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Relationships between Exposure to Online Pornography, Psychological Well-Being and Sexual Permissiveness among Hong Kong Chinese Adolescents: a Three-Wave Longitudinal Study

Cecilia M. S. Ma[1] (ID)

Abstract With the increased accessibility to the Internet, adolescents can access the online pornography intentionally and accidentally. The purposes of this study were (a) to examine the relationships of exposure to online pornography to subsequent psychological well-being (depression and life satisfaction) and sexual permissive attitudes and (b) to explore whether these relationships differ by the nature of exposure. A sample of 1401 early Chinese adolescents participated a three-wave longitudinal study. Results from the cross-lagged models suggested that the effects of online pornography differ by the nature of exposure. The present study sheds light on the dynamic relationships between exposure to online pornography, depression, life satisfaction and permissiveness sexual attitudes.

Keywords Online pornography · Depression · Life satisfaction · Chinese adolescents · Sexual permissive attitudes

Introduction

With the advancement of mobile network technologies, adolescents can now access the Internet almost anywhere. In 2017, there were over 3850 million Internet users in the world, of which almost 50% were located in Asia (Internet Live Stats 2018). China has the highest number of internet users (over 730 million) in the world, twice the number in the U.S.A. (287 million), which was ranked third in 2017 (Statista 2018). Internet use

✉ Cecilia M. S. Ma
  cecilia.ma@polyu.edu.hk

1   Department of Applied Social Sciences, The Hong Kong Polytechnic University, HJ431,
    Hunghom, Kowloon, Hong Kong

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among adolescents has also increased at an alarming rate. In Hong Kong, nearly every adolescent (99.9%) aged 10–14 years has used the Internet in the past twelve months (Hong Kong Census and Statistics Department 2017). Around 78% of the adolescents (aged 10–14) own smartphones and on average, each child spends around 24 h per week on the Internet (Hong Kong Census and Statistics Department 2017), which is higher than the rates in North America (9–13 h) and Europe (7–11 h) (World Internet Project 2015). The increased accessibility to the Internet has raised concerns about the vulnerability of adolescents, especially in relation to the online sexual material (e.g., viewing pornography).

The potential effects of pornography among adolescents have been well documented. Research suggests that exposure to pornography is linked to decreased satisfaction with life (Peter and Valkenburg 2006), higher depressive symptoms (Ma et al. 2018), more permissive sexual attitude (Braun-Courville and Rojas 2009; Lo and Wei 2006), greater sexual uncertainty (Peter and Valkenburg 2008), recreational attitudes toward sex (Häggström-Nordin et al. 2005), and early initiation of sexual activity (Arulogun et al. 2016). However, the impact of this exposure may vary depending on the viewers' motives when using online pornography (Ward 2003). On one hand, adolescents use online pornography to satisfy their sexual interest. One other hand, some may encounter this online material accidentally through pop-up advisements or spam emails (Wolak et al. 2007). They may come into contact with online sexual content unexpectedly when using online communications or when visiting social network sites (van Oosten et al. 2015).

According to Peter and Valkenburg (2006), intentional exposure refers to the deliberate, actively sought, and conscious use of pornography, whereas non-intentional exposure refers to accidental or unexpected encounters with pornography. Mitchell et al. (2003) conducted the first study on the impact of non-intentional exposure to online pornography. Using a nationally representative sample, they found that about 73% of American adolescents (aged 10–17) were non-intentionally exposed to pornographic materials when using the Internet (Mitchell et al. 2003). Similarly, using a sample of Australian adolescents (aged 16–17), Flood (2007) found that 60% of girls and 84% of boys were non-intentionally exposed to online pornography. About 31% of British adolescents (aged 9–19) reported that they had been non-intentionally exposed to the online pornographic material (Livingstone and Bober 2004). Using a representative sample of 1500 American adolescents (aged 10–17), (Wolak et al. 2007) found that 6% of the participants felt discomfort when they were non-intentionally exposed to the pornographic material.

The prevalence rates of intentional exposure vary across studies. Ybarra and Mitchell (2005) found that around 8% of American adolescents (aged 10–13) were intentionally exposed to online pornography. Chen et al. (2013) found that 58.7% of Taiwanese adolescents (aged 15–18) were intentionally exposed to online pornography as opposed to non-intentional exposure (41.3%). However, Ma et al. (2016) reported lower prevalence of intentional exposure among Hong Kong Chinese youth, with only about 10% of the adolescents (aged 11–16) having been intentionally exposed to online pornography. Existing studies have mainly focused on the prevalence of these two types of exposure (e.g., Chen et al. 2013; Flood 2007; Ma et al. 2016; Mitchell et al. 2003). Little is known how adolescents handle both intentional and non-intentional exposure to online pornography on psychological and cognitive levels. The present

study will extend the past research by how the relationships between adolescents' online pornography use and psychological well-being differ according to the nature of the exposure.

Today, adolescents can easily use the ubiquitous broadband networks to access pornographic material. However, relatively little research has examined the effects of the exposure to online pornography in non-Western cultures. Most of the research on the impact of the exposure to pornographic material has been conducted in Western cultures, in which individuals tend to have open and liberal views toward sex (Peter and Valkenburg 2016; Schalet 2011). In contrast, under the influence of Confucius, Chinese adolescents living in traditionally Confucian societies tend to consider sex as a taboo and seldom discuss it in school or within the family (To and Chu 2009). Given the anonymity afforded by the Internet, Chinese adolescents are thus more likely to use online pornography to satisfy their sexual interests and to explore their sexual identity than their Western counterparts.

Chinese adolescents have been reported having a higher prevalence of intentional exposure to online pornography (58.7% among Taiwan Chinese adolescents, Chen et al. 2013; 10% among Hong Kong Chinese adolescents, Ma et al. 2016) than American adolescents (8%, Ybarra and Mitchell 2005). Moreover, studies conducted in Hong Kong and other Asian cities have mostly focused on how this exposure are related to demographic and family characteristics (e.g., Lou et al. 2012; Ma and Shek 2013; Shek and Ma 2016; Tom et al. 2012; Tu et al. 2012). What is not known is the long-term impact of the intentional and non-intentional exposure to online pornography on adolescents' developmental outcomes. The proposed study will attempt to add the literature by exploring the longitudinal effects of the exposure to online pornography in a Chinese context.

The goal of this study was to examine the relationships of exposure to online pornography to subsequent psychological well-being and sexual permissive attitudes. In addition, the present study also explored whether these relationships differ by the nature of exposure. By using the three-wave data cross-lagged panel design, two research questions are "How different types of exposure affect adolescents' psychological well-being over time", "How permissiveness is related to adolescents' exposure to online pornography over time". Based on the literature, it was hypothesized that intentional exposure to online pornography will have a positive longitudinal effect on depression (Hypothesis 1a) and a negative longitudinal effect on life satisfaction (Hypothesis 1b). Similarly, non-intentional exposure to online pornography will have a positive longitudinal effect on depression (Hypothesis 2a) and a negative longitudinal effect on life satisfaction (Hypothesis 2b). Lastly, it was hypothesized that permissive sexual attitude will have a positive longitudinal effect on intentional (Hypothesis 3a) and non-intentional exposure to online pornography exposure (Hypothesis 3b).

Methods

A sample of 1401 participants, comprising 758 boys (54.1%) from Grades 7, was followed up across three waves with 12-month intervals between waves. The first wave was conducted in spring 2015. Students were recruited from 13 secondary schools. The average age at Wave 1 was 12.43 years (SD = .70). At Wave 2 and Wave 3, the number

of participants were 1368 (98%) and 1384 (99%), respectively. Of these, 1091 students (78%) participated in all three measurement points and were included in this analysis. Missing data was random (i.e., not associated with demographic characteristics, type of exposure to online pornography, depression, life satisfaction). The procedures of data collection were identical in all waves. Parental consent and adolescents' informed consents were obtained prior the administration of the survey. Ethical approval was received from the author's Institutional Review Board.

Intentional and Non-intentional Exposure to Online Pornography

Adolescents' intentional exposure to online pornography was measured with 6 items, which focused on the frequency of intentional exposure to a) online pornographic stories, b) pornographic pictures, c) pornographic videos, d) pornographic advertisement, e) pornographic websites, and f) online sex chat (e.g., "*How often you were intentionally exposed to online pornographic stories over the past six months*"). Same questions were asked for non-intentional exposure to online pornographic materials. Response options were 0 = never, 1 = at least once a month, 2 = 1–3 times a month, 3 = at least once a week, 4 = several times a week, 5 = everyday. All six items were averaged to create a scale (mean score), with higher scores indicating higher exposure to online pornography. Cronbach's alpha of the two scales was acceptable across waves (intentional: Waves 1–3: α = .78–.90; non-intentional: Waves 1–3: α = .83–.92) (Table 1).

Depression

Depression was measured by Patient Health Questionnaire-9 (PHQ-9, Kroenke et al. 2001). Participants indicated their depressive symptoms on a four-point scale, with 0 = not at all, 1 = several days, 2 = more than half the days, 3 = nearly every day. All nine items were averaged to create a mean score, higher scores indicating higher depressive symptoms (e.g., "*Feeling tired or having little energy*"). Cronbach's alpha of the scale was satisfactory (Wave 1 = .90, Wave 2 = .91, Wave 3 = .91).

Life Satisfaction

Life satisfaction was measured using five-item Satisfaction with Life Scale (Diener et al. 1985). The items were rated on a 6-point scale, (1 = strongly disagree to 6 = strongly agree). A higher score indicates more satisfied with their life (e.g., "*I am satisfied with my life*"). Cronbach's alpha for the scale was .84 in Wave 1 .85 in Wave 2 and .87 in Wave 3.

Permissive Sexual Attitude

Adolescents' permissive sexual attitude was measured using the five-items developed by Sprecher (1989). The items were rated on a 6-point scale (1 = strongly disagree to 6 = strongly agree). Higher scores on this scale indicated a more permissive attitude towards sex (e.g., "*I believe that sexual intercourse is*

Table 1 Descriptive statistics and correlation coefficients among all study variables

	M (SD)	α	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
1. ITE (Wave 1)	.13 (.34)	.78	—														
2. ITE (Wave 2)	.22 (.54)	.90	.34**	—													
3. ITE (Wave 3)	.30 (.62)	.90	.16**	.33**	—												
4. Non-ITE (Wave 1)	.06 (.28)	.83	.54**	.16**	.15**	—											
5. Non-ITE (Wave 2)	.17 (.56)	.92	.29**	.64**	.26**	.22**	—										
6. Non-ITE (Wave 3)	.26 (.67)	.91	.24**	.34**	.66**	.24**	.44**	—									
7. DE (Wave 1)	1.10 (.79)	.90	.15**	.07**	.09**	.13**	.06*	.09**	—								
8. DE (Wave 2)	1.16 (.80)	.91	.07*	.15**	.12**	.03	.13**	.08**	.42**	—							
9. DE (Wave 3)	1.30 (.80)	.91	.07*	.18**	.20**	.00	.09**	.14**	.36**	.47**	—						
10. LS (Wave 1)	2.87 (1.19)	.84	-.08**	-.10**	-.10**	-.03	-.09**	-.10**	-.36**	-.29**	-.22**	—					
11. LS (Wave 2)	2.84 (1.14)	.85	-.08**	-.12**	-.10**	-.01	-.13**	-.10**	-.26**	-.42**	-.31**	.52**	—				
12. LS (Wave 3)	2.76 (1.14)	.87	-.02	-.09**	-.06*	.03	-.07*	-.04	-.21**	-.31**	-.36**	.43**	.59**	—			
13. PSA (Wave 1)	2.44 (1.06)	.80	.23**	.14**	.14**	.15**	.15**	.15**	.20**	.07*	.13**	-.03	-.04	-.01	—		
14. PSA (Wave 2)	2.58 (1.08)	.83	.14**	.24**	.21**	.09**	.21**	.21**	.13**	.14**	.15**	-.10**	-.11**	-.06	.48**	—	
15. PSA (Wave 3)	2.72 (1.10)	.83	.15**	.16**	.30**	.12	.14**	.32**	.12**	.12**	.16**	-.06*	-.06*	-.09**	.37**	.51	—

ITE Intentional exposure, *DE* Depression, *LS* Life satisfaction, *PSA* Permissive sexual attitudes

* $p < .05$; ** $p < .01$

acceptable on a first date"). Cronbach's alphas were .80, .83 and .83 at Wave 1, Wave 2 and Wave 3, respectively.

Control Variables

Demographic variables, including initial age (age at Wave 1), gender (male = 0; female = 1), religiosity (yes = 0; no = 1), socio-economic status (received financial aids = 0; did not received financial aids = 1), and parents' marital status (two-parent families = 0; one-parent families = 1) were included in the model as covariates.

Data Analysis

A path analysis was employed to analyze the three-wave cross-lagged panel data (Kessler and Greenberg 1981). This method allows for assessing potential reciprocal effects among exposure to online pornography, psychological well-being, and sexual permissiveness (Selig and Little 2012). This study examined the effects of the exposure to online pornography on well-being and sexual permissiveness, while investigated the potential effect of psychological well-being and sexual permissiveness on exposure to online pornography. Demographic characteristics, including initial age, gender, religiosity, parents' marital status, and socio-economic status, were included as control variables. All hypothesized models were estimated for intentional and non-intentional exposure to online pornography separately. Only cases with no missing data were included in the path analysis, therefore resulting in a sample of 975 adolescents.

Models were evaluated based on the Comparative Fit Index (CFI), the Root Mean Square Error of Approximation (RMSEA) and the Standardized Root Mean Square Residual (SRMR). CFIs greater than .90 (Byrne 1990), the RMSEAs less than .08 (Browne and Cudeck 1992) and the SRMRs smaller than .08 (Hu and Bentler 1999) were considered as evidence of an acceptable model fit. A Robust Maximum Likelihood estimator (MLM, Satorra and Bentler 1994) was used to cope with the non-normality of the data. The Satorra-Bentler Scaled Chi-Square (ΔS-Bχ^2) difference test was employed to evaluate which model fit the data better (Satorra and Bentler 2001).

Results

Preliminary Analyses

Table 1 displays the descriptive statistics, internal consistency and correlations for all variables across three waves. The means of all variables, except life satisfaction, increased over time. Significant gender differences were found on all variables ($p < .05$), except on depression at Wave 1 ($p > .05$) and life satisfaction (Waves 1–3). In general, males reported more intentionally and non-intentionally exposure to online pornography, more depressive symptoms and higher permissive sexual attitudes than females. Significant differences in parents' marital status were found in both types of exposure to online pornography (Wave 3) and life satisfaction (Waves 1–3). No significant differences in religiosity and socio-economic status were found ($p > .05$). Details can be found in Table 2.

Table 2 Mean differences of all study variables by gender, religiosity and socio-economic status and parents' marital status

	Male	Female	t	Religious (Yes)	Religious (No)	t	SES (yes)	SES (no)	t	Two-parent families	One-parent families	t
1. ITE (Wave 1)	.158 (.41)	.10 (.25)	2.78**	.09 (.26)	.13 (.34)	−1.66	.17 (.37)	.11 (.31)	1.51	.12 (.32)	.16 (.42)	−1.53
2. ITE (Wave 2)	.27 (.65)	.18 (.38)	2.67**	.20 (.45)	.22 (.62)	−.62	.27 (.50)	.22 (.56)	.83	.22 (.53)	.26 (.58)	−.95
3. ITE (Wave 3)	.35 (.67)	.25 (.57)	2.38*	.29 (.63)	.28 (.68)	.08	.32 (.60)	.29 (.66)	.45	.28 (.60)	.40 (.73)	−2.42*
4. Non-ITE (Wave 1)	.08 (.35)	.04 (.17)	2.09*	.04 (.21)	.06 (.26)	−.97	.07 (.22)	.05 (.24)	.70	.06 (.29)	.07 (.24)	−.59
5. Non-ITE (Wave 2)	.25 (.72)	.09 (.30)	4.51**	.14 (.43)	.18 (.63)	−.82	.13 (.35)	.18 (.58)	−.79	.15 (.51)	.25 (.73)	−2.24*
6. Non-ITE (Wave 3)	.38 (.84)	.13 (.39)	6.09**	.26 (.70)	.26 (.72)	−.11	.19 (.45)	.26 (.71)	−.84	.24 (.67)	.34 (.72)	−1.79
7. DE (Wave 1)	1.07 (.83)	1.13 (.75)	−1.13	1.02 (.78)	1.12 (.82)	−1.57	1.22 (.80)	1.09 (.81)	1.46	1.08 (.79)	1.24 (.86)	−1.39
8. DE (Wave 2)	1.06 (.81)	1.26 (.78)	−3.83**	1.18 (.85)	1.14 (.79)	.67	1.32 (.82)	1.15 (.80)	1.81	1.13 (.78)	1.24 (.86)	−1.77
9. DE (Wave 3)	1.23 (.82)	1.37 (.79)	−2.72**	1.29 (.81)	1.26 (.78)	.44	1.41 (.78)	1.30 (.80)	1.16	1.29 (.78)	1.36 (.87)	−1.11
10. LS (Wave 1)	2.88 (1.21)	2.86 (1.18)	.19	2.94 (1.21)	2.93 (1.19)	.16	2.64 (1.30)	2.88 (1.20)	−1.72	2.93 (1.19)	2.63 (1.19)	3.16**
11. LS (Wave 2)	2.87 (1.15)	2.80 (1.13)	.95	2.78 (1.17)	2.92 (1.13)	−1.46	2.70 (1.15)	2.84 (1.15)	−1.01	2.91 (1.12)	2.55 (1.14)	4.03**
12. LS (Wave 3)	2.83 (1.20)	2.70 (1.06)	1.79	2.73 (1.17)	2.80 (1.12)	−.77	2.58 (1.03)	2.77 (1.16)	−1.43	2.83 (1.12)	2.50 (1.19)	3.68**
13. PSA (Wave 1)	2.62 (1.12)	2.23 (.95)	5.87**	2.18 (1.01)	2.56 (1.06)	−4.48	2.51 (1.08)	2.44 (1.05)	.52	2.42 (1.05)	2.49 (1.08)	−.86
14. PSA (Wave 2)	2.78 (1.14)	2.37 (.96)	6.09**	2.41 (1.07)	2.64 (1.09)	−2.61	2.57 (1.07)	2.59 (1.08)	−.21	2.56 (1.08)	2.63 (1.10)	−.87
15. PSA (Wave 3)	2.91 (1.21)	2.52 (.92)	5.66**	2.53 (1.12)	2.76 (1.10)	−2.59	2.75 (1.02)	2.70 (1.10)	.34	2.68 (1.10)	2.81 (1.11)	−1.40

ITE Intentional exposure, *DE* Depression, *LS* Life satisfaction, *PSA* Permissive sexual attitudes, *SES* socio-economic status

* $p < .05$; ** $p < .01$

Depression

Hypothesis 1a predicted that intentional exposure to online pornography was associated with depression. The initial model did not fit the data very well ($\chi^2 = 80.306$, $df = 26$, $p < .01$, CFI = .854, SRMR = .043, RMSEA = .060. Two paths were suggested to improve the model fit (intentional $_{Wave\ 1}$➜ depression $_{Wave\ 1}$, $\chi^2 = 64.739$, $df = 25$, $p < .01$, CFI = .893, SRMR = .036, RMSEA = .052; intentional $_{Wave\ 2}$➜ depression $_{Wave\ 2}$, $\chi^2 = 70.270$, $df = 25$, $p < .01$, CFI = .878, SRMR = .039, RMSEA = .056. The modified model fit the data better ($\chi^2 = 54.766$, $df = 24$, $p < .01$, CFI = .917, SRMR = .032, RMSEA = .047, Table 3) and also supported by the significant differences in Satorra-Bentler test (ΔS-B $\chi^2 = 28.434$, $p < .01$, Table 3). The auto-regressive coefficients (i.e., paths between the same variable at two time points) between intentional exposure to online pornography and depression were significant ($p < .01$), indicating both variables were stable across waves. As can be seen in Fig. 1, a significant cross-lagged effect (paths between the independent variable at Time 1 and the dependent variable at Time 2) between depression at Wave 2 and later intentional exposure to pornography was found ($\beta = .19$, $SE = .07$, $p < .01$). Thus, Hypothesis 1a was partially supported.

With regard to Hypothesis 1b, the initial model did not fit the data very well ($\chi^2 = 120.660$, $df = 26$, $p < .01$, CFI = .763, SRMR = .056, RMSEA = .038. High MI values were found in the error terms of depression (Wave 2 and Wave 3) and non-intentional exposure to online pornography (Wave 2 and Wave 3). Following the recommendation by Little et al. (2007) and the past longitudinal studies (Jun 2016; Trepte and Reinecke 2013), the error terms of the same variables were allowed to be free over time. Therefore, the covariation of the errors of depression and non-intentional exposure were related (depression in Wave 2 and Wave 3: $\chi^2 = 102.989$, $df = 25$, $p < .01$, CFI = .804, SRMR = .056, RMSEA = .070; non-intentional in Wave 2 and Wave 3:
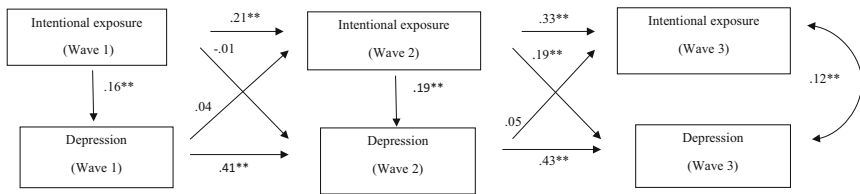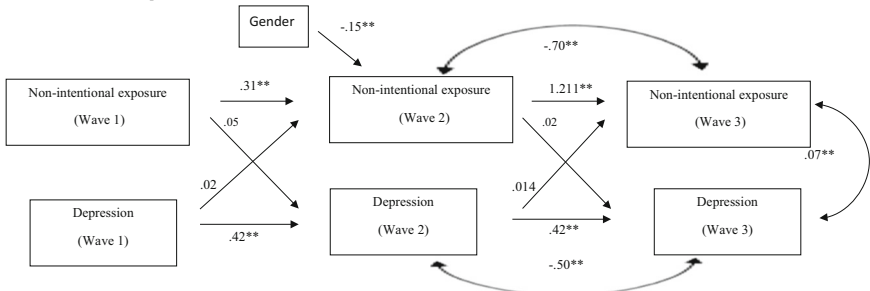

Fig. 1 Autoregressive cross-lagged associations between exposure to online pornography and depression across time All beta coefficients are standardized. Age, gender, religiosity, parents' marital status, socio-economic status were included in the model but not depicted for ease of presentation * $p < .05$; ** $p < .01$
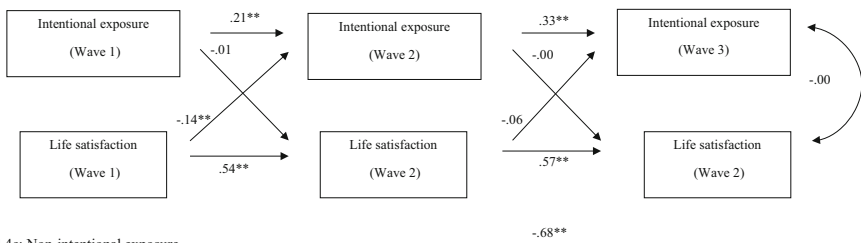
$\chi^2 = 97.358$, $df = 25$, $p < .01$, CFI = .818, SRMR = .052, RMSEA = .070). In addition, a gender effect on this exposure is suggested ($\chi^2 = 110.287$, $df = 25$, $p < .01$, CFI = .786, SRMR = .051, RMSEA = .076. The modified model showed a good fit to the data ($\chi^2 = 42.521$, $df = 23$, $p < .01$, CFI = .951, SRMR = .032, RMSEA = .038, Table 3) and was supported by the significant results in the Satorra-Bentler test (ΔS-B $\chi^2 = 31.821$, $p < .01$, Table 3). As depicted in Fig. 1, all cross-lagged effects between depression and non-intentional exposure to online pornography were not significant ($p > .05$). Therefore, the results did not support Hypothesis 1b.

Life Satisfaction

As predicted in Hypothesis 2a, intentional exposure to online pornography was associated with life satisfaction (Fig. 2). The model demonstrated an adequate fit ($\chi^2 = 60.598$, df = 26, $p < .01$, CFI = .933, SRMR = .034, RMSEA = .048, Table 3). More specifically, the intentional exposure to online pornography at Wave 1 was related to decreased life satisfaction at Wave 2 ($\beta = -.14$, SE = .04, $p < .01$).

Regarding non-intentional exposure to online pornography, the fit indices showed an inadequate fit of the model ($\chi^2 = 113.466$, $df = 26$, $p < .01$, CFI = .763, SRMR = .052, RMSEA = .076). In line with Model 2, the error terms of non-intentional exposure to pornography (non-intentional exposure in Wave 2 and Wave 3: $\chi^2 = 85.025$, $df = 25$, $p < .01$, CFI = .889, SRMR = .042, RMSEA = .064 and life satisfaction: $\chi^2 = 99.400$, $df = 25$, $p < .01$, CFI = .862, SRMR = .050, RMSEA = .071 in Wave 2 and Wave 3) were allowed to be correlated across time. The modified model indicated an adequate overall fit ($\chi^2 = 68.366$, $df = 24$, $p < .01$, CFI = .918, SRMR = .039, RMSEA = .056, Table 3) and was supported by the significant results in the Satorra-Bentler test (ΔS-B $\chi^2 = 17.12$, $p < .01$, Table 3). The longitudinal effect of non-intentional exposure on life
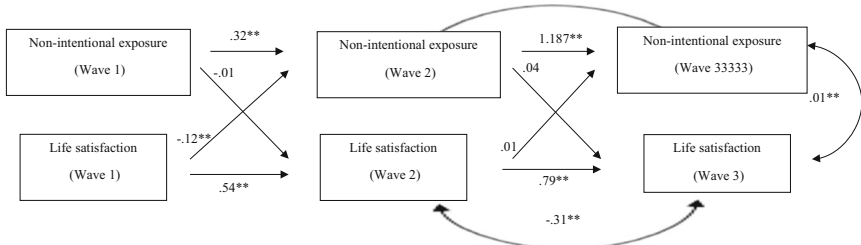

Fig. 2 Autoregressive cross-lagged associations between exposure to online pornography and life satisfaction across time All beta coefficients are standardized. Age, gender, religiosity, parents' marital status, socioeconomic status were included in the model but not depicted for ease of presentation * $p < .05$; ** $p < .01$

satisfaction ($\beta = -.12$, $SE = .04$, $p < .01$, Fig. 2) was found, thereby confirming Hypothesis 2b.

Permissive Sexual Attitude

The relationship between permissive sexual attitude and intentional exposure was tested in Model 5. The initial model showed inadequate fit indexes ($\chi^2 = 76.072$, $df = 26$, $p < .01$, CFI = .874, SRMR = .049, RMSEA = .057). A path was suggested from Permissiveness in Wave 1 to intentional exposure at Wave 1 ($\chi^2 = 50.988$, $df = 25$, $p < .01$, CFI = .934, SRMR = .037, RMSEA = .042). The change is supported by the significant differences in Satorra-Bentler test (ΔS-B $\chi^2 = 32.87$, $p < .01$, Table 3). The cross-sectional ($\beta = .22$, $SE = .03$, $p < .01$) and longitudinal ($\beta = .13$, $SE = .05$, $p < .01$) effects of permissiveness on intentional exposure to online pornography, thus confirmed H3a (Fig. 3).
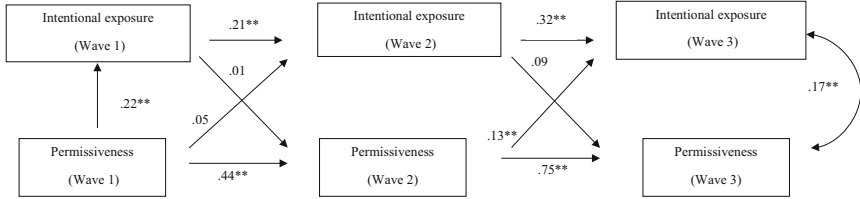
Regarding non-intentional exposure to online pornography, the initial model did not fit the data very well ($\chi^2 = 102.672$, $df = 26$, $p < .01$, CFI = .821, SRMR = .058, RMSEA = .071). an inspection of modification indices suggested that the error terms of permissiveness and non-intentional exposure were allowed to be related (permissiveness in Wave 2 and permissiveness in Wave 3: $\chi^2 = 91.764$, $df = 25$, $p < .01$, CFI = .844, SRMR = .054, RMSEA = .068; non-intentional in Wave 2 and non-intentional in Wave 3: $\chi^2 = 84.782$, $df = 25$, $p < .01$, CFI = .861, SRMR = .052, RMSEA = .064). In addition, a path was suggested from permissiveness at Wave 1 to non-intentional exposure at Wave 2 ($\chi^2 = 89.021$, $df = 25$, $p < .01$, CFI = .851, SRMR = .051, RMSEA = .066). The modified model fitted the data better $\chi^2 = 56.275$, $df = 23$, $p < .01$, CFI = .922, SRMR = .037, RMSEA = .050, Table 3). The above changes were supported by the significant differences in Satorra-Bentler test (ΔS-B $\chi^2 = 23.715$, $p < .01$). As predicted in H3b, permissiveness at Wave 1 was related to non-intentional exposure at Wave 1 ($\beta = .18$, $SE = .04$, $p < .01$). More specifically, permissiveness at Wave 2 was associated with non-intentional exposure to online pornography at Wave 3 ($\beta = .10$, $SE = .05$, $p < .05$, Fig. 3).

Discussion

The primary purpose of the study was to test the longitudinal relationships among online pornographic exposure, psychological well-being, and permissive sexual attitudes using a three-wave cross-lagged panel data of Chinese adolescents.

As hypothesized, adolescents exposure to online pornography was associated with depressive symptoms, and was in line with previous studies (e.g., Ma et al. 2018; Wolak et al. 2007). Adolescents, who were intentionally exposed to online pornography, reported a higher level of depressive symptom. These results are in line with past studies on the negative impact of internet usage on psychological well-being, such as depressive symptoms (Nesi and Prinstein 2015; Primack et al. 2017; Zhao et al. 2017), self-esteem (Apaolaza et al. 2013; Valkenburg et al. 2017), and loneliness (Bonetti et al. 2010; Ma 2017). Additionally, this study provides empirical support for the long-term effects of intentional exposure to online pornography on depression over time. This suggests that early intentional exposure to online pornography might lead to later

Model 5a: intentional exposure
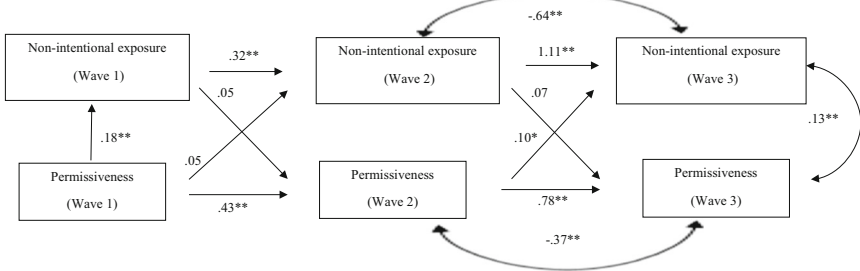

Model 6d: Non-intentional exposure

Fig. 3 Autoregressive cross-lagged associations between exposure to online pornography and permissive sexual attitude across time All beta coefficients are standardized. Age, gender, religiosity, parents' marital status, socio-economic status were included in the model but not depicted for ease of presentation * $p < .05$; ** $p < .01$

depressive symptoms during adolescence. It is noteworthy that this linkage has only been found in intentional exposure, but not in non-intentional exposure, to online pornography. The present study sheds light on the importance to differentiate between non-intentional and intentional exposure to online pornography in order to examine the impact of this behavior.

The negative relationship between life satisfaction and exposure to online pornography was in line with earlier studies (Peter and Valkenburg 2006; Ma et al. 2018; Wolak et al. 2007). The present study shows that adolescents who are less satisfied in their lives at Wave 2 may lead them to be exposed to both types of pornographic exposure at Wave 3. The most interesting finding was that the concurrent relationship between life satisfaction and online pornography was not significant. The present study extends the literature by untangling the longitudinal relationship between life satisfaction and pornography use as noted by other researchers (Peter and Valkenburg 2006). Aligned with the previous longitudinal study (Peter and Valkenburg 2011), the findings of this study imply that life satisfaction may be an antecedent, rather than the outcome, of this behavior. Findings consistently showed a positive relationship between loneliness and internet use (Amichai-Hamburger and Ben-Artzi 2003; Morahan-Martin and Schumacher 2003). Perhaps, less satisfied people tend to use the Internet more than the more satisfied counterparts. The present study highlights the importance to study the longitudinal impacts of this behavior in the future. Future research should further examine the potential long-term effects of life satisfaction on this behavior. To date, little research has explored the directionality of the relationship between online pornography use and psychological well-being. The current study enhanced the past research by clarifying the dynamic association between exposure to online pornography and psychological well-being over time.

Table 3 Fit statistics of all models

	Description	χ2	df	CFI	RMSEA (90% CI)	SRMR	ΔS-B χ2	Δdf
Depression								
Model 1	Intentional	80.306**	26	.854	.060 (.05-.08)	.043	–	–
Model 1a	ITE Wave 1→DE Wave 1	64.739**	25	.893	.052 (.04-.07)	.036	26.126**	1
Model 1b	ITE Wave 2→DE Wave 2	70.270***	25	.878	.056 (.01-.07)	.039	8.852**	1
Model 1c	ITE Wave 1→DE Wave 1 ITE Wave 2→DE Wave 2	54.766***	24	.917	.047 (.03-.06)	.032	28.434**	2
Model 2	Non-intentional	120.660**	26	.763	.038 (.02-.06)	.056	–	–
Model 2a	Covariation between DE Wave 2 and DE Wave 3	97.358***	25	.818	.070 (.06-.09)	.052	6.576*	1
Model 2b	Covariation between Non-ITE Wave 2 and Non-ITE Wave 3	102.989***	25	.804	.070 (.05-.08)	.056	9.943**	1
Model 2c	Gender→Non-ITE Wave 2	110.287**	25	.786	.076 (.06-.09)	.051	10.736**	1
Model 2d	Covariation between DE Wave 2 and DE Wave 3 Covariation between Non-ITE Wave 2 and Non-ITE Wave 3 Gender→ Non-ITE Wave2	42.521**	23	.951	.038 (.02-.06)	.032	31.821**	3
Life satisfaction								
Model 3	Intentional	60.598**	26	.933	.048 (.03-.06)	.034	–	–
Model 4	Non-intentional	113.466**	26	.763	.076 (.06-.09)	.052	–	–
Model 4a	Error covariation between LS Wave 2 and LS Wave 3	99.400**	25	.862	.071 (.06-.09)	.050	7.57**	1
Model 4b	Error covariation between Non-ITE Wave 2 and Non-ITE Wave 3	85.025**	25	.889	.064 (.05-.08)	.042	15.305**	1
Model 4c	Error covariation between LS Wave 2 and LS wave 3 Error covariation between Non-ITE Wave 2 and Non-ITE Wave 3	68.366***	24	.918	.056 (.04-.07)	.039	17.120**	2
Permissiveness								
Model 5	Intentional	76.072**	26	.874	.057 (.06-.09)	.049	–	–
Model 5a	PSA Wave 1 → INT Wave 1	50.988***	25	.934	.042 (.03-.06)	.037	32.873**	1
Model 6	Non-intentional	102.672**	26	.821	.071 (.06-.09)	.058	–	–

Table 3 (continued)

	Description	χ^2	df	CFI	RMSEA (90% CI)	SRMR	ΔS-B χ^2	Δdf
Model 6a	Covariation between Non-ITE Wave 2 and Non-ITE Wave 3	84.782**	25	.861	.064 (.05-.08)	.052	7.274**	1
Model 6b	Covariation between PSA Wave 2 and PSA Wave 3	91.764**	25	.844	.068 (.05-.08)	.054	9.922**	1
Model 6c	Non-INT Wave 1 →PSA Wave 1	89.021**	25	.851	.066 (.05-.08)	.051	14.772**	1
Model 6d	Covariation between Non-ITE Wave 2 and Non-ITE Wave 3	56.275**	23	.922	.050 (.03-.07)	.037	23.715**	3
	Covariation between PSA Wave 2 and PSA Wave 3							
	Non-INT Wave 1 1 →PSA Wave 1							

ITE Intentional exposure, DE Depression, LS Life satisfaction, PSA Permissive sexual attitudes, χ^2 Chi-Square, df degrees of freedom, CFI the comparative fit index, RMSEA the root mean square error of approximation, CI confidence interval, SRMR the standardized root mean square residual, ΔS-B χ^2 the difference in the Satorra-Bentler statistic, Δdf the difference in degrees of freedom

*p <.05; ** p <.01

The present study shows the concurrent and longitudinal effects of permissive sexual attitudes on both types of exposure to online pornography. As expected from previous research (Lo and Wei 2006; Brown and L'Engle 2009; Peter and Valkenburg 2006), sexually permissive adolescents reported higher levels of exposure to both types of online pornography. The present study supports the notion that adolescents select media materials based on their attitudes toward sex (Brown and Cantor 2000).

The finding that an increase in permissiveness towards sex predicted higher levels of exposure to online pornography contradicted with the results from prior studies (Brown et al. 2006; Brown and L'Engle 2009; Lo and Wei 2006). In a study using a sample of 444 Dutch adolescents (aged 13–16), Baams et al. (2015) found that adolescents with higher levels of exposure to pornographic materials reported having a more permissive sexual attitude after 12 months. Similar results were also found in a study by Doornwaard et al. (2015) who suggested a predictive effect of online pornography on sexually permissive attitudes. In their study, the permissive attitude did not predict later online pornography use. Clearly, more research is needed to test the reciprocal relationship between exposure to online pornography and sexually permissive attitudes.

Limitations should be noted in the present study. First, due to the research design, no casual inferences should be concluded regarding the relationships among exposure to online pornography, psychological well-being and sexual permissiveness. Second, the findings can only be generalized in the present sample. More research is warranted to explore its generalizability in other cultural contexts. Third, future studies with more waves may untangle the long-term relationship between exposure to online pornography and psychological well-being in later adolescence. Lastly, self-reported data were collected. Future research could use qualitative methods to extend the presents findings.

Conclusions

Despite the above limitations, the current study extends our understanding about the nature of the exposure to online pornography. More importantly, intentional exposure appears to be associated with negative psychological well-being. This study emphasizes the need for more research to clarify the nature of exposure to pornography in this field of research. A higher level of exposure to online pornography is associated with depressive symptoms, lower levels of life satisfaction, and higher levels of sexually permissive attitudes. The unique contribution of the present study is that it not only shows how different types of exposure are related to psychological wellbeing, but it also indicates the dynamic relationships between psychological well-being, permissiveness sexual attitudes and exposure to online pornography. These findings demonstrate the importance of using a longitudinal design to understand the correlates and outcomes of this behavior. Utilizing these insights will help practitioners design more appropriate treatment programs for adolescents.

Compliance with Ethical Standards

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