including these populations would introduce a confounding variable. Fourth, we excluded articles that did not substantially deal with adolescents' pornography use: 115 articles in Web of Science and 66 articles in PsycINFO. Typically, such articles had the term *pornography* only in the keywords but made no further substantial reference to it; focused only on issues such as child pornography or Internet addiction; or were content, discourse, or other types of text analyses. The set of articles resulting from our search was relatively similar in Web of Science and PsycINFO, albeit larger in Web of Science. Therefore, we had an independent coder assess for 10% of the retrieved articles in Web of Science whether, according to our criteria, they had to be included in our review. The intercoder reliability was 100%.

Overall, 64 quantitative articles and nine qualitative articles qualified to be included in the review. However, when reading the included articles, we found references to two more quantitative studies that had not emerged in our search. We therefore also included a quantitative study by Lo, Neilan, Sun, and Chiang (1999; cited in Lo and Wei 2005) and a quantitative study by Vandenbosch and Eggermont (2013b; cited in Vanden Abeele, Campbell, Eggermont, and Roe, 2014). In total, we thus reviewed 75 studies, 66 quantitative (see Appendix in Supplementary online data) and nine qualitative

studies (Abiala & Hernwall, 2013; Arrington-Sanders et al., 2015; Cameron et al., 2005; Kinsman, Nyanzi, & Pool, 2000; Lavoie, Robitaille, & Herbert, 2000; Lofgren-Mårtensson & Månsson, 2010; Marston & Lewis, 2014; Mattebo, Larsson, Tydén, Olsson, & Häggström-Nordin, 2012; Rothman, Kaczmarzsky, Burke, Jansen, & Baughman, 2015).

Only two articles from our selection were published in the period 1995–1999 and only four in the period 2000–2004. In the period 2005–2009, however, the number of published articles rose to 20, and in the period between 2010 to 2014 to 41. In 2015 (until December 15), eight articles were published. Most of the quantitative and qualitative articles ($n = 35$) originated in Europe. Of these articles, 15 came from the Netherlands, seven from Sweden, five from Belgium, two from Greece, and one each from the Czech Republic, Germany, Great Britain, Italy, and Switzerland. One study drew on data from multiple European countries (Ševčíková, Šerek, Barbovski, & Daneback, 2014). Sixteen articles originated in Asia (six in Hong Kong, four in Taiwan, two in Korea, and one each in Cambodia, China, Malaysia, and Thailand). Fourteen articles came from the United States and one from Canada. Five studies were done in Africa (two in Ethiopia and one each in Morocco, Nigeria, and Uganda), and two articles each came from Australia and Israel.

With few exceptions (Arrington-Sanders et al., 2015; Bekele, Van Aken, & Dubas, 2011; Mattebo, Tydén, Häggström-Nordin, Nilsson, & Larsson, 2013; Odeyemi, Onajole, & Ogunowo, 2009; Skoog, Stattin, & Kerr, 2009; Vandenbosch & Eggermont, 2013a), the articles focused on both male and female adolescents. Some articles dealt with early adolescents (e.g., Atwood et al., 2012; Ma & Shek, 2013; Shek & Ma, 2012a, 2012b); others centered on middle (e.g., Skoog et al., 2009) or late adolescents (e.g., Chen et al., 2013; Flood, 2007; Luder et al., 2011; Weber et al., 2012). The majority of articles, however, focused on samples of adolescents with a relatively wide age range, as the Appendix shows for the quantitative studies.

Several studies relied on the same samples. The same Dutch sample was used in the articles by Peter and Valkenburg (2006a, 2006b, 2007); another one in Peter and Valkenburg (2008a, 2008b, 2009a, 2009b, 2010a, 2010b); and a third in Peter and Valkenburg (2011b, 2011c, 2011d). Mitchell, Finkelhor, and Wolak (2003), Ybarra and Mitchell (2005) and Mitchell, Wolak, and Finkelhor (2007) relied on the same sample of U.S. adolescents (Youth Internet Safety Survey 1). Mitchell et al. (2007) and Wolak, Mitchell, and Finkelhor (2007) used the Youth Internet Safety Survey 2, while Jones, Mitchell, and Finkelhor (2012) combined the Youth Internet Safety Surveys 1 and 2 with the third version of that survey. Shek and Ma (2012a, 2012b, 2014) and Ma and Shek (2013) drew on one sample of adolescents in Hong Kong; and Mattebo, Tydén, et al. (2013) and Mattebo, Tydén, Häggström-Nordin, Nilsson, and Larsson (2014) based their work on one sample of adolescents in Sweden. Mesch (2009) and Mesch and Maman (2009) both used the 2004 National Israeli Youth Survey, while To et al.

(2012) and To, Iu Kan, and Ngai (2015) relied on the same sample of adolescents in Hong Kong. Finally, the studies by Doornwaard, van den Eijnden, et al. (2015) and by Doornwaard, Bickham, Rich, ter Bogt, and van den Eijnden (2015) relied on one sample of Dutch adolescents. Overall, our review is based on 49 genuine study samples for the quantitative studies and nine genuine samples for the qualitative studies.

We read the quantitative articles with a focus on the two goals of the review. If information that was necessary to address either of the two goals of our review was not mentioned explicitly in the articles, we tried to derive this information from contextual information or references to other documents. To get insight into effect sizes, we calculated Cohen's d (Cohen, 1988) for significant findings in multivariate analyses, provided that bivariate statistics, such as Pearson's r or odds ratios, were also reported for these findings. It is important to note that the Cohen's d values reported in this review present rough first approximations, as they are based only on the limited available statistics in the articles. They cannot replace formal meta-analytical computations of Cohen's d . In line with conventions, we consider Cohen's d values that range between 0.20 and 0.49 (equals r values between 0.10 and 0.24) small relations, values between 0.50 and 0.79 (equals r values between 0.25 and 0.37) intermediate relations, and values of 0.80 and above (equals r values of 0.38 and higher) strong relations. We read the qualitative articles with a focus on how their results compared with the findings of the quantitative articles.

Results

Methodological Characteristics of Quantitative Research on Adolescents and Pornography

The Appendix presents an overview of the quantitative-empirical research on adolescents and pornography published between 1995 and 2015 in peer-reviewed journal articles. As the Appendix shows, quantitative-empirical research on adolescents and pornography was exclusively based on surveys. In terms of the survey mode, the majority of studies used paper-and-pencil surveys (49%) or online surveys (20%). (These and the following figures were calculated on the basis of the number of genuine study samples.) In all, 12% of the studies relied on face-to-face surveys and 8% on telephone surveys, whereas computer-assisted self-interviews occurred only twice (in three articles, the survey mode was unclear). By far the most questionnaires were self-administered (73%), as opposed to interviewer administered (20%). Most self-administered questionnaires were completed at home or in a classroom or school setting. With three studies, the survey mode and administration were unclear.

The majority of studies (59%) relied on a sample with some random component (typically at the first stage of sampling, for example, schools or households); 4% of the studies were based on quota samples, defined as samples in

which, based on official statistics, quotas for specific sample characteristics, such as age, biological sex, and educational level, were set before the data were gathered and targeted in the data collection. A total of 37% of the studies relied on convenience samples, defined as samples that did not have a random or quota element (e.g., when invitations are sent out to all visitors of a Web site). The sample sizes (defined on the basis of the respondents used for the analyses in a study) varied from $N = 97$ (Skoog et al., 2009) to $N = 11,712$ (Ševčíková et al., 2014), with a median size of $N = 896$. The average sample size was $N = 1,498$ with a standard deviation of 1,930, indicating great diversity in sample sizes. Response rates were reported in fewer than half of the studies and ranged between 10% (for parents; Hardy et al., 2013) and 98.7% (Mesch & Maman, 2009), with a median response rate of 82% and an average response rate of 74% ($SD = 24.35$). In the longitudinal studies, attrition was between 5% (Brown & L'Engle, 2009) and 46% (Peter & Valkenburg, 2008a), with a median of 22% and an average attrition of 23% ($SD = 11.80$).

In terms of the design, 80% of the studies had a cross-sectional design and 20% had a longitudinal design; 64% of the articles relied on multiple ordinary least squares (OLS), logistic, or multinomial regression, and 21% used structural equation modeling (SEM). In addition, 15% of the articles presented results based exclusively on uni- or bivariate statistics. (The percentages for the statistical techniques used were calculated on the total number of quantitative articles.) As for the control variables, articles varied greatly, from controlling just for demographics (e.g., Bonino et al., 2006) to elaborate sets of control variables, encompassing demographic, personality, sexual, and Internet use variables (e.g., Luder et al., 2011). In articles based on cross-sectional designs, the diversity in substantive focus, samples, and statistical techniques made it difficult to identify a precise hierarchy of control variables used. However, it seems safe to say that demographics, Internet use-related variables (e.g., frequency, type, and location of use), and family-related variables (e.g., family structure, parental education, family relationships) were relatively often controlled for. In articles based on longitudinal designs, it was a common practice to control for previous levels of the criterion variable (i.e., autoregressive effects; see Appendix), with several studies controlling for, or including, additional variables in the analysis (Beyens, Vandenbosch, & Eggermont, 2015; Brown & L'Engle, 2009; Peter & Valkenburg, 2011b, 2011c, 2011d; Vandenbosch, 2015). When autoregressive effects were not investigated, either strong predictors of the criterion variable (i.e., general aggression rather than sexual aggression; Ybarra et al., 2011) were part of the model or it was impossible to control for previous levels of a criterion variable (i.e., sexual initiation; Vandenbosch & Eggermont, 2013b).

Conclusion: Dominance of Self-Administered Questionnaires and Cross-Sectional Designs. The vast majority of studies on adolescents and pornography followed

insights from survey research and used paper-and-pencil or online surveys with self-administered questionnaires. Nearly two-thirds of the studies (63%) relied on samples with some random or a quota component. The response rates were relatively high, probably because many studies were conducted in a school setting, but this figure is based on limited information. Attrition rates in longitudinal surveys were also relatively high.

Overall, then, some cautious generalization on the basis of the aggregate results seems possible. In terms of design, however, the dominance of cross-sectional designs, along with the correlational character of the longitudinal designs, asks for caution in drawing causal conclusions. This point seems even more important given the recent controversy (e.g., Brown, 2011; Steinberg & Monahan, 2011) about whether regression-based analyses, which dominate research on adolescents and pornography, should be replaced with propensity score analysis as it better accounts for differences in factors that make adolescents use pornography differentially.

Prevalence of Adolescents' Use of Pornography

Adolescents' use of pornography has been assessed in the studies by focusing on (a) unintentional use, (b) intentional use, and (c) any use of pornography (i.e., not distinguishing between unintentional and intentional use). Table 1 shows the prevalence of adolescents' pornography use in the various studies in which it was reported. Adolescents' unintentional use of pornography has typically been studied as unwanted (e.g., Mitchell et al., 2003; Wolak et al., 2007) or accidental (e.g., Flood, 2007; Tsaliki, 2011) exposure to Internet pornography. This type of exposure may occur, for example, through opening unsolicited messages or receiving spam e-mails (Chen et al., 2013; Mitchell et al., 2003), mistyping Web site addresses, searching for terms that have a sexual and a nonsexual meaning (Flood, 2007), or accidentally accessing pop-up images and advertisements (Chen et al., 2013; Ševčíková et al., 2014). Prevalence rates for unintentional exposure to Internet pornography ranged from 19% found among 10- to 12-year-olds in the United States (Mitchell et al., 2007) to 60% among Australian girls and 84% among Australian boys aged 16 to 17 (Flood, 2007); and rates seem to have dropped in recent years, at least in the United States (Jones et al., 2012). The most recent studies found that 41% of Taiwanese adolescents had been unintentionally exposed to Internet pornography (Chen et al., 2013), while 68% of adolescents in the United States had ever unintentionally encountered pornography (Hardy et al., 2013).

Adolescents' intentional use of pornography has usually been studied as deliberate (e.g., Luder et al., 2011), purposeful (e.g., Peter & Valkenburg, 2006a) exposure to pornographic content, often involving active search for the material (Tsaliki, 2011). Prevalence rates of intentional exposure to pornography also varied greatly. While Ybarra and Mitchell (2005) found only 7% of 10- to 17-year-olds in

the United States to be intentional users of pornography in traditional media (8% on the Internet), Chen et al. (2013) reported that 59% of Taiwanese 10- through 12th-grade students had intentionally used Internet pornography in the past year.

Investigations that dealt with any pornography use of adolescents without distinguishing between intentional and unintentional exposure to pornography also came to diverging results. Prevalence rates ranged between less than 7% (exposure to pornography; Dong, Cao, Cheng, Cui, & Li, 2013; pornography use on Internet and in traditional media in past year; Shek & Ma, 2012a) to 71% (use of Internet pornography in the past year; Chen et al., 2013). Weber et al. (2012) found that 93% boys and 52% girls aged 16 to 19 had watched a pornographic movie in the six months prior to survey. Prevalence rates for lifetime exposure to pornography ranged from 25% among Taiwanese adolescents (Internet pornography; Cheng, Ma, & Missari, 2014) to 98% among German boys and 81% among German girls (pornographic movie; Weber et al., 2012).

Nearly all studies to date have focused on one-time measurements of adolescents' pornography use, thereby neglecting how this use may develop over time. Addressing this research gap, Doornwaard, van den Eijnden, et al. (2015) recently studied the trajectories that adolescents' use of Internet pornography followed. They found four trajectories of pornography use for boys: a non-use or infrequent use trajectory; a trajectory in which pornography strongly increased; a trajectory of occasional use; and a trajectory of decreasing use. Three trajectories of pornography use emerged for girls: a stable nonuse or infrequent use trajectory; a strongly increasing use trajectory; and a stable occasional use trajectory.

Conclusion: Adolescents Use Pornography, But Prevalence Rates Differ Greatly. Findings about the prevalence of adolescents' use of pornography differ greatly, regardless of whether the studies dealt with unintentional, intentional, or any use of pornography. The studies suggest that at least a sizable minority of all adolescents use pornography, but exact aggregate figures about adolescents' pornography use seem difficult to derive from the literature.

The diversity of findings about the prevalence of adolescents' pornography use has at least three reasons. First, as Table 1 and the Appendix indicate, the studies vary methodologically, notably in terms of sampling method, sample size, sample composition, survey mode/administration, and operationalization of pornography use. As a result, many figures about pornography may be specific to the particular study and difficult to compare across investigations. Second, in the period from 1995 to 2015, which we reviewed here, the Internet has undergone dramatic changes—and with it adolescents' access to Internet pornography. A finding that was valid in the early 2000s may thus no longer be up to date today. Third and finally, while a clear pattern is not discernible in the studies reviewed, the cultural context

(e.g., sex education, sexual liberalism) of studies is likely to affect how often adolescents (report to) use pornography. How these three factors—methodological differences, technological changes, and cultural context—influence the prevalence of adolescents' pornography use needs systematic attention in future studies. Currently, we cannot preclude that any conclusion about prevalence rates of adolescents' exposure to pornography is confounded by at least the three factors just mentioned.

Predictors of Adolescents' Pornography Use

Predictors of adolescents' pornography use refer to the variables that forecast which specific adolescents use pornography. In what we identified as a predictor, we followed the focus and conceptualization in the particular study. To reduce the risk of spurious findings, we do not report results of bivariate analyses and focus instead only on results of multivariate analyses. For longitudinal studies, we report results from models with two variables only when autoregressive effects were included (i.e., controlling for previous values of the criterion variable).

In what follows, we do not include the predictors of adolescents' unintentional use of pornography that have been studied in the literature. It is logically questionable whether an activity that involves a chance component will vary systematically among adolescents. In addition, it is unclear whether a positive answer to a question about unintentional exposure is just a way to circumvent socially undesirable answers to a question about intentional exposure. Finally, in the conceptualization of unintentional exposure, the literature has not sufficiently explicated whether, after an inadvertent initial contact, exposure ceases to be unintentional. After all, if adolescents decide to continue watching the pornographic material encountered, it is difficult to see how this continued exposure remains inadvertent or accidental.

The first proposition of the DSMM (Valkenburg & Peter, 2013) is that media use is predicted by dispositional, developmental, and social variables. In terms of dispositional predictors of pornography use, five groups of variables have been investigated (excluding studies on unintentional use): demographics, personality characteristics, norm-related variables, sexual interest, and Internet behavior. As for demographics, many studies have shown that male adolescents used pornography more often than female adolescents did (Holt, Bossler, & May, 2012; Lo et al., 1999; Lo & Wei, 2005; Mesch, 2009; Mesch & Maman, 2009; Peter & Valkenburg, 2006a, 2011d; Ševčíková et al., 2014; Shek & Ma, 2012a; Tsitsika et al., 2009; Wolak et al., 2007; Ybarra & Mitchell, 2005). A recent cross-nationally comparative study in European Union countries, however, has pointed out that sex differences in the use of pornography are less distinct in more liberal countries than in less liberal countries (Ševčíková et al., 2014). Vandenbosch (2015) found no sex differences in Dutch adolescents' exposure to affection-, dominance-, or violence-themed Internet pornography. Bi-

Table 1. Operationalization and Prevalence of Adolescents' Pornography Use (Unintentional, Intentional, Any) (Only Studies That Reported Prevalence)

Author(s), Year Published, Country	Operationalization of Pornography Use	Prevalence Unintentional	Prevalence Intentional	Prevalence Any
Cowan & Campbell, 1995, United States	Use of pornographic video (a) ever and (b) how often			(a) 83% boys, 48% girls; (b) 30% boys, 10% girls at least once a month
Lo et al., 1999, Taiwan	Pornography use on computers and print media at least once or twice a year			23% (computers) to 46% (porn comics)
Kim, 2001, Korea	Use of pornographic film on Internet	25%		43%
Mitchell et al., 2003, United States	Exposure to Internet pornography			
Lo & Wei, 2005, Taiwan	Use of Internet pornography at least once or twice a year			38%
Ybarra & Mitchell, 2005, United States	Use of pornography on (a) Internet or (b) in traditional media in previous year		(a) 8%; (b) 7%	
Bonino et al., 2006, Italy	Use of pornography in comics/magazines or films/videos in past six months			36%
Peter & Valkenburg, 2006a, Netherlands	Use of Internet pornography in past six months		55% (71% boys; 40% girls)	
Flood, 2007, Australia	Exposure to Internet pornography	84% boys; 60% girls	38% boys; 2% girls	
Mitchell et al., 2007, United States	Exposure to Internet pornography in past year	10- to 12-year-olds: 19%; 13- to 15-year-olds: 35%; 16- to 17-year-olds: 44%		34%
Wolak et al., 2007, United States	Exposure to Internet pornography in past year	66%		
Peter & Valkenburg, 2008b, Netherlands	Use of Internet pornography in past six months (here: pictures with people having sex)		28% boys; 3% girls	
Brown & L'Engle, 2009, United States	Use of sexually explicit media (X-rated movies, erotic and pornographic magazines, pictures of naked people on computer)			53% boys; 28% girls
Mesch, 2009; Mesch & Haman, 2009, Israel	Use of Internet pornography		16% [15%] (very frequent use 2001 [2004])	
Odeyemi et al., 2009, Nigeria	Watching pornographic films		18%	36% girls
Skoog et al., 2009, Sweden	Downloading and watching Internet pornography (boys only)			
Tsitika et al., 2009, Greece	Use of Internet pornography in past month		26% (40% boys; 13% girls)	24%
Bleakley, Hennessy, & Fishbein, 2011, United States	Seeking pornography from Internet sites			
Häggsström-Nordin, Borneskoog, Eriksson, & Tydén, 2011, Sweden	Reading or watching pornography (ever)			95% boys; 50% girls
Hasking et al., 2011, Australia	Purchased pornographic material under age 18			
Kim, 2011, Korea	Viewing pornography			
Luder et al., 2011, Switzerland	Deliberate and unwanted use of Internet pornography in past 30 days	47% boys; 35% girls	29% boys; 1% girls	16% (30% boys; 4% girls)
Peter & Valkenburg, 2011a, Netherlands	Use of Internet pornography in past six months (here: pornographic videos)		20%	47%
Tsalitki, 2011, Greece	Use of pornography	44%/28%, 15-18 year-old boys/girls; 40%/27% of 10-14 year-old boys/girls	57%/11% of 15-18 year-old boys/girls; 13%/4% of 10-14 year-old boys/girls	

Ybarra et al., 2011, United States	Use of (violent) pornography in past 12 months			Pornography: 19% (T1), 27% (T2), 22% (T3); violent pornography (averages): 1% magazines; 1% online; 3% movies	
Jones et al., 2012, United States	Unwanted exposure to Internet pornography		2000: 35%; 2005: 34%; 2010: 23%		< 7%
Shek & Ma, 2012a, Hong Kong	Pornography use (Internet and traditional media, such as rental movies, magazines) in past year				< 12%
Shek & Ma, 2012b, Hong Kong	Pornography use (Internet and traditional media, such as rental movies, magazines) in past year				44%
To et al., 2012, Hong Kong	Use of sexually explicit online material past year				(a) 98% boys, 81% girls; (b) 93% boys, 52% girls
Weber et al., 2012, Germany	Exposure to pornographic video clip or film (a) ever and (b) in past six months				71% 6%
Chen et al., 2013, Taiwan	Exposure to Internet pornography		41%	59%	
Dong et al., 2013, China	Use of pornography				
Hardy et al., 2013, United States	Exposure to pornography (ever)		68%	37%	
Kadri, Benjelloun, Kendili, Khoubila, & Moussaoui, 2013, Morocco	Use of Internet pornography				47% boys; 18% girls
Ma & Shek, 2013, Hong Kong	Pornography use (Internet and traditional media) in past year				< 15%
Mattebo, Tyden, et al., 2013, Sweden	Frequent use of pornography (i.e., at least a few times/month)				10%
Vandenbosch & Eggermont, 2013b, Belgium	Use of Internet pornography in past six months			46%	
Bogale & Seme, 2014, Ethiopia	Watched pornographic movies or read pornographic magazines (ever)				52%
Cheng et al., 2014, Taiwan	Visited pornographic Web sites (ever)				25%
Manaf et al., 2014, Malaysia	Reading and watching pornographic material				25%
Ševčíková & Daneback, 2014, Czech Republic	Use of Internet pornography in past six months (individual/collective)				57%
Vanden Abeele et al., 2014, Belgium	Mobile pornography use				9%
Beyens et al., 2015, Belgium	Use of Internet pornography in past six months			43%	
Lopez et al., 2015, Cambodia	Pornography use				11%; 20% boys; 2% girls

or homosexual male adolescents have been found to use Internet pornography more often than heterosexual male adolescents (Luder et al., 2011; Peter & Valkenburg, 2011d). Adolescents with higher academic achievement were more likely to encounter dominance-themed Internet pornography in a Dutch study (Vandenbosch, 2015). Similarly, higher-educated girls were more likely to use Internet pornography in a Swiss study (Luder et al., 2011). In another Dutch study, however, educational level was unrelated to the use of Internet pornography (Peter & Valkenburg, 2011d).

In terms of personality characteristics, robust evidence has emerged that sensation-seeking adolescents use pornography more often than their counterparts (Beyens et al., 2015; Luder et al., 2011; Peter & Valkenburg, 2006a, 2011d; Ševčíková et al., 2014), although a recent study reported no influence of sensation seeking on the themes in Internet pornography (i.e., affection, dominance, violence) to which adolescents were exposed (Vandenbosch, 2015). Similarly, young people with lower self-control consumed more Internet pornography (Holt et al., 2012). Adolescents who were less satisfied with their lives were also more likely to use Internet pornography (Peter & Valkenburg, 2006a), a cross-sectional finding that was replicated in a longitudinal study (Peter & Valkenburg, 2011d). In two Korean studies, adolescents with a lower self-esteem also used pornography more often (Kim, 2001, 2011). In an Israeli study, in contrast, self-esteem was found to be unrelated to adolescents' use of Internet pornography (Mesch & Maman, 2009). Less perceived autonomy was linked with more frequent use of pornography (Weber et al., 2012), as was greater self-efficacy (Kim, 2001, 2011). Finally, adolescents with a hyperfeminine or hypermasculine gender orientation were more likely to be exposed to violence-themed Internet pornography than adolescents without such a hypergender orientation (Vandenbosch, 2015).

Norm-related variables refer to concepts that deal with the extent to which adolescents comply with or reject norms and values in a given society. Regarding these variables, rule-breaking adolescents (Wolak et al., 2007; Ybarra & Mitchell, 2005) and youth who use substances (Ybarra & Mitchell, 2005) have been reported to use pornography more frequently. Pornography use was also found to be most characteristic of a group of adolescents called "major delinquents" (Hasking, Scheier, & Ben Abdallah, 2011, p. 26). In contrast, religious adolescents (Hardy et al., 2013) and those in religious schools (Mesch, 2009; Mesch & Maman, 2009) use pornography less frequently, largely because religiosity has been shown to be associated with higher self-control, more negative attitudes toward pornography, and the feeling that watching pornography violates social expectations and norms (Hardy et al., 2013). Two Dutch studies, however, found no influence of religiosity on the use of Internet pornography (Peter & Valkenburg, 2006a; Vandenbosch, 2015). Whether adolescents were enrolled in school and lived with both parents was also unrelated with pornography use (Lopez, Mukaire, & Mataya, 2015). Finally, negative attitudes toward school (Mesch, 2009;

Mesch & Maman, 2009) as well as having friends who engage in deviant activities (Holt et al., 2012) were associated with a greater use of Internet pornography.

As for adolescents' sexual interest, those with greater sexual interest, as well as those who also used sexual content in other media, were also more often exposed to Internet pornography (Peter & Valkenburg, 2006a). Finally, in terms of Internet behavior, the use of Internet pornography use was higher among those with greater digital skills in a study across countries of the European Union (Ševčíková et al., 2014), but was unrelated to adolescents' computer skills in a U.S. study (Holt et al., 2012). The use of Internet pornography seemed to be lower when filter software was installed (Wolak et al., 2007). Adolescents who used Internet pornography more frequently also used the Internet more often (Ševčíková et al., 2014) and for different activities, such as file sharing (Wolak et al., 2007), sex education (Tsitsika et al., 2009), talking to strangers (Wolak et al., 2007), Internet gaming, and buying goods (Tsitsika et al., 2009).

In terms of developmental predictors of pornography use, research has focused on three groups of variables: age/pubertal maturation, sexual experience, and developmental competencies. Regarding age, inconsistent results have emerged. While four studies have shown that pornography use increased with age (Ševčíková et al., 2014; Shek & Ma, 2012a; Wolak et al., 2007; Ybarra & Mitchell, 2005), five other studies did not find such an increase (Holt et al., 2012; Mesch, 2009; Mesch & Maman, 2009; Peter & Valkenburg, 2006a, 2011d). A recent study reported more exposure to affection-themed Internet pornography for younger adolescents and more exposure to dominance-themed pornography for older adolescents (Vandenbosch, 2015). For pubertal maturation, in contrast, results seem more consistent. More frequent use of Internet pornography was found both for boys (Beyens et al., 2015; Peter & Valkenburg, 2006a) and girls (Luder et al., 2011) with a more advanced pubertal maturation. Regarding sexual experience, results are inconclusive. Greater sexual experience was associated with a more frequent use of Internet pornography in one study (Ševčíková et al., 2014) and with less frequent use of Internet pornography (among girls) in another (Peter & Valkenburg, 2006a). As for developmental competencies, cognitive-behavioral competencies (i.e., abilities to solve problems, set goals, make effective behavior choices and act accordingly) were related to more frequent pornography use. In contrast, positive youth development qualities (e.g., social competence, self-efficacy, and moral competence) were related to less frequent pornography use, both on the Internet and in less traditional media (Shek & Ma, 2012a).

In terms of social predictors of pornography use, researchers dealt with family-related and peer-related variables as well as with victimization. Less commitment to the family (Mesch, 2009; Mesch & Maman, 2009), poor family functioning in general (Shek & Ma, 2014), and specifically less mutuality in family functioning (Shek & Ma, 2012a) were all associated with a stronger use of pornography. The same was true for a poor emotional bond with the caregiver (for Internet pornography; Ybarra & Mitchell, 2005) and a caregiver who used coercive

discipline (for traditional pornography; Ybarra & Mitchell, 2005). In addition, family conflict and poor family communication were related to more pornography use on the Internet and in traditional media, albeit mediated by less positive youth development (Ma & Shek, 2013). Weaker prosocial attitudes also correlated with more frequent pornography use (Mesch, 2009; Shek & Ma, 2012a). Restrictive parental mediation (Ševčíková et al., 2014) and installed blocking software (Wolak et al., 2007) were associated with less pornography use on the Internet. In contrast, the variables of parental control and parents talking about Internet pornography with their children were found to be unrelated to adolescents' use of Internet pornography (Peter & Valkenburg, 2006a; Wolak et al., 2007).

Regarding peers, more frequent online pornography use was found when the majority of adolescents' friends were younger (Peter & Valkenburg, 2006a), when adolescents used the Internet at their friends' homes (Wolak et al., 2007), when they communicated more often with their friends about pornography (males only; Weber et al., 2012), and when peers were perceived to use pornography (for females only; Weber et al., 2012). A study on the use of pornography on mobile phones also showed that popularity with same-sex peers, popularity with opposite-sex peers, desire for popularity, and peer pressure were linked with more frequent pornography use (Vanden Abeele et al., 2014). Attachment to peers, however, has been found to be unrelated to adolescents' use of Internet pornography (Mesch & Maman, 2009). Finally, regarding victimization, Wolak et al. (2007) found that adolescents were more likely to use Internet pornography when they were harassed online and victimized in their offline lives.

Conclusion: The Typical Adolescent Pornography User Is a Male, Pubertally More Advanced, Sensation-Seeker, With Weak or Troubled Family Relations

Research has studied a plethora of predictors of adolescents' use of pornography. However, cumulative evidence of what predicts adolescents' use of pornography is still somewhat limited. Although there are no generally accepted standards about the number of replications needed to establish cumulative evidence, there is agreement that research findings should be reproduced at least once and preferably more times (e.g., Casadevall & Fang, 2010). In this review, we define cumulate evidence as the same result obtained by at least three different research teams in at least three different samples for identical (or conceptually close) predictors in the absence of a considerable number of opposing results. Against this background we can tentatively conclude that the most likely users of pornography are male, pubertally more advanced, sensation-seeking adolescents with weak or troubled family relations. However, it is important to note that the predictors of pornography use may change as access to pornography or the cultural context of pornography change. For example, if the Internet is accessible only for the privileged or skilled, those who access pornography on the Internet may differ strongly from those who access it if the Internet is accessible to everyone. Similarly, if pornography is normalized in a culture, its

use may be predicted by a very different set of variables than when it is considered deviant.

Pornography Use and Adolescents' Sexual Attitudes, Self-development, and Behavior

Similar to our review of the predictors of adolescents' pornography use, in this section we also report only findings of multivariate analyses. As previously done, we report results from models with only two variables in longitudinal designs only when autoregressive effects were included.

Sexual Attitudes

In terms of sexual attitudes, research has centered on two types of attitudes: permissive sexual attitudes and gender-stereotypical sexual beliefs. We use the term *permissive sexual attitudes* as an umbrella term for positive attitudes toward sex with casual partners, typically in an uncommitted setting or outside a romantic relationship. In the literature, permissive sexual attitudes have been assessed with measures such as sexually nonexclusive attitudes (Lo et al., 1999), instrumental attitudes toward sex (Peter & Valkenburg, 2010b), attitudes toward uncommitted sexual exploration (Peter & Valkenburg, 2008b), or attitudes toward sexually permissive behavior (Lo & Wei, 2005). The term *gender-stereotypical sexual beliefs* refers to beliefs in which traditional, stereotypical notions of male and female roles as well as of gender relations dominate. Measures in the literature include progressive gender-role attitudes (Brown & L'Engle, 2009), notions of women as sex objects (Peter & Valkenburg, 2007, 2009a), gender-stereotypical beliefs about power imbalance in sexual relationships (To et al., 2012), and beliefs about gender equality (To et al., 2015).

Permissive Sexual Attitudes. Consistent evidence has emerged that adolescents' use of pornography is related to stronger permissive sexual attitudes (Brown & L'Engle, 2009, only boys; Doornwaard, Bickham, et al., 2015, only boys; Lo et al., 1999; Lo & Wei, 2005; Peter & Valkenburg, 2006b, 2008b, 2010b; To et al., 2015; To et al., 2012). Most evidence is based on cross-sectional surveys (Lo et al., 1999; Lo & Wei, 2005; Peter & Valkenburg, 2006b, 2008b; To et al., 2015; To et al., 2012). The sizes of the associations in cross-sectional studies ranged from Cohen's $d = 0.45$ (Lo et al., 1999) to $d = 0.72$ (Peter & Valkenburg, 2008b), with an average of $d = 0.56$ across the studies. In the longitudinal studies, the only meaningful effect size that could be calculated was $d = 0.39$ (Peter & Valkenburg, 2010b). For interpretation of these results, it is important to note that the distribution of variables in the studies usually indicated that adolescents on average tended to reject permissive sexual attitudes (Brown & L'Engle, 2009; Doornwaard, van den Eijnden, et al., 2015; Peter & Valkenburg, 2008b, 2010b; To et al., 2012) or were

undecided (Lo et al., 1999; Lo & Wei, 2005; Peter & Valkenburg, 2006b). None of the studies found that, on average, adolescents endorsed permissive sexual attitudes.

The second proposition of the DSMM is that cognitive, emotional, and excitative response states mediate the relation between media use and criterion variables. Some studies have found that the perceived realism of pornography (Peter & Valkenburg, 2006b), notably its perceived social realism (i.e., similarity to real-world sex) and perceived utility as a source of sexual information (Peter & Valkenburg, 2010b), mediated the association between the use of Internet pornography and permissive attitudes. There was also evidence that adolescents' more active and affirmative response states to pornography (i.e., a composite of physiological, affective, cognitive, and behavioral responses to Internet pornography; To et al., 2012) partly mediated this relation. Effect or association sizes between pornography use and the mediators ranged from Cohen's $d = 0.52$ (for social realism; Peter & Valkenburg, 2010b) to $d = 1.00$ (Peter & Valkenburg, 2006b), with an average of $d = 0.79$. The distribution of the variables in the two studies indicated that, on average, adolescents did not perceive pornography as (socially) realistic or as a useful source for sexual information.

The third proposition of the DSMM is that dispositional, developmental, and social variables may not only predict media use but also moderate the extent to which media use predicts criterion variables. To date, moderators of the association between pornography use and permissive attitudes have not been investigated frequently. In terms of biological sex (a dispositional moderator according to the DSMM), Brown and L'Engle (2009) as well as Doornwaard, Bickham, et al. (2015) found an association between pornography use and permissive sexual attitudes only for boys. Peter and Valkenburg (2010b), in contrast, found no moderating role of adolescents' biological sex and sexual experience (a developmental moderator). To et al. (2015) reported that the relation between the use of Internet pornography and permissive sexual attitudes (i.e., body-centered sexuality) was stronger if adolescents talked more with the parents about sexuality and felt more peer pressure about using pornography (social moderators).

As far as transactional relations between pornography use and permissive attitudes are concerned (proposition four in the DSMM), evidence is limited. The aforementioned longitudinal studies by Peter and Valkenburg (2010b) and Doornwaard, Bickham, et al. (2015) found that, over time, the use of Internet pornography predicted permissive attitudes, while permissive attitudes did not predict pornography use.

Gender-Stereotypical Sexual Beliefs. Two cross-sectional (Peter & Valkenburg, 2007; To et al., 2012) and two longitudinal studies (Brown & L'Engle, 2009; Peter & Valkenburg, 2009a) have shown that adolescents' pornography use is related to stronger gender-stereotypical sexual beliefs. A third cross-sectional study found that the

association between the use of Internet pornography and general beliefs about gender equality became more negative as adolescents talked more often about sex with their parents. However, a direct association between pornography use and gender equality was not present in that study (To et al., 2015). Similarly, a third longitudinal study did not find an association between how often adolescents used Internet pornography and gender-stereotypical sexual beliefs (Peter & Valkenburg, 2011b). In the studies that provided statistics to compute effect sizes, the effect sizes ranged from Cohen's $d = 0.10$ (To et al., 2015) to $d = 0.74$ (Peter & Valkenburg, 2009a), resulting in an average Cohen's d of 0.42. The distributions of the variables in the studies revealed that adolescents on average did not hold gender-stereotypical sexual beliefs.

Two studies demonstrated that the relation between adolescents' pornography use and various criterion variables was mediated (proposition two of the DSMM) by specific response states: Active and affirmative response states to pornography partly mediated the association between the use of Internet pornography and stereotypical beliefs in To et al.'s study (2012). Liking pornography mediated this relation in Peter and Valkenburg's (2009a) investigation. The size of the effect of pornography use on liking in Peter and Valkenburg's (2009a) study was Cohen's $d = 1.21$.

The moderators that were studied (proposition three of the DSMM) elicited inconsistent differential associations between pornography use and gender-stereotypical sexual beliefs. On the one hand, adolescents' biological sex (a dispositional moderator) did not augment or diminish the relation between pornography use and stereotypical beliefs (Brown & L'Engle, 2009; Peter & Valkenburg, 2009a), nor did adolescents' age (a developmental moderator) (Peter & Valkenburg, 2009a). On the other hand, communication with parents about sexuality (a social moderator) seemed to render the association between the use of Internet pornography and beliefs about gender equality more negative (To et al., 2015).

As for transactional relations (proposition four of the DSMM), one longitudinal study found evidence of transactional relations between the use of Internet pornography and gender-stereotypical sexual beliefs (Peter & Valkenburg, 2009a). The use of Internet pornography not only predicted stronger stereotypical beliefs over time but stereotypical beliefs also predicted a more frequent use of Internet pornography over time (Cohen's $d = 0.68$). This relation was significantly stronger for male than for female adolescents and was mediated by liking pornography.

Sexual Self-Development

Three longitudinal and three cross-sectional studies have dealt with the relation between adolescents' pornography use and their sexual self-development (i.e., aspects and tasks related to the development of the sexual self). Some evidence has emerged that adolescents' use of Internet

pornography is related to greater sexual uncertainty, that is, the extent to which adolescents are unclear about their sexual beliefs and values (Peter & Valkenburg, 2008b, 2010a), although uncertainty levels were low on average. Effect sizes varied between Cohen's $d = 0.32$ in a cross-sectional study (Peter & Valkenburg, 2008b) and $d = 0.20$ in a longitudinal study (Peter & Valkenburg, 2010a). One study found that male adolescents' use of Internet pornography was linked, through self-objectification and the internationalization of appearance ideals, with greater body surveillance (Cohen's $d = 0.35$; Vandenbosch & Eggermont, 2013a). Body surveillance was low to moderate among the boys in that study.

Studies have also shown that more frequent pornography use is related, with an effect size of Cohen's $d = 0.62$, to sexual preoccupation (i.e., a strong cognitive engagement in sexual issues, sometimes to the exclusion of other thoughts; Peter & Valkenburg, 2008a), as well as to sexual fantasizing (To et al., 2012). On average, adolescents' level of sexual preoccupation was moderate (Peter & Valkenburg, 2008a), while sexual fantasizing occurred infrequently (To et al., 2012). Finally, pornography use has been found to be associated with greater sexual dissatisfaction over time, Cohen's $d = 0.24$ (Wave 1 to Wave 2) and 0.28 (Wave 1 to Wave 3) (Peter & Valkenburg, 2009b), with adolescents being on average neither dissatisfied nor satisfied with their sex lives. Across the different indicators of sexual self-development, the average effect size was Cohen's $d = 0.28$ when the outlier sexual preoccupation was excluded and $d = 0.35$ when sexual preoccupation was included.

At least four articles have indicated that the relation between adolescents' pornography use and sexual self-development is not direct but mediated (proposition two of the DSMM). To et al.'s (2012) study showed that active and affirmative response states when watching Internet pornography partly mediated the association between pornography use and sexual daydreaming. Peter and Valkenburg (2008a) demonstrated that sexual arousal mediated the relation between the use of Internet pornography and sexual preoccupation, with an effect size of Cohen's $d = 1.28$ between pornography use and sexual arousal. The same authors also found that involvement in pornography mediated the relation between the use of Internet pornography and sexual uncertainty, Cohen's $d = 1.09$ (Peter & Valkenburg, 2010a). However, the means of these mediators indicated that, on average, adolescents reported they were not particularly sexually aroused by, nor involved in, pornography. Finally, Vandenbosch and Eggermont (2013a) showed that male adolescents' self-objectification (Cohen's $d = 0.32$, with pornography use) and their internalization of appearance ideals (Cohen's $d = 0.37$, with pornography use) mediated the relation between the use of Internet pornography and body surveillance. The average Cohen's d for the various mediators was 0.77 .

Researchers focused on biological sex, sexual experience, and age as moderators of the relation between pornography use and sexual self-development (proposition

three of the DSMM). When female adolescents watched more pornography, they became more strongly involved with the material than male adolescents did (Peter & Valkenburg, 2010a). However, the association between the use of Internet pornography and sexual preoccupation, as well as the mediation through sexual arousal, was the same for adolescent boys and girls (Peter & Valkenburg, 2008a). Regarding sexual experience (a developmental variable), Peter and Valkenburg (2009b) showed that adolescents with no or little own sexual experience, as well as those who perceived their friends as sexually inexperienced, became more dissatisfied with their sex lives when they watched more Internet pornography. As for adolescents' age, all relations between pornography use and sexual self-development were the same for different age groups.

Three longitudinal studies investigated transactional relations between adolescents' use of Internet pornography and sexual self-development (proposition four of the DSMM) but did not find consistent evidence for such relations. The use of Internet pornography predicted greater sexual preoccupation, greater sexual uncertainty, and greater sexual dissatisfaction, but neither sexual preoccupation nor sexual uncertainty nor sexual dissatisfaction consistently predicted the use of Internet pornography (Peter & Valkenburg, 2008a, 2009b, 2010a).

Sexual Behavior

Research on the relation between adolescents' use of pornography and their sexual behavior can be divided in four groups: (a) the occurrence of sexual intercourse and experience with different sexual practices; (b) casual sex behavior (i.e., sex-related and sexual behavior without relational commitment); (c) sexual risk behavior (i.e., sexual behavior that may increase the likelihood of unhealthy consequences); and (d) perpetration of sexual aggression as well as sexual victimization.

Four longitudinal studies (Brown & L'Engle, 2009; Cheng et al., 2014; Doornwaard, Bickham, et al., 2015; Vandenbosch & Eggermont, 2013b) and five cross-sectional studies (Atwood et al., 2012; Bogale & Seme, 2014; Luder et al., 2011; Manaf et al., 2014; Mattebo et al., 2014) have dealt with the association between pornography use and the occurrence of sexual intercourse as well as experience with different sexual practices. Both cross-sectionally and longitudinally, evidence has emerged that more frequent pornography use is related to a higher likelihood to have sexual intercourse (Atwood et al., 2012; Bogale & Seme, 2014; Brown & L'Engle, 2009; Manaf et al., 2014). More specifically, when adolescents used pornography more often, they also seemed to be more likely to start having sexual intercourse (Cheng et al., 2014; Vandenbosch & Eggermont, 2013b). This association, however, was stronger for girls than boys (Cheng et al., 2014) and emerged only among adolescents at an early pubertal stage (Vandenbosch & Eggermont, 2013b). Luder et al. (2011) did not find a

relation between pornography use and early sexual debut. Finally, researchers did not find consistent associations between pornography use and a greater experience with different sexual practices (Doornwaard, Bickham, et al., 2015; Mattebo et al., 2014). In the studies on the occurrence of sexual intercourse, the majority of adolescents, who ranged in age from 12 to 24, did not have sexual intercourse. Effect sizes could be calculated for only two studies, with a Cohen's $d = .35$ in Atwood et al.'s (2012) study and a Cohen's $d = 0.45$ in Bogale and Seme (2014), resulting in an average effect size of $d = 0.40$.

Regarding casual sex behavior, one longitudinal Taiwanese study (Cheng et al., 2014) and three cross-sectional studies demonstrated that adolescents' pornography use was associated with more experience with casual sex behavior, both in Taiwan (Lo et al., 1999; Lo & Wei, 2005) and in Sweden (Mattebo et al., 2014). The majority of adolescents did not have experience with casual sex behavior. Effect sizes could be calculated for only the two cross-sectional Taiwanese studies, resulting in an average effect size of Cohen's $d = 0.55$.

Evidence for an association between adolescents' pornography use and sexual risk behavior was mixed. Two cross-sectional studies have found positive relations between pornography use and sexual risk behavior. For example, Luder et al. (2011) found that adolescent males who more frequently used pornography were more likely to not have used a condom during their last sexual intercourse, while for female adolescents this was not the case. Van Ouytsel, Ponnet, and Walrave (2014) reported an association between more frequent pornography use and sexting (i.e., the sending of sexually suggestive pictures or videos of oneself). However, in their longitudinal study Peter and Valkenburg (2011c) found no association between adolescents' pornography use and unprotected sex with a casual sex partner. Similarly, in Luder et al.'s (2011) cross-sectional study, pornography use was unrelated to a higher number of sexual partners and first sexual intercourse before age 15. Across the studies, the majority of adolescents did not engage in sexual risk behavior, although occurrence rates varied considerably among the studies.

Regarding the perpetration of sexual aggression, use of pornographic magazines and comics was found to be associated with sexually harassing a peer or forcing someone to have sex in a cross-sectional study among Italian adolescents, while viewing pornographic films and videos was not (Bonino et al., 2006). Biological sex and age were controlled for. In a longitudinal U.S. study (Brown & L'Engle, 2009), the use of sexually explicit material via movies, magazines, and computers was associated, among boys, with sexual harassment perpetration (e.g., touching or brushing up against a schoolmate in a sexual way, cornering a schoolmate in a sexual way). Baseline behavior, age, ethnicity, socioeconomic status, parent education, pubertal maturation, and sensation seeking were controlled for.

In another longitudinal U.S. study (Ybarra et al., 2011), use of violent pornography was related to the perpetration of

sexual assault, both in person and technology based, while use of pornography in general was not, controlling for demographics, generalized aggression, technology use, psychosocial indicators, victimization, truthful answering, and being alone while answering. Adolescents' use of violent pornography was operationalized as seeing in an X-rated movie, in a magazine, or on a Web site "a person being physically hurt by another person while they were doing something sexual" (Ybarra et al., 2011, p. 5). In-person sexual assault was operationalized as kissing, touching, or doing "anything sexual with another person when that person did not want to do so" (Ybarra et al., 2011, p. 5). Technology-based sexual harassment was operationalized with items such as asking "anyone to do something sexual online when the other person did not want to do so" and sending "a picture text message that was sexual in a way when that person did not want to receive it" (Ybarra et al., 2011, p. 5). The occurrence of active sexual harassment varied between 60% in the second wave in Brown and L'Engle's (2009) study and 4% in the studies by Bonino et al. (2006) and Ybarra et al. (2011). In the study by Ybarra et al. (2011), on average a maximum of 3% of adolescents' used violent pornography. On the basis of the documentation in the studies, meaningful effect sizes could not be calculated.

Three cross-sectional studies also found that (sexual) victimization was related to pornography use. A study conducted in Ethiopia (Bekele et al., 2011) demonstrated a statistically strong association between female students' use of pornographic films and their sexual violence victimization ($r = 0.61$, Cohen's $d = 1.54$). This association was also significant for the various subscales of the overall sexual violence victimization index (i.e., becoming the victim of sexual offense, sexual assault, sexual coercion, and sexual aggression). In the context of the strong effect size, it is noteworthy that "Watched pornographic films pressured by a male school friend" was an item on the sexual offense scale, as was "Have had sexual intercourse as a result of watching pornographic film" on the sexual coercion scale (Bekele et al., 2011, pp. 614–615). In line with the study from Ethiopia, the aforementioned study from Italy also indicated that female adolescents who watched pornographic magazines and videos more often were more likely to become the victim of sexual violence (Bonino et al., 2006). However, it remains somewhat unclear whether the pertinent analyses (see Table 4 in Bonino et al., 2006, p. 282) were multivariate and controlled for age (as suggested in the text on p. 281). Reading pornographic magazines and comics was unrelated to becoming a victim of sexual violence (Bonino et al., 2006). Finally, in a study conducted in China, pornography use was linked with greater polyvictimization (i.e., multiple simultaneous types of abuse and neglect, including sexual victimization) among both male and female adolescents (Dong et al., 2013).

Victimization rates varied between the studies: 8% of female adolescents in the study by Bonino et al. (2006) reported having been sexually harassed by peers, and 10%

of the girls reported having been forced to have sex. In the study by Dong et al. (2013), 17% experienced polyvictimization, while 68% of the female adolescents in the study by Bekele et al. (2011) experienced at least one instance of sexual violence throughout their lives.

None of the studies on adolescents' pornography use and their sexual behavior studied mediators (proposition two of the DSMM). As for moderators (proposition three of the DSMM), the available evidence suggests the relation between pornography use and the perpetration of sexual aggression may be stronger among boys than girls (Brown & L'Engle, 2009). By contrast, the association between pornography use and sexual victimization has been demonstrated notably among girls (Bekele et al., 2011; Bonino et al., 2006). The association between pornography use and sexual initiation was stronger among girls than boys (Cheng et al., 2014). This association was also moderated by pubertal maturation: Among those at an early stage of pubertal maturation, pornography use was related to a higher likelihood to initiate sex. Conversely, among those at a later stage of pubertal maturation, it was related to a lower likelihood to do so (Vandenbosch & Eggermont, 2013b). In at least one study the relation between pornography use and casual sex behavior emerged only among female adolescents (Cheng et al., 2014). Transactional relations between pornography use and the occurrence of certain sexual behaviors (proposition four of the DSMM) were investigated only by Vandenbosch and Eggermont (2013b) and Doornwaard, Bickham, et al. (2015), who found no evidence that sexual behavior would affect pornography use.

Conclusion: Pornography Related to Sexual Attitudes and Some Sexual Behaviors, But Causality Unclear

Overall, existing research has produced consistent evidence that adolescents' pornography use is related to their sexual attitudes. Robust evidence has emerged regarding the association between pornography use and stronger permissive sexual attitudes, which was, according to Cohen's (1988) standards, intermediate in the cross-sectional studies. However, adolescents' scores on permissive sexual attitudes were low on average. Consequently, it seems more appropriate to speak of an association between more frequent pornography use and less strict (rather than more permissive) sexual attitudes.

Regarding the relation between pornography use and stronger gender-stereotypical sexual beliefs, evidence seems to demonstrate that adolescents' pornography use is related to less progressive sexual beliefs (which seems the more appropriate wording given the distributions of the variables). However, the size of the relation between more frequent pornography use and more gender-stereotypical sexual beliefs was small. In light of the not entirely consistent research findings and small effect sizes, the relation between pornography use and stronger gender-stereotypical sexual beliefs thus deserves further attention in future studies.

Some studies suggest that the relation between pornography use and both permissive sexual attitudes and gender-stereotypical beliefs is mediated by cognitive and emotional response states. However, cumulative evidence is still missing because the various mediators are conceptually diverse. To date, research has also not yet established consistent evidence of dispositional moderators (e.g., biological sex) of the association between pornography use and both permissive sexual attitudes and gender-stereotypical beliefs. While developmental variables (e.g., age) do not seem to moderate the relation, some preliminary (albeit noncumulative) evidence has emerged that social variables, such as parental communication about sexuality, may play a role. There was not much evidence of transactional effects between adolescents' pornography use and permissive sexual attitudes. However, one study did find transactional effects between pornography use and gender-stereotypical beliefs.

Existing research points to an association between adolescents' pornography use and various concepts related to adolescents' sexual self-development, but cumulative evidence has not yet been established: The majority of findings are based on analyses of the same sample (Peter & Valkenburg, 2008b, 2009b, 2010a), and the concepts studied are still rather diverse. Similarly, conclusions about which response states exactly mediate the relation between pornography use and sexual self-developments are not possible yet: Half of the results were based on the same sample (Peter & Valkenburg, 2008a, 2010a), and evidence of cognitive response states as mediators is still scarce. No consistent evidence emerged about whether the relation between pornography use and sexual self-development was stronger for male or female adolescents. In addition, while one study found that adolescents' sexual experience reduced the strength of the relation between pornography use and sexual self-development, age was not found to moderate it. No evidence of transactional effects emerged.

By and large, the studies we reviewed tended to show that adolescents' pornography use was related to the occurrence of sexual intercourse, more experience with casual sex behavior, and a higher likelihood to engage in sexual aggression as well as to experience it, notably among female adolescents. There was no evidence that more frequent pornography use is associated with greater experience with different sexual practices. In addition, consistent, robust, and cumulative evidence of a relation between pornography use and sexual risk behavior is missing.

Research did not provide any insights into mediators of the relation between adolescents' pornography use and their sexual behavior, nor was there evidence of transactional effects. The relation between pornography use and sexual aggression was stronger for boys, while that between pornography use and sexual victimization was demonstrated mainly for girls. The association between pornography use and sexual initiation was stronger for girls and adolescents at an early pubertal stage. Girls also showed a stronger relation between pornography use and casual sex behavior

in one study. Generally, however, our knowledge about moderators of the association between pornography use and sexual behavior is still diverse and lacks a cumulative character.

Conclusions about adolescents' pornography use and their sexual behavior should be seen in light of the following caveats: First, effect sizes for the relationship between pornography use and the occurrence of sexual intercourse as well as experience with casual sex behavior were small and intermediate, respectively. However, the calculation of the effect sizes was based on only a few studies that provided the necessary statistics. The effect sizes thus present only rough, incomplete first approximations. Second, on average adolescents did not engage frequently in sexual intercourse or casual sexual behavior. This means that adolescents' pornography use was associated with a low rate of these behaviors rather than with their massive occurrence. Third, both the figures for the perpetration of sexual aggression and for sexual victimization varied considerably among the studies. Future research needs to systematically work on comparable conceptual and operational definitions of sexual aggression and sexual victimization. Fourth, while all associations found between adolescents' pornography use and sexual behavior would benefit from a more systematic approach to the conceptual and operational definition of pornography use, this is particularly necessary for the relation between pornography and sexual aggression. The measures used to study this association were relatively diverse, and we need to know better which characteristics of pornography are related to sexual aggression, and which are not, to explain this association more thoroughly. Similarly, we need to know more about the processes that underlie the relation between pornography and sexual victimization to understand better why this relation has been found in the literature.

Comparison With Findings from Qualitative Research

Several of the research foci of quantitative research on adolescents' use of pornography have also been addressed in qualitative research on the issue. For example, similar to quantitative research, qualitative research has shown that adolescents use pornography both accidentally and intentionally (Cameron et al., 2005; Lofgren-Mårtenson & Månsson, 2010). Similarly, there is consistent evidence in qualitative research that male adolescents use pornography more frequently than female adolescents do (Cameron et al., 2005; Lofgren-Mårtenson & Månsson, 2010). Qualitative research, in addition, has yielded reasons for this sex difference in pornography use. Compared to girls, boys use pornography more often out of curiosity, for sexual arousal (Abiala & Hernwall, 2013; Arrington-Sanders et al., 2015; Cameron et al., 2005; Lofgren-Mårtenson & Månsson, 2010), and for entertainment (Rothman et al., 2015). Boys also seem to use pornography more frequently for what Lofgren-Mårtenson and Månsson (2010) have called "social

intercourse," the watching of pornography together with other boys. Although boys are generally critical of pornography, girls are more repelled by pornography: They often find it dumb and gross (Cameron et al., 2005) and approach it from a negative point of view (Abiala & Hernwall, 2013; Lofgren-Mårtenson & Månsson, 2010).

While qualitative research did not provide more information on other predictors (e.g., developmental or social) of pornography use, it did shed light on two issues that quantitative studies have neglected to date. First, it more elaborately pointed to the functions of pornography use for nonheterosexual adolescents. For example, a recent U.S. study has found that same-sex-attracted Black adolescents used pornography in particular to explore their own sexual identity and to determine their readiness for sex (Arrington-Sanders et al., 2015). Second, qualitative research has studied the specific content of pornography that adolescents choose. For example, urban, low-income, Black and Hispanic adolescents most often watched pornography that portrayed heterosexual intercourse, but they also got in contact with more extreme forms of pornography, such as public humiliation, bestiality, bondage, and bukkake (Rothman et al., 2015).

Qualitative studies have also addressed the relation between pornography use and gender-stereotypical sexual beliefs. Two Swedish studies, for example, showed that both male and female adolescents were critical of the unequal depiction of men and women in pornography (Lofgren-Mårtenson & Månsson, 2010), with men being stereotypically presented as dominant and women as subordinate (Mattebo et al., 2012). At first sight, these results seem to be at odds with the finding from quantitative studies that pornography use is related to stronger gender-stereotypical sexual beliefs (Brown & L'Engle, 2009; Peter & Valkenburg, 2007, 2009a; To et al., 2012). However, in all quantitative studies, adolescents held, on average, rather progressive beliefs about gender roles. More frequent use of pornography may thus be related to gender-stereotypical beliefs in the sense that it weakens progressive beliefs about gender, at least when adolescents learn to like the material (Peter & Valkenburg, 2009a). Still, an important question for future research will be whether critical attitudes toward gender relations in pornography may moderate the relation between pornography use and gender-stereotypical sexual beliefs.

Regarding adolescents' sexual self-development, qualitative studies pointed to some ambivalence in how adolescents approach pornography (Lofgren-Mårtenson & Månsson, 2010; Mattebo et al., 2012). Female adolescents reported both sexual arousal and agony, and male adolescents described both positive and negative feelings to pornography (Mattebo et al., 2012). This ambivalence tentatively corresponds with the sexual uncertainty that has been linked to pornography use in quantitative studies (Peter & Valkenburg, 2008b, 2010a). The ambivalence that adolescents feel when confronted with pornography may

translate into uncertainty about what they feel and want sexually. There was no further overlap between quantitative and qualitative studies in other aspects of adolescents' sexual self-development. However, some qualitative studies found that, while female adolescents, in particular, criticized the unattainable body ideals featured in pornography (Mattebo et al., 2012), they also admitted being influenced by these ideals (Lofgren-Mårtenson & Månsson, 2010), considered them a source of sexual information (Kinsman et al., 2000), and more generally felt pressured by sexual messages in pornography (Mattebo et al., 2012).

Regarding the relation between pornography use and sexual behavior, recent qualitative studies tentatively showed that adolescents may learn sexual performance scripts or sexual practices from pornography (Lavoie et al., 2000; Marston & Lewis, 2014), with some adolescents imitating what they see in pornography (Arrington-Sanders et al., 2015; Rothman et al., 2015). These findings suggest some relation between pornography use and sexual behavior, as demonstrated by quantitative studies (e.g., Brown & L'Engle, 2009; Vandenbosch & Eggermont, 2013b), and also point to the pornographic script as a frame of reference for sexual performances (Lofgren-Mårtenson & Månsson, 2010). Specifically, some adolescents seem to use pornography as a "manual for sex" (Arrington-Sanders et al., 2015), for example, to learn about sexual organs, sexual positions, sexual roles, and the performance of particular sexual techniques, as well as how to behave during sex (Arrington-Sanders et al., 2015; Rothman et al., 2015). In a Canadian study, adolescent girls also pointed out that boys may learn sexual aggression from pornography, with which some boys seemed to agree (Lavoie et al., 2000). While participants in Swedish research emphasized that they were able to distinguish between pornographic fiction and sexual reality, they also sometimes considered pornography a reliable source of information (Lofgren-Mårtenson & Månsson, 2010).

These findings dovetail with quantitative research that has shown the perceived realism (Peter & Valkenburg, 2006b), and notably the perceived utility of pornography as a source of sexual information (Peter & Valkenburg, 2010b), can explain why pornography use is related to permissive sexual attitudes. In these quantitative studies, adolescents on average did not perceive pornography as realistic. More frequent pornography use, however, made them perceive this material as "less unrealistic," which in turn was related to more permissive sexual attitudes. To deepen our understanding of the role of pornography as source of sexual information, future research will have to deal with the conditions under which specific types of adolescents use pornography to learn about sex and sexuality.

In sum, while quantitative and qualitative research on adolescents and pornography differ in the particular research foci chosen, their results are more often consistent or complementary than contradictory. In several cases, the comparison of findings from quantitative and qualitative research also raises

crucial questions for future research. Of central importance will be to identify the situations in which relations between pornography use and sexual attitudes, self-development, and behavior are bigger or smaller, as well as the types of adolescents for whom these relations are more or less distinct.

Critical Evaluation of Results

Our review of the past 20 years of research on adolescents and pornography has shown that adolescents use pornography although prevalence rates vary greatly. The most frequent adolescent users of pornography are male, sensation-seeking adolescents at a more advanced pubertal stage with weak or troubled family relations. Pornography use is associated with more permissive sexual attitudes and stronger gender-stereotypical sexual beliefs. Adolescents' pornography use is also related to the occurrence of sexual intercourse, greater experience with casual sex behavior, and more sexual aggression, both in terms of perpetration and victimization. In contrast to an earlier review of the topic (Owens et al., 2012), our review thus suggests that, by now, some more cumulative evidence is building up about the predictors of adolescents' use of pornography and its relation with sexual attitudes and sexual behavior. However, this evidence is still preliminary, as it needs to be interpreted in the context of at least four shortcomings and four more general biases in the literature.

Shortcomings

The first shortcoming in the literature on adolescents and pornography refers to the operationalization of pornography use. As evident from Table 1, researchers have operationalized pornography use in many different ways, which makes the findings difficult to compare. Operationalizations vary, for example, in the types of use (i.e., intentional, unintentional, any use); the time frame for which use is assessed (e.g., past 30 days, past six months, past year, ever); whether the focus is on Internet-based pornography or other types; and whether *Playboy*-type nudity is included in the assessment of pornography use next to more explicit material (e.g., Lo et al., 1999; Van Ouytsel et al., 2014; Ybarra et al., 2011). We therefore need homogeneous, validated measures of pornography use. Ideally, such measures are standardized, but given the diversity in cultural standards of pornography and sexuality, much is gained already when the measures compare across different cultures. In this context, it will also be important to take into account adolescents' increasing use of mobile Internet access.

When designing and validating such measures it will be crucial to try to assess also what pornographic content adolescents are exposed to when they use pornography. Owens et al. (2012) have already pointed out that we know nearly nothing about the content adolescents actually encounter when using pornography. Several years later, we observe this issue is still not resolved. Currently, we know

from only one qualitative study that adolescents use mainstream pornography as well as more extreme types of pornography (Rothman et al., 2015). Ybarra et al.'s (2011) study, however, suggested this distinction is important: Sexual aggression was related only to watching violent pornography but not to watching mainstream pornography. Only with a closer investigation of the pornographic content that adolescents use can we truly understand why adolescents are attracted to, or repelled by, pornography and how it relates to their sexual attitudes, self-development, and behavior.

A second shortcoming refers to the high number of cross-sectional designs in the field. While, overall, quantitative research seems reasonably solid in terms of survey mode and administration as well as sampling and response rates, the dominance of cross-sectional designs precludes causal claims about the relations between pornography use and sexual attitudes, self-development, and behavior. Although the increasing number of longitudinal designs adds methodological rigor to the literature, such designs do not solve this problem. Not only do we lack supporting evidence from experimental studies, but we also need to pay systematic attention to control variables in the statistical analysis because in longitudinal designs spurious associations are also possible due to the correlational nature of the research. The majority of longitudinal studies do include autoregressive effects and some studies include additional control variables (see, however, a recent critique of autoregressive effects in Hamaker, Kuiper, & Grasman, 2015). By and large, however, the use of control variables seems to be guided by study-specific considerations and availability of variables rather than by overarching theoretical and empirical rationales. Moreover, only a few studies to date have considered important distal variables, such as sexual interest/drive and pubertal maturation, as control variables. Biological variables, such as testosterone or cortisol levels, also have rarely been studied. In the light of these important caveats, it seems premature to interpret the relations established in this review in the sense that pornography use causes changes in sexual attitudes, self-development, and behavior.

A third important shortcoming in current research that hampers a deeper understanding of adolescents' pornography use and its ramifications is the lack of a more advanced overarching theoretical perspective. We organized the literature along propositions of a recent integrative model from media effects research, the DSMM (Valkenburg & Peter, 2013). With this model, we tried to systematize both predictors of pornography use, as well as underlying processes and moderators of the associations of pornography use and transactional relations. In line with the first proposition of the DSMM, we identified various dispositional, developmental, and social predictors of pornography use. However, evidence of the underlying processes (second proposition of the DSMM) and moderators of the associations of pornography use (third proposition of the DSMM) and notably of transactional relations (fourth proposition of

the DSMM) remained scarce and, if available, inconsistent. Research did provide some first insights into cognitive, emotional, and excitative response states that mediate the relationship between pornography use and permissive attitudes, gender-stereotypical sexual beliefs, and sexual self-development. However, we are missing cumulative knowledge about these response states from multiple studies or replications, done in different cultural contexts and by different researchers to get a sense of the validity and reliability of the existing results. The studies on dispositional, developmental, and social moderators of the relations of pornography use currently form a patchwork of haphazardly selected moderators with inconsistent results rather than a systematic research program. Finally, research has paid little attention to transactional relations between pornography use and criterion variables. Studies devote elaborate attention to the influence of pornography use on sexual attitudes, sexual self-development, and behavior, but much less to the equally important and theoretically justified question of whether sexual attitudes, sexual self-development, and behavior may be related to pornography use in a transactional way.

The lack of a more advanced theoretical perspective in current research along with a lack of pertinent results has several troublesome consequences. After 20 years of research, we still know little about why pornography use is associated with, for example, sexual attitudes and behavior. However, without knowing why pornography use is associated with other variables, we are unable to counteract undesirable associations and stimulate desirable ones. Moreover, we also do not know for which types of adolescents the associations of pornography use are the strongest—and for which types of adolescents they are weak or nonexistent. As the comparison of quantitative and qualitative research findings has shown, some of the most important emerging research questions center on the issue of who is resilient to messages in pornography and who is susceptible. Finally, we lack evidence of whether the ramifications of pornography use can be conceptualized as a multidirectional, cyclical process (i.e., transactional) rather than as a unidirectional and unilinear one. Many public debates about adolescents' use of pornography tend to rely on a simplistic monkey-see-monkey-do notion of how adolescents deal with pornography and how it affects them. To inform such debates, knowledge about transactional relations of pornography use is needed.

A fourth shortcoming lies in the absence of a genuine developmental perspective. With pubertal maturation, this review identified a developmental predictor of adolescents' pornography use. Two studies pointed to the moderating role of pubertal maturation (Vandenbosch & Eggermont, 2013b) and sexual experience (Peter & Valkenburg, 2009b) in the ramifications of adolescents' use of pornography. Still, we hardly understand what pornography use means to adolescents in the context of the enormous cognitive, emotional, and social changes young people experience during adolescence.

In this context, it also seems important to compare adolescents' and adults' use of pornography and its implications for the two groups. The scarce existing research suggests that adults and adolescents do not differ in their use of Internet pornography (Peter & Valkenburg, 2011d). However, associations between pornography use and risky sexual behavior as well as a specific stereotypical gender belief (token resistance) have been found among adults but not among adolescents (Peter & Valkenburg, 2011b, 2011c). At the same time, the results on the association between adolescents' pornography use and permissive sexual attitudes dovetail with recent survey-based research on adults' use of pornography (e.g., Wright, 2013, 2014a). It is thus currently unclear whether pornography use has similar or different implications for adolescents and adults. Systematic comparisons between adolescents and adults may therefore improve a developmental understanding not only of pornography use in adolescence but also across the life span.

Biases

In addition to the more specific shortcomings in the current literature on adolescents and pornography, there are four general biases in large parts of the research (see also Peter, 2013). First, research suffers from a cultural bias. More than two-thirds of the articles we reviewed came from Europe, North America, or Australia. Moreover, 63% of the articles originated in only a handful of countries (i.e., the Netherlands, the United States, Sweden, Hong Kong/China, and Belgium). Although five of the articles we reviewed dealt with African countries, we do not have the same knowledge about Africa as we have about Europe, Northern America, and some Asian countries, notably Hong Kong/China and Taiwan. We still know nothing about adolescents and pornography in Central and South America, several Asian countries, Russia, and the Middle East (except Israel).

The results of this review may also be biased by cultural differences in adolescents' sexual and gender socialization in the countries that dominate the research on adolescents' pornography use. The Netherlands and Sweden, for example, are characterized by liberal approaches to adolescent sexuality and pornography. Relatively strong input from these two countries in the overall results of this review may thus preclude generalizing our findings to sexually more conservative countries. We therefore need knowledge from more and more diverse countries, and preferably from cross-nationally comparative research, to understand the cultural contingencies of adolescents' use of pornography.

Second, current research suffers from a heteronormativity bias. With one exception (Arrington-Sanders et al., 2015), all studies have at least implicitly focused on heterosexual pornography and, consequently, investigated issues that often presuppose opposite-sex relations. Although some studies have found that bisexual and gay male adolescents use pornography more often than heterosexual male adolescents (Luder et al., 2011; Peter & Valkenburg, 2011d), our

knowledge about the functions, meanings, and implications of pornography use among gay, lesbian, and bisexual adolescents is restricted. Based on the findings by Arrington-Sanders et al. (2015), however, many implicitly heteronormative assumptions of current research may be revealed by studying nonheterosexual adolescents.

Third, the research we reviewed tends to have a negativity bias, focusing primarily on risks and dangers of adolescents' pornography use rather than on opportunities and potential positive implications of pornography use, such as sexual pleasure (e.g., Tsaliki, 2011). The focus of research on negative implications of pornography use may be justified by theoretical considerations and addresses culturally based public concerns. However, to get an encompassing notion of what adolescents' pornography use entails, it seems necessary to ask also whether pornography use can be associated, for example, with greater sexual knowledge (for an exception, see To et al., 2012), sexual self-efficacy, or sexual self-esteem. Such questions may also help question the implicit assumption in much current research that adolescents are generally vulnerable to messages in pornography. Not only does the assumption of vulnerable adolescents deny them agency and critical skills (Buckingham & Bragg, 2004), it also seems at odds with recent studies that compared adolescents with adults and found associations between pornography use and gender-stereotypical beliefs as well as sexual risk behavior only among adults (Peter & Valkenburg, 2011b, 2011c).

Fourth, current research on adolescents' use of pornography is biased toward the status quo. Many studies tend to overlook that the transformation of adolescent sexuality is part of larger social and cultural changes, for example, the informalization of personal and sexual relationships and the individualization of sexual choice, at least in many Western countries. Adolescent sexuality is thus no longer fully controlled by traditional authorities but is, at least partly, a question of personal taste and pleasure (Attwood & Smith, 2011). In this view, the associations found between pornography use and permissive attitudes, sexual uncertainty, the occurrence and frequency of sexual behavior, and experience with casual sex may (also) be understood as part of larger sociocultural changes.

Future Research

From the various shortcomings in the literature, several requirements for future research can be derived. First, more longitudinal studies are needed, accompanied by a systematic, theoretically and empirically grounded treatment of control variables. In this context, it may also be useful to think about longitudinal panel studies spanning several years to track developments in adolescents' pornography use and pertinent attitudes, self-development, and behavior. Ideally, longitudinal studies should be linked with experimental research among young adults to tackle causal questions. In addition, it seems prudent to avoid studies using

convenience samples and accept research based on such samples only if it can be shown that they do not bias the results.

Second, the field needs to commit itself to theory building and testing. Several studies rely on theoretical ad hoc reasoning and empirical regularities rather than on established theories as a rationale for their research. Future researchers, therefore, need to try to test unifying theoretical frameworks that guide research and reduce and systematize the myriad concepts currently being studied. In this review, we offered one integrative model, the DSMM (Valkenburg & Peter, 2013), which has been used in recent studies (Beyens et al., 2015; Vanden Abeele et al., 2014) and may be able to guide future research. However, other frameworks, such as the media practice model (Steele & Brown, 1995), the sexual behavior sequence (Byrne, 1976; Fisher, 1986), or the 3A model (Wright, 2014b), are also suitable.

Third, research needs to pay more attention to the content in pornography that adolescents use. We need to know the prevalence and predictors of the use of particular pornographic content similar to what we now know about the use of pornography in general. In this context, it may also be important to study to what extent and how preferences for different pornographic content develop.

Fourth, given the enormous developmental changes in adolescence, future research needs to pursue a developmental perspective on adolescents' use of pornography. Comparisons with other age groups, such as (young) adults may greatly advance our knowledge about whether adolescents' pornography use and its implications may be specific for this age group or apply to other age groups as well.

Fifth, we need to de-Westernize research on adolescents and pornography more strongly than is currently the case. As outlined, our current knowledge is biased toward rich Western or Westernized countries. While in several countries in this world pornography is illegal and extremely difficult to study, if not impossible, we believe a more diverse look at adolescents and pornography will challenge and enrich what we currently know about the topic.

Sixth, researchers should devote more attention to the use of pornography among gay, lesbian, and bisexual adolescents, similar to research done among adults (e.g., Duggan & McCreary, 2004; Traeen, Nilsen, & Stigum, 2006). As Arrington-Sanders et al. (2015) have suggested, the availability of sexual information, the knowledge about sexual scripts, and the confidence about one's sexual identity may differ for same-sex-attracted adolescents, which in turn may affect how they use pornography.

Seventh, the field needs to become more open to questions about positive implications of adolescents' use of pornography, notably sexual pleasure, and address more strongly notions of differential susceptibility as well as resilience to pornography. Only with such a more encompassing view of adolescents' use of pornography can we achieve a more nuanced understanding of what pornography means to adolescents.

Eighth and finally, at least at a theoretical level, we need to learn to put adolescents' use of pornography in the context of larger social and cultural developments. Many debates about adolescents and pornography may benefit from considering adolescents' use of pornography as a part of bigger developments rather than as a singular phenomenon of its own.

In conclusion, research on adolescents and pornography has progressed considerably in the past 20 years, particularly at the empirical level. In our view, however, future research needs to address at least the aforementioned eight requirements to put our knowledge about adolescents and pornography at an empirically rigorous, theoretically advanced, and intellectually unbiased and open-minded basis. We believe this endeavor is necessary not only to advance the academic debate about pornography and adolescents but also to be able to inform the public soundly.

Supplemental Material

Supplementary data for this article can be found by accessing the publisher's [Web site](#).

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