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Factors associated with online victimization among Malaysian adolescents who use social networking sites: a cross-sectional study

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Title	Factors associated with online victimization among Malaysian adolescents who use social networking sites: a cross-sectional study
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Abstract

Objective:

To determine the prevalence of online interpersonal victimization among Malaysian adolescents using social networking sites (SNS) and its association with patterns of SNS use, offline victimization, offline perpetration as well as parental conflict.

Methods:

A cross-sectional study of students from randomly selected public secondary schools in the state of Negeri Sembilan was conducted using an anonymous self-administered questionnaire. The questionnaire enquired about patterns of SNS use and included measures of online victimization, online perpetration, offline victimization and parental conflict.

Results:

Of the 1487 respondents aged between 15 and 16 years, 92% had used at least one SNS. More than half of SNS users (52.2%) reported experiences of online victimization over the past 12 months. Males were significantly more likely to experience online harassment compared to females. There were no significant gender differences in experiences of unwanted sexual solicitation. Adolescents who engaged in perpetration behaviours online had almost 6 times higher odds of reporting frequent online victimization compared with online behaviours involving personal disclosure. There was a significant dose-response relationship between engagement in multiple types of online behavior and the risk of frequent online victimization. Both online and offline perpetration were associated with an increased risk of victimization. Those who were victimized offline or experienced parental conflict were twice as more likely to report online victimization.

Conclusion:

Intervention to prevent online electronic aggression should target perpetration behavior both online and offline. Youth should be equipped with skills in communication and decision-making in relationships that can be applied across a spectrum of contexts both online and offline.

Strengths and limitations of this study

- Randomised population-based study
- High response rate
- Examines association of online victimization with behavior and experiences both online and offline
- Results are based on self-reporting which is subject to distortions from errors in recollection and social-desirability bias
- Cross-section design limits inferences regarding the direction of the associations found

INTRODUCTION

Electronic aggression enacted through a range of behavior perpetrated on various platforms with the use of computers, cellphones and other electronic devices has been found to be a common experience among young persons [1-3]. Prevalence estimates of victimization in the form of harassment range from 5.5% to 72%, varying according to operational definitions and time frames applied for measurement [4-13]. Varying levels of unwelcome sexual aggression have been reported across Europe ranging from 1 in 10 (Germany, Iceland, Portugal) to 1 in 2 (Poland) [14]while U.S. surveys report declining trends form 1 in 5 youth Internet users to 9% over a decade [7].

In the absence of consensus on conceptual definitions, a number of terms with overlapping meanings such as electronic bullying, cyberbullying, cyber-aggression, internet bullying, internet harassment, online harassment or technology-based victimization have been used in reference to this form of violence [12 15 16]. The term "cyberbullying" is usually applied to online aggression perpetrated by peers that overlaps with traditional bullying whereas "online harassment" encompasses a broader range of offences which occur in a setting outside adult supervision and scrutiny [17]. Distinctive characteristics of electronic aggression include greater permanence of content, visibility to a wider audience and repeat victimization through replication without active involvement of the perpetrator [18-20]. The possibility of attacking remotely round-the-clock with multiple media makes the victimization experience more intrusive and difficult to escape [3 21]. Anonymity and blinding of perpetrators to their victim's reactions may reduce inhibitions, foster deindividuation, reduce accountability and promote antinormative behaviours [22].

The relationship between online interpersonal harassment and aggressive or sexually exploitative offline encounters as well as longer term mental health outcomes makes this an important public health concern [5 14 23 24]. Exposure to electronic aggression among youth has been associated with emotional disturbances, negative mental health outcomes and a range of internalizing and externalizing behaviours as well as substance abuse problems [25].

Some studies examining demographic characteristics have found associations of victimization with age and gender but not all have found a consistent pattern [1 3 8 9 11 14 23 25-36]. Increased digital competence and patterns of online behavior such as increased time spent online [8 10 14 17 37 38], disclosure of personal information to online acquaintances [23 39 40] and harassing others online [40 41]have been found to be associated with increased risks of online interpersonal victimization. Cumulative engagement in multiple activities individually identified as risky has been associated with escalation of the risk of online interpersonal victimization [40]. There is also evidence linking engagement in risky online behavior and online interpersonal victimization with offline victimization experiences of child abuse and bullying, engagement in offline physical relational and sexual aggression as well as conflicts with caregivers [10 17 24 41-43]. Available research suggests that determinants of exposure to online interpersonal victimization and consequent harm are a composite of general factors such as adolescent-related interests in social communication and sexual exploration, gender as well as cultural norms that may interact with specific factors which enhance vulnerability [44 45]. Specific vulnerabilities may be related to past or concurrent offline victimization, difficult family relationships, alternative sexual orientation, problem behavior, substance abuse and accompanying psycho-

social difficulties which could influence the propensity to engage in problematic interactions online [24 39 45].

The objective of this study was to determine the prevalence of online interpersonal victimization among Malaysian adolescents using social networking sites (SNS) and its association with patterns of SNS use, offline victimization, offline perpetration as well as parental conflict. There is a lack of academic research to explore risks encountered by young persons using digital communication from middle income Asian countries such as Malaysia. The SNS platform was selected to study this form of victimization based on its affordances as well as its popularity and importance among adolescents as a mode of communication [46 47]. The integration of various levels of private and public communication within the platform, accessibility to a network of contacts and the ability to display and exchange personal information in textual form as well as digital images simultaneously creates favourable conditions to develop social relationships and generates avenues for victimization [14 48 49].

Based on existing research, factors which could affect exposure to online interpersonal victimization were organized within a theoretical framework (Figure 1). The focus of this study was on variables associated with greater intensity of victimization as measured by frequency.

The following research questions were formulated:

1. What is the prevalence of SNS usage and specific online behaviours among adolescents?
2. What is the prevalence of online or offline victimization and perpetration experienced by adolescents using SNS?

3. If there an association between frequent online victimization and online behavior?
4. Is there an association between frequent online victimization and experience of offline victimization, online perpetration, offline perpetration and parental conflict?

METHOD

Sample

The study was carried out with students from public secondary schools in the state of Negri Sembilan which has a heterogenous population reflecting the multi-ethnic composition of the country. Twelve schools (7 urban, 5 rural) were randomly selected from a list of 117 schools. For each selected school, 4-5 classes of Form 4 students were randomly selected. Sample size was calculated based on previous studies of online victimization reporting prevalence rates ranging from 5% to 55% [9 41 50]. An upper estimate that 55% of students would be likely to experience at least one type of victimization was used. We assumed a confidence interval of 95% and precision of 2.5%, inflated for missing data of 30%. These assumptions yielded a sample size of approximately 1560.

Procedure

Students completed an anonymous self-administered paper and pencil questionnaire. Participation was voluntary with assurances that confidentiality would be maintained and responses would not influence school grades. The surveys were conducted in classes in a single session. Questionnaires were administered without the presence of class teachers. These procedures were necessary to increase response and disclosure. At the end of every

survey session, all students were provided with an information sheet containing a list of contacts of available support services and helplines.

Instrument

Details of the questionnaire are provided in supplementary file. The questionnaire contained items regarding socio-demographic characteristics and details regarding the use of social networking sites (SNS). A number of items measured risky online behavior relating to the public display of personal information, interaction with individuals encountered online without a prior offline introduction and disclosure of personal information to such individuals. Online victimization as well as online perpetration in the form of harassment and unwanted sexual solicitation in the previous 12 months was measured with questions adapted from the Growing Up with Media Survey and the Youth Internet Safety Survey [40 41]. Lifetime experiences of offline victimization were assessed using the validated ISPCAN Child Abuse Screening tool for young adults [51]. Offline perpetration was measured in 3 domains (psychological, physical, sexual) with 4 stem questions from the Growing Up with Media Survey. A validated version of the Measure of Parenting Style was used to assess parental conflict levels [52].

Ethical considerations

Institutional approval was granted by the Medical Ethics Committee of the University fo Malaya Medical Centre (MEC 890.97). Permission for data collection was obtained from the Ministry of Education and the state Department of Education of Negri Sembilan.

Informed consent was obtained from school authorities and parents. Students gave their assent to participation.

Statistical Analysis

Data was analyzed using Statistical Package for Social Sciences (SPSS) windows version 22.0. Descriptive statistics of the type and frequency of specific risky online behaviours, victimization and perpetration experiences was reported in proportions. Subgroup analysis focusing on gender differences of these behaviours and experiences were also examined and reported. Missing data of each variable of interest was less than 5% of the cases, and listwise deletion analysis was conducted for complete cases. Multiple logistic regression analysis was used to estimate the odds of reporting frequent online victimization among SNS users given specific online behavior, types of online behavior and engagement in multiple forms of online behavior after adjusting for demographic and SNS use characteristics. Next, odds ratios were estimated to understand the association between offline victimization, parental conflict as well as online perpetration with frequent online victimization by further adjusting for the total number of online behaviours besides demographic and SNS use characteristics.

RESULTS

Socio-demographic characteristics

The response rate from a total of 1,634 students was 91% after eliminating 3 refusals and 144 incomplete responses. The 1,487 respondents were from 15 to 16 years of age and

53.9% were female. They comprised predominantly Malay (69.6%) followed by 16.7% Indian, 13.6% Chinese and 0.2% other ethnic groups. Approximately 90% were living with both their parents. Seventy percent of their parents had completed at least a secondary school education.

Prevalence of SNS usage

Ninety-two percent of respondents had used at least one social networking site (SNS). The rest of the analysis was based on this subset denoted as "SNS users". More than a third of SNS users started at the age of 12 years or younger, below the recommended age for SNS use. The most commonly used SNS was Facebook. Approximately half of the adolescents possessed more than one profile and 45.4% accessed their profiles daily. Duration of weekly use ranged from 20 minutes to 100 hours with a median of 3 hours. Two-thirds had more than 300 "friends" or contacts in their profile, with a third reporting more than a 1000 contacts. Communication and social interaction were found to be the most important reasons for SNS use compared to other purposes such as leisure, keeping up with peers and public participation. Half of the respondents (50.2%) acknowledged using SNS to meet new people and make new friends. Three-quarters (74.5%) had accepted requests to include unknown persons into the list of contacts with no significant gender differences.

Prevalence of Specific Risky Online Behaviour

The prevalence of different types of online behaviours involving personal information disclosure, interaction with strangers and online perpetration is shown in Table 1. Of

these, the most commonly reported was interacting with strangers while the posting of revealing images was the least common. With the exception of sending personal information to strangers, most of the listed behaviours including online perpetration were found to be more common among males. Approximately one in three had engaged in at least one of the 6 listed behaviours while nearly a third had engaged in 3 or more (31.8%). There was a significant upward trend of engagement in multiple risky online behaviours among males compared to females (p<0.001). (See Figure 2).

Table 1 : Prevalence of specific risky online behaviors (N = 1364)

Specific online behaviour	Male (N=646) (%)	Female (N=718) (%)	Total (N=1364) (%)	p value
Posting personal information on a public profile	36.1	29.7	32.7	**0.012**
Sending personal information to a stranger[1]	45.2	47.5	46.4	0.397
Posting revealing photographs or videos	2.2	0.8	1.5	**<0.001**
Interaction with stranger[1]	89.9	86.5	88.1	0.050
Perpetration of harassment	37.2	27	31.8	**<0.001**
Perpetration of unwanted sexual solicitation	5.3	0.4	2.7	**<0.001**

p value based on Pearson's chi-square test comparing differences in risky online behaviours between genders
p value in bold significant at p<0.05
[1] "stranger" refers to a contact encountered solely through an online SNS without a prior face-to-face meeting

Prevalence of Victimization

The prevalence of online victimization, online perpetration, offline victimization and offline perpetration by gender is shown in Table 2.

Online victimization

More than half of the respondents (52.2%) had experienced some form of online victimization. The prevalence of online harassment was higher than unwanted sexual solicitation. Males were significantly more likely to experience online harassment compared to females. Whilst females were more likely to report unwanted sexual solicitation, the gender difference was not statistically significant. Frequent online victimization was slightly more common among males than females.

Online perpetration

One in three respondents reported engaging in some form of perpetration online. Perpetration of online harassment or aggression was more common than unwanted sexual solicitation. Males had a significantly higher prevalence of both types of behavior and were more likely to be frequent perpetrators.

Offline victimization

There was a high prevalence of offline victimization in general (60.3%) reported by the study population with about one-third of SNS users reporting experiences of multiple types of victimization. Physical victimization was the most prevalent, followed by psychological and sexual. There were no significant gender differences found among subtypes of victimization except for psychological victimization which was more prevalent among females.

Offline perpetration

Offline perpetration was reported by 37.5% of the respondents. About a quarter of the respondents reported having perpetrated either psychological or physical aggression towards others. The prevalence of offline sexual perpetration was much lower, at around 3%, and was more commonly reported by males. About one in every 10 respondents had engaged in multiple types of perpetration.

Table 2: Prevalence of victimization and perpetration experiences by types and gender

Type of Exposure	Male (N=646) %	Female (N=718) %	Total (N=1364) %	P value
Online victimization	54.8	49.9	52.2	0.068
*Types**				
Online harassment	52.2	43.3	47.5	**<0.001**
Sexual solicitation	17.2	20.8	19.1	0.094
Frequency of victimization				**0.002**
Frequent victimization	19.3	12.4	15.7	
Infrequent victimization	35.4	37.5	36.5	
No victimization	45.2	50.1	47.8	
Online Perpetration	37.6	27.0	32.0	**<0.001**
*Types**				
Online harassment	37.2	27.0	31.8	**<0.001**
Sexual solicitation	5.3	0.4	2.7	**<0.001**
Frequency of perpetration				**<0.001**
Frequent perpetration	14.1	6.8	10.3	
Infrequent perpetration	23.5	20.2	21.8	
No perpetration	62.4	73.0	68.0	
Offline Victimization	58.2	62.3	60.3	0.127
*Types**				
Physical	50.2	47.8	48.9	0.379
Sexual	17.0	17.0	17.0	0.986
Psychological	26.3	39.8	33.4	**<0.001**
Multiple types of offline victimization				

None	37.7	41.8	39.7	0.130
1	30.5	28.7	29.5	
≥2	27.8	33.5	30.8	
Offline Perpetration	39.3	35.8	37.5	0.179
Types*				
Physical	25.9	19.1	22.3	**0.003**
Psychological	23.4	23.5	23.5	0.943
Sexual	5.1	1.5	3.2	**<0.001**
Multiple types of offline perpetration				**0.008**
None	60.7	64.2	62.5	
1	25.9	27.7	26.8	
≥2	12.4	8.1	10.7	

*Categories are not mutually exclusive
p value based on Pearson's chi-square test comparing victimization or perpetration experiences by gender.

Association between risky online behaviour and online victimization

The association between frequent online victimization and online behaviour is summarized in Table 3. Results were adjusted for sociodemographic and SNS use characteristics. The posting of revealing photographs was the only behaviour involving personal disclosure which was associated with a higher risk of online victimization. Adolescents who engaged in perpetration behaviours had almost 6 times higher odds of reporting frequent online victimization, compared with online behaviours involving personal disclosure. There was a significant dose-response relationship between engagement in multiple types of online behaviour and the risk of frequent online victimization. Neither the length of time spent on SNS nor the number of people in the respondents' contact lists were found to be associated with frequent online victimization.

Table 3. Association of online victimization with risky online behaviours

Characteristics	Odds of Online Victimization			
	Adjusted for Socio-demographic Characteristics		Adjusted for SNS Use Characteristics	
	AOR (95% Cl)	p value	AOR (95% Cl)	*p* value
Specific Online behaviour				
Posting personal information on a public profile	1.1 (0.7-1.4)	0.913	1.1 (0.7-1.3)	0.830
Sending personal information to strangers	1.7 (1.3-2.4)	0.001	1.2 (0.9-1.7)	0.309
Interaction with strangers	1.4 (0.8-2.4)	0.198	1.1(0.6-2.0)	0.682
Posting revealing pictures	**3.0 (1.2-7.5)**	**0.018**	**3.5(1.4-8.9)**	**0.007**
Perpetration of harassment	**6.1 (4.4-8.6)**	**< 0.001**	**5.6 (4.0-7.9)**	**<0.001**
Perpetration of unwanted sexual solicitation	**4.1 (1.9-8.5)**	**< 0.001**	**2.2 (1.1-4.4)**	**0.030**
Types of online behaviour				
Personal disclosure behaviours	1.7 (0.8-3.4)	0.157	1.3 (0.6-2.6)	0.471
Perpetration behaviours	**6.3 (4.5-8.4)**	**< 0.001**	**6.2 (4.5-8.6)**	**< 0.001**
Multiple types of online behaviours				
≤1	1		1	
2	**2.2 (1.4-3.6)**	**0.001**	**2.4 (1.5-3.8)**	**<0.001**
3	**4.1 (2.5-6.7)**	**< 0.001**	**4.2 (2.6-6.7)**	**< 0.001**
≥4	**5.9 (3.4-10.5)**	**< 0.001**	**6.4 (3.7-11.1)**	**< 0.001**

Abbreviations: AOR adjusted odds ratio; CI, confidence interval
Personal disclosure behaviours consist of posting and sending personal information, interacting with strangers and posting revealing pictures
Perpetration behaviours include adolescents perpetrating harassment and unwanted sexual solicitation
Odds ratio are adjusted for (1) socio-demographic characteristics (ethnicity, gender, geographic location, parent's relationship status and parent's education level) and (2) SNS use (frequency & age of SNS access)

Correlates of Frequent Online Victimization

Both online and offline perpetration were found to be associated with an increased risk of online victimization when adjusted for sociodemographic and internet use characteristics. The observed relationship remained strongly significant after adjustment for total number of online behaviours (see Table 4). Specifically, adolescents who engaged in frequent online perpetration were 12 times more likely to report frequent online victimization. Similarly, an upward trend of frequent online victimization was seen among those who engaged in multiple types of perpetration.

While adolescents who were victimized in the offline world were twice more likely to report online victimization, the odds did not increase with exposure to multiple types of offline victimization. Respondents who experienced high levels of parental conflict were twice more likely to be harassed or victimized online.

Table 4. Association between online victimization with offline and online correlates

Characteristics	Odds of Online Victimization			
	Model 1 Adjusted for Socio-demographic and SNS Use Characteristics		Model 2 Adjusted for Total No. of Online Behaviors	
	AOR (95% Cl)	P value	AOR (95% Cl)	P value
Online Perpetration				
None	1	NA	1	NA
Infrequent	**2.6 (1.8-4.0)**	**<0.001**	**1.8 (1.5-2.0)**	**<0.001**
Frequent	**21.8 (13.8-34.5)**	**<0.001**	**12.5 (8.2-18.9)**	**<0.001**
Offline Perpetration				
None	1	NA	1	NA
Offline perpetration	**2.0 (1.5-2.8)**	**<0.001**	**1.6 (1.2-2.2)**	**<0.001**
Multiple types of offline perpetration				

0	1	NA	1	NA
1	**1.6 (1.1-2.3)**	**0.013**	1.3 (0.9-1.8)	0.171
2	**2.9 (1.8-4.7)**	**<0.001**	**2.4 (1.5-3.7)**	**<0.001**
3	**12.3 (3.0-50.2)**	**<0.001**	**7.9 (2.3-27.2)**	**0.001**
Offline Victimization				
None	1	NA	1	NA
Offline victimization	**1.8 (1.3-2.6)**	**<0.001**	**1.7 (1.2-2.3)**	**0.001**
Multiple types of offline victimization				
0	1	NA	1	NA
1	1.4 (0.9-2.1)	0.136	1.0 (0.7-1.6)	0.654
2	2.2 (1.4-3.4)	<0.001	1.4 (0.9-2.1)	0.117
3	3.1 (1.8-5.5)	<0.001	1.6 (0.9-2.7)	0.075
Parental Conflict				
Low	1	NA	1	NA
Medium	1.5 (0.9-2.3)	0.067	**1.6 (1.5-1.9)**	**<0.001**
High	**2.2(1.5-3.2)**	**<0.001**	**1.7(1.2-2.51**	**0.003**

AOR, adjusted odds ratio; CI, confidence interval; NA, data not applicable
Model 1: Odds ratios were adjusted for sociodemographic (ethnicity, gender, geographic location, parent's relationship status and parent's education level) and SNS use characteristics (frequency of access and age of 1st access)
Model 2: Odds ratios were adjusted for total number of online behaviours (posting personal information on a public profile, posting revealing photographs or videos, sending personal information to strangers, interacting with strangers, perpetration of harassment and unwanted sexual solicitation), besides demographic and SNS use.

DISCUSSION

The high prevalence of SNS users and reported motivation for use are consistent with studies in Europe and other local studies reflecting utilization of this platform as part of normative adolescent practice [47 50 53-55]. Initiation of SNS use at a young age mirrors findings in Europe where 27% of 9-10 year olds said they had a SNS profile [56]. Knowledge of these demographic patterns should be applied in any initiative to address the overall safety, well-being and development of youth [57].

Higher levels of interaction with unknown persons were found than what has been previously reported in the U.S. [58] or locally [50]. This may be due to adolescents maximizing avenues for social communication and sexual exploration away from adult scrutiny, particularly within the context of a conservative Asian and predominantly Muslim community. It could also be the consequence of boredom, curiosity and social inhibitions in face-to-face encounters [59]. When such behaviour is normative, a communication-based approach to education on safeguarding individual privacy and security is more likely to be effective than a restrictive approach [60].

The prevalence of online harassment in this study falls within the wide range of existing prevalence estimates of 5.5%and 72% [4-11], confirming that the problem extends to youth in this region and needs to be addressed. The odds of experiencing harassment are marginally higher among youth who report online interaction with strangers suggesting that harassment originates predominantly from known persons. This may include peers who concurrently bully them offline as has been reported by others [11 42 61], but could not be verified within this study design. The higher prevalence of online harassment compared to unwanted sexual solicitation is similar to the pattern of offline victimization, where levels of physical and psychological victimization exceed sexual victimization.

The higher levels of harassment experienced by boys in this study has also been reported in a few Asian studies [11 23]. This is likely to be related to their increased tendency towards online perpetration, which was found to be the most important predictor of

frequent online victimization. In contrast, a number of studies have found increased electronic aggression directed at girls or no gender differences. We postulate that cultural conditioning in Asian societies where assertiveness is emphasized in boys and politeness expected of girls may partly account for these differences [11]. These differences reinforce the value of conducting local research to determine the applicability of international data to specific settings.

The prevalence of unwanted sexual solicitation in this study is higher than recent U.S. studies whereas research from Europe has revealed a wide variation [7 9]. The steady decline in the U.S. has been attributed to increased consciousness with the introduction of Internet safety education programmes as well as changing patterns of use and better law enforcement. In comparison, the development of safety education programmes are still in their relative infancy in Malaysia. In contrast to other studies, the absence of gender differences here is consistent with previous Malaysian studies on offline victimization [62 63]. This could be related to greater involvement of boys with online perpetration and risky behaviour such as posting of revealing images on their SNS profile. With the widespread utilization of SNS by the majority of youth for an ever-growing range of functions related to leisure activities and social communication, it is postulated that the time spent online may not be a discriminator of victimization risk, unlike earlier studies [17]. This may explain why the duration of time spent online was not a predictor of victimization in this study.

Personal information disclosure other than the posting of revealing images was associated with a marginal increase in the odds of online victimization. Marked risk escalation occurred only when this was combined with a number of other behaviours, extending the evidence found in another U.S.-based study where engagement in 4 types of online behaviour was found to be a tipping point [40]. Among component behaviours, uploading personal revealing photographs and online perpetration were major contributors to risk in this study. Involvement in 4 or more listed types of behaviour was seen in less than 10% of respondents in this study. Participation in multiple types of risky behaviour may be a possible marker of individuals with a greater willingness to forgo privacy for self-disclosure as well as to provoke others [2 48 60 64]. Instead of targeting individual types of behaviour in isolation, understanding the psyche of adolescents who belong to this high-risk group may yield more useful strategies for prevention and suggests directions for future research.

Demonstration of the association of frequent online victimization with offline victimization experiences and parental conflict underlines the importance of taking into account broader contextual factors in formulating an understanding of contributors to the risk of online victimization. The adverse psychosocial impact of previous victimization may result in emotional dysregulation and lack of social competence. Convergence of psychosocial difficulties with family conflict and weak family ties may increase an individual's risk of becoming a target of victimization in different ways. Affected persons may be drawn into intimate interactions online, exercise less discretion in their uploading

of content and have an increased propensity to express hostility in their online exchanges [24 39 41].

The study findings that both online and offline perpetration are important predictors of online victimization adds to evidence from previous studies [39]. Examining underlying motivations and triggers of this form of aggression would be a logical step to address online victimization. As adolescents seek to establish their identity and grapple with issues relating to intimacy and sexuality [44], aggression may be employed as a strategy offline and online to establish and maintain social dominance. This could result in subsequent targeting for victimization by rivals [65].

The following study limitations are acknowledged. Results are based on self-reporting which is subject to distortion from errors in recollection and social-desirability biases that could result in underrerporting [44]. The high response rate and the anonymity assured in the study increased the possibility of reporting an unwanted experience among the adolescents. The cross-sectional design limits inferences regarding the direction of associations found. The relationship between perpetration and victimization may be bidirectional, i.e. perpetration could result in victimization or be a reaction to victimization, extending across online and offline interaction. In addition, other factors such as academic performance [23 30], sexual orientation [66] and conduct problems [41 42] which have been found to be associated with online victimization were not explored in this study.

CONCLUSION

The study establishes that perpetration behaviour both online and offline should be an important target for intervention to prevent online electronic aggression. While specific affordances within platforms may facilitate victimization and evolve with development of new technologies, the focus should be on equipping youth with skills in communication and decision-making in relationships that can be applied across a spectrum of contexts both online and offline [57].

CONTRIBUTORSHIP STATEMENT

Mary J Marret conceived the study design, supervised the data collection and wrote the manuscript.

Wan-Yuen Choo carried out the statistical analysis and co-wrote the manuscript.

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COMPETING INTERESTS

The authors have no competing interests to declare.

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DATA SHARING STATEMENT

The dataset for this research has not yet been uploaded into a data repository.

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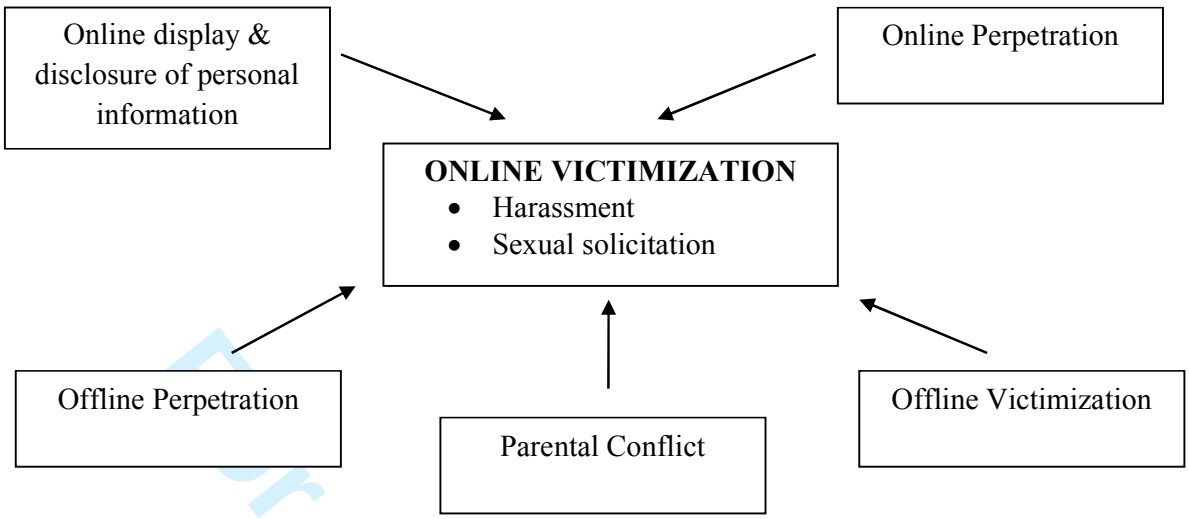

Figure 1: Theoretical framework of factors which may affect exposure to online victimization

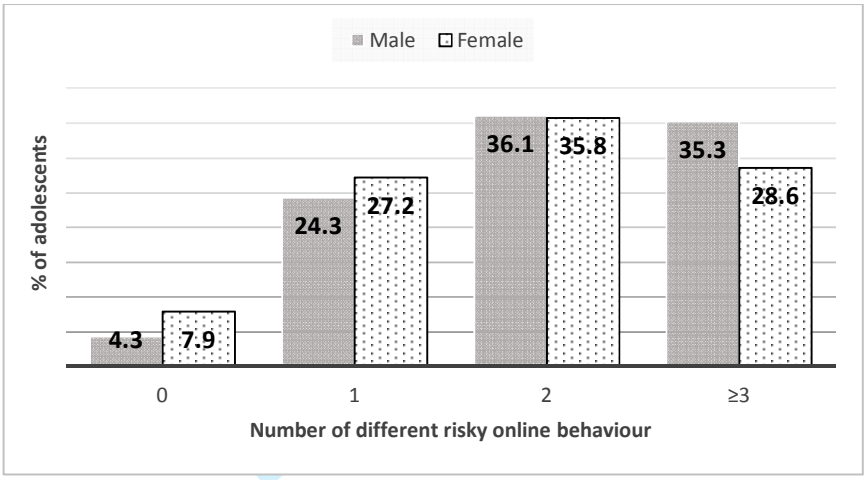

Figure 2: Cumulative risky online behaviour by gender

Details of questionnaire used in survey

The following items were included in the questionnaire:

Socio-demographic information. Items included were age, gender, ethnicity, place of residence, parents' marital status and parents' education level.

Use of social networking sites (SNS). Items included were the age of initiation of SNS use, motivation for use, most frequently used SNS, number of SNS profiles, frequency and duration of access to SNS, number of SNS contacts and motivations for use

Privacy settings and disclosure of personal information on SNS. Items included were the use of privacy settings on their SNS profiles and about specific behaviors pertaining to public display of personal information on user profiles as well as the sharing of personal information and interaction with "SNS contacts". The term SNS contacts denoted individuals encountered solely through a SNS without a prior face-to-face introduction.

Posting of personal information was measured by display of any of the following data on a publicly accessible profile: real name, photograph, residential address, name of school, telephone number

Disclosure of personal information was deemed to occur if any of the following data were sent to an SNS contact: real name, photograph, address, name of school, telephone number

Posting of revealing images was deemed to occur if an image (either a still photograph or video) of the respondent clad only in a swimsuit or undergarments was displayed on a publicly accessible SNS profile

Interaction with strangers was deemed to occur if respondents accepted "friend requests" from individuals unknown to them or communicated with such individuals through chat, replying of messages or posting comments on their wall

Victimization on SNS. The following items assessed victimization within the previous 12 months under categories of harassment and unwanted sexual solicitation. The frequency of these experiences was indicated on a 6-point scale which ranged from "daily or almost daily" to "never". To facilitate statistical analysis, the responses were grouped under three categories: (1) frequent (experiences occurred at least a few times a year) (2) infrequent (experiences occurred once in the past 12 months (3) never

Harassment was measured through 3 questions adapted from the Growing Up with Media Survey (whether someone made rude or mean comments, spread rumours whether they were true or not, made threatening or aggressive remarks [1]

Unwanted sexual solicitation was measured with 3 questions adapted from the Youth Internet Safety Survey (whether someone had forced sexual talk when they were unwilling, whether someone had asked for sexual information about themselves which they were unwilling to share or if someone had asked them to do something sexual against their will) [2].

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Previous studies have shown high reliability for both instruments. The internal reliability estimated with Cronbach's Alpha was .93 for Internet sexual solicitation victimization and 0.79 for Internet harassment victimization [1 3 4].

Perpetration on SNS. The following items assessed self-reported online perpetration within the previous 12 months under categories of harassment and unwanted sexual solicitation. The frequency of these actions was indicated on a 6-point scale which ranged from "daily or almost daily" to "never". To facilitate statistical analysis, the responses were grouped under three categories: (1) frequent (respondents did this at least a few times a year) (2) infrequent (respondents did this once in the past 12 months (3) never.

Perpetration of harassment was measured with three questions from the Growing Up with Media Survey (making rude or mean comments, spreading rumours about someone whether they were true or not, directing threatening or aggressive comments towards others on SNS) [1].

Perpetration of unwanted sexual solicitation was measured with three questions adapted from the Youth Internet Safety Survey (forcing others to engage in sexual talk, asking for sexual information or asking another to do something sexual when they were unwilling) [1].

The internal reliability for the measures was estimated with Cronbach's Alpha: Perpetration of harassment (Cronbach .82); and Perpetration of unwanted sexual solicitation (Cronbach .93) [1].

Experiences of offline victimization. Lifetime experiences of offline victimization were assessed using the validated ISPCAN Child Abuse Screening tool for young adults Version ICAST-R with 5 stem questions each assessing three domains of offline victimization (sexual abuse, physical abuse or psychological abuse). For each stem question, the response options were: (1) yes; (2) no and (3) cannot remember. For each positive response, follow-up questions enquired about the frequency of maltreatment experiences and the category of the perpetrator. A positive response to at least one stem question denoted victimization in that particular domain. A summary index indicating the number of categories of victimization was created ranging from 0 (none) to 3 (all three types). Previous studies have shown moderate to high reliability [5].

Offline bullying. Lifetime perpetration of offline bullying was assessed using 4 stem questions to measure three domains (1) psychological (not allowing a peer to join in a group out of anger or hostility, spreading rumours about someone whether they were untrue or not) (2) physical (pushing, beating or slapping a peer) (3) sexual (kissing or touching a peer sexually when they did not consent). For each item, respondents were asked the frequency of these actions on a 6-point scale from "daily or almost daily" to "never" [1]. A summary index of the number of types of perpetration was created ranging from 0 (none) to 3 (all three types).

Parental conflict. A validated version of the Measure of Parenting Style (MOPS) was used to assess parental conflict levels with 15 core items assessing Parental Indifference (6 items), Parental Over-Control (4 items), and Parental Abuse (5 items). Responses were scored on a 4- point Likert type scale as follows: 0 = not true at all; 1 = slightly true; 2 = moderately true; 3 = extremely true. A total score was derived from summation of scores for all the items with higher scores indicating greater levels of parental conflict. The instrument has shown moderate to high reliability and validity. Previous studies with Cronbach's alphas ranging

from .76 to .93 suggest that the measures are within acceptable internal consistency while test-retest coefficients for the subscale ranged from 0.74 to 0.94, indicating high to moderate consistency [6].

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STROBE 2007 (v4) Statement—Checklist of items that should be included in reports of *cross-sectional studies*

Section/Topic	Item #	Recommendation	Reported on page #
Title and abstract	1	(*a*) Indicate the study's design with a commonly used term in the title or the abstract	Title & abstract 1-2
		(*b*) Provide in the abstract an informative and balanced summary of what was done and what was found	Title & abstract 2
Introduction			
Background/rationale	2	Explain the scientific background and rationale for the investigation being reported	Introduction 4-6
Objectives	3	State specific objectives, including any prespecified hypotheses	Introduction 6-7
Methods			
Study design	4	Present key elements of study design early in the paper	Methods 7-8
Setting	5	Describe the setting, locations, and relevant dates, including periods of recruitment, exposure, follow-up, and data collection	Methods 7-8
Participants	6	(*a*) Give the eligibility criteria, and the sources and methods of selection of participants	Methods 7-8
Variables	7	Clearly define all outcomes, exposures, predictors, potential confounders, and effect modifiers. Give diagnostic criteria, if applicable	Methods 7-9
Data sources/ measurement	8*	For each variable of interest, give sources of data and details of methods of assessment (measurement). Describe comparability of assessment methods if there is more than one group	Methods 7-9
Bias	9	Describe any efforts to address potential sources of bias	Procedure 7-8
Study size	10	Explain how the study size was arrived at	Sample 7
Quantitative variables	11	Explain how quantitative variables were handled in the analyses. If applicable, describe which groupings were chosen and why	Statistical analysis 9
Statistical methods	12	(*a*) Describe all statistical methods, including those used to control for confounding	Statistical analysis 9
		(*b*) Describe any methods used to examine subgroups and interactions	Statistical analysis 9
		(*c*) Explain how missing data were addressed	Statistical analysis 9
		(*d*) If applicable, describe analytical methods taking account of sampling strategy	Not applicable
		(*e*) Describe any sensitivity analyses	Not applicable
Results			

Participants	13*	(a) Report numbers of individuals at each stage of study—eg numbers potentially eligible, examined for eligibility, confirmed eligible, included in the study, completing follow-up, and analysed	Statistical analysis 7 & 9
		(b) Give reasons for non-participation at each stage	Sample 7
		(c) Consider use of a flow diagram	Explained in text 7& 9
Descriptive data	14*	(a) Give characteristics of study participants (eg demographic, clinical, social) and information on exposures and potential confounders	Results 9 - 17
		(b) Indicate number of participants with missing data for each variable of interest	Statistical analysis 9
Outcome data	15*	Report numbers of outcome events or summary measures	Results 9 - 17
Main results	16	(*a*) Give unadjusted estimates and, if applicable, confounder-adjusted estimates and their precision (eg, 95% confidence interval). Make clear which confounders were adjusted for and why they were included	Results 9-17
		(*b*) Report category boundaries when continuous variables were categorized	Results 9 - 17
		(*c*) If relevant, consider translating estimates of relative risk into absolute risk for a meaningful time period	Not relevant
Other analyses	17	Report other analyses done—eg analyses of subgroups and interactions, and sensitivity analyses	Results 9 -17
Discussion			
Key results	18	Summarise key results with reference to study objectives	Discussion 17 - 21
Limitations	19	Discuss limitations of the study, taking into account sources of potential bias or imprecision. Discuss both direction and magnitude of any potential bias	Discussion 17 -21
Interpretation	20	Give a cautious overall interpretation of results considering objectives, limitations, multiplicity of analyses, results from similar studies, and other relevant evidence	Discussion 17 -21
Generalisability	21	Discuss the generalisability (external validity) of the study results	Discussion 17 -21
Other information			
Funding	22	Give the source of funding and the role of the funders for the present study and, if applicable, for the original study on which the present article is based	Funding 23

*Give information separately for cases and controls in case-control studies and, if applicable, for exposed and unexposed groups in cohort and cross-sectional studies.

Note: An Explanation and Elaboration article discusses each checklist item and gives methodological background and published examples of transparent reporting. The STROBE checklist is best used in conjunction with this article (freely available on the Web sites of PLoS Medicine at http://www.plosmedicine.org/, Annals of Internal Medicine at http://www.annals.org/, and Epidemiology at http://www.epidem.com/). Information on the STROBE Initiative is available at www.strobe-statement.org.

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Factors associated with online victimization among Malaysian adolescents who use social networking sites: a cross-sectional study

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Keywords	Internet, interpersonal relations, crime victims, adolescent, bullying
Word Count	7, 980

Abstract

Objective:

To determine the prevalence of online interpersonal victimization and its association with patterns of SNS use, offline victimization, offline perpetration and parental conflict among Malaysian adolescents using social networking sites (SNS).

Methods:

A cross-sectional study of students from randomly selected public secondary schools in the state of Negeri Sembilan was conducted using an anonymous self-administered questionnaire. The questionnaire examined patterns of SNS use and included measures of online victimization, online perpetration, offline victimization and parental conflict. A response rate of 91% from a total of 1,634 yielded a sample of 1,487 students between 15 and 16 years of age.

Results:

Ninety-two percent of respondents had used at least one SNS. More than half of SNS users (52.2%) reported experiences of online victimization over the past 12 months. Males were significantly more likely to experience online harassment compared to females (52.2% vs 43.3%, $p < 0.001$). There were no significant gender differences in experiences of unwanted sexual solicitation. Adolescents who engaged in perpetration behaviours online had almost 6 times higher odds of reporting frequent online victimization compared with online behaviours involving personal disclosure. There was a significant dose-response relationship between engagement in multiple types of online behaviour and the risk of frequent online victimization. Both online and offline perpetration were associated with an increased risk of victimization. Those who were victimized offline or experienced parental conflict were twice as likely to report online victimization.

Conclusion:

Interventions to prevent online electronic aggression should target perpetration behaviour both online and offline. Youth should be equipped with skills in communication and decision-making in relationships that can be applied across a spectrum of contexts both online and offline.

Strengths and limitations of this study

- Large population-based study
- High response rate
- Examines association of online victimization with behaviour and experiences both online and offline
- Results are based on self-reporting which is subject to distortions from errors in recollection and social-desirability bias
- Cross-section design limits inferences regarding the direction of the associations found

INTRODUCTION

Electronic aggression enacted through a range of behaviour perpetrated via computers, cellphones and other electronic devices has been found to be a common experience among young persons [1-3]. Prevalence estimates of victimization in the form of harassment range from 5.5% to 72%. The wide variability in prevalence has been attributed in part to the operational definitions applied, as well as the time frame of assessment. It has been observed that studies using broad definitions and measurement of lifetime experiences have reported higher levels of prevalence. More conservative estimates have emerged from studies with narrow definitions and the limiting of measurements to recent experiences [4-13]. Varying levels of unwelcomed sexual aggression have been reported across Europe ranging from 1 in 10 (Germany, Iceland, Portugal) to 1 in 2 (Poland) [14]. A review of three U.S. surveys reported declining trends from 1 in 5 youth Internet users to 9% over a decade [7].

The relationship between online interpersonal harassment and aggressive or sexually exploitative offline encounters as well as longer term mental health outcomes makes this an important public health concern [5 14-16]. Exposure to electronic aggression among youth has been associated with emotional disturbances, negative mental health outcomes and a range of internalizing and externalizing behaviours as well as substance abuse problems [17].

One of the challenges to research in this field is the absence of consensus on a conceptual definition [12 18]. A number of terms with overlapping meanings such as electronic bullying, cyberbullying, cyber-aggression, internet bullying, internet harassment, online harassment or technology-based victimization have been used to describe this form of violence [12 18 19]. Electronic aggression may be enacted through a range of behaviours. This includes the spreading of harmful lies, directing rude or threatening comments against individuals,

spreading of embarrassing rumours and posting of digital photographs or videos intended to humiliate others. These acts may originate from known or anonymous sources [20]. The term "cyberbullying" is usually applied to online aggression perpetrated by peers that overlaps with traditional bullying [21]. The term "online harassment" encompasses a broader range of offences, committed by known or anonymous sources of any age, which occur in a setting outside adult supervision and scrutiny [21]. Electronic aggression of a sexual nature directed towards an unwilling subject has been termed "unwanted sexual solicitation". This can take the form of invitations to talk about sex, do something sexual or share personal sexual information that may be diverse in nature and origin [22]. Perpetrators of this type of behaviour are usually male [23]. Such acts may originate from troubled youth with a history of other behavioural problems or adult sexual predators engaged in deliberate manipulation and seduction of minors [22 24 25]. The latter are not limited to strangers encountered online. They may include adults within the family and social circle [25]. Distinctive characteristics of electronic aggression include greater permanence of content, visibility to a wider audience and repeat victimization without active involvement of the perpetrator [26-28]. The possibility of attacking remotely at any time of the day or night with multiple media makes the victimization experience more intrusive and difficult to escape [3 29]. Anonymity and blinding of perpetrators to their victim's reactions may reduce inhibitions, foster deindividuation, reduce accountability and promote antinormative behaviours [20].

With its diversity in form, expression, participants and underlying motivations, no robust theoretical model has been identified which can adequately explain the phenomenon of electronic aggression [30]. A number of contextual factors associated with its occurrence among youth have been studied to identify opportunities for intervention and prevention.

They include demographic characteristics of victims, patterns of Internet use, online behaviour and experiences of offline victimization.

From a developmental perspective, the amount of time spent online as well as the degree of social interaction online may vary with age. Forms and expressions of aggression may also evolve with changing levels of maturity. These differences may play a part in the level of online victimization experienced by different age groups [30]. An increasing trend of cyberbullying between the ages of 11 and 15 years that peaks in middle school and subsequently declines in high school has been reported [1 31-33]. However not all studies have found a consistent relationship between cyberbullying and age [8].

Examination of online victimization in relation to gender has yielded a mixed picture. A preponderance of female victimization has been reported in some studies from North America and Europe [2 14 17 32 34-37]. This may reflect targeting of victims based on gender. This could also be due to the involvement of more girls in indirect bullying, as both bullies and victims [1 30]. Data from the UKCGO and SAFT surveys conducted in Europe found variations across countries and age groups. Higher levels of victimization were found among older teenage girls in UK and Norway, and among boys aged 9 to 12 years in Ireland [9]. A few studies have not found gender-based victimization patterns [31 38 39]. Others, mainly from Asia, have reported a preponderance of males in combined roles of perpetrators and victims [11 15 40]. One of these studies from mainland China attributed this gender difference to patterns of upbringing. In traditional Chinese culture, girls are expected to be gentle, kind and polite whereas boys are encouraged to be more assertive [11].

Patterns of Internet use have been explored in relation to the routine activities theory [41] which predicts higher levels of victimization among those with greater exposure to risk through their activities [42]. Support for this theory has been found in the association of online interpersonal victimization with increased time spent online [8 22] and increased digital competence [14].

With regard to online behaviour, disclosure of personal information to online acquaintances [15 43 44] and harassing others online [22 44] have been found to be associated with increased risks of online interpersonal victimization. Cumulative engagement in multiple activities individually identified as risky has been associated with escalation of the risk of online interpersonal victimization [44]. There is also evidence linking engagement in risky online behavior and online interpersonal victimization with offline experiences and behaviour. These include victimization in the form of child abuse and bullying, engagement in offline physical relational and sexual aggression as well as conflicts with caregivers [10 16 21 22 45 46]. These offline experiences have existed prior to the advent of new communication technologies. It has been postulated that the integration of the Internet into the lives of youth has resulted in the extension of problems encountered offline to online interactions. Consequently, a broad view which incorporates electronic victimization within the victimization spectrum has been proposed by some researchers in preference to considering traditional and electronic victimization as separate entities [13 47]. This perspective would be valuable in seeking strategies to reduce the prevalence of various forms of youth victimization as a whole [13]. Current research suggests that the determinants of exposure to online interpersonal victimization and consequent harm are a composite of general factors that may interact with specific factors which enhance individual vulnerability. General factors include adolescent-related interests in social communication and sexual

exploration, gender, as well as cultural norms [48 49]. Specific vulnerabilities may be related to past or concurrent offline victimization, difficult family relationships, alternative sexual orientation, problem behavior, substance abuse and accompanying psycho-social difficulties which could influence the propensity to engage in problematic interactions online [16 43 49].

The objective of this study was to determine the prevalence of online interpersonal victimization among Malaysian adolescents using social networking sites (SNS) and its association with patterns of SNS use, offline victimization, offline perpetration as well as parental conflict. There is a lack of research to explore risks encountered by youth using digital communication from middle income Asian countries such as Malaysia. Over the past decade, there has been rapid expansion in the Internet penetration rate and the use of mobile communication devices throughout Malaysia. A programme called CyberSAFE in schools was launched by the Malaysian government in response to emerging safety threats [50]. Through a partnership between government agencies and the telecommunication industry, a series of training workshops on cybersecurity have been conducted for teachers and students across the country [51 52]. Concommitant school surveys within this programme have found that electronic aggression is a common problem, especially among older adolescents [50 51]. Almost half of those surveyed were found to practice low levels of online safety. Another finding was that awareness of online dangers did not translate into positive action [51]. Building on these preliminary findings, this study explores factors which may contribute to victimization. This would provide an evidence base for designing interventions to reduce online victimization. The study findings would also be relevant in the formulation of policies and legislation to protect young persons.

Social networking sites incorporate features which facilitate communication and the development of social relationships. These include (a) the integration of various levels of private and public communication (b) accessibility to a network of contacts (c) the ability to display and exchange personal information in textual form as well as digital images [53 54]. However the same features simultaneously generate avenues for victimization [14 42 55]. The SNS platform was selected to study electronic aggression among youth based on these features and its popularity among adolescents as a communication tool [50 53 54 56].

Based on the aforementioned research, factors which could affect exposure to online interpersonal victimization were organized into a conceptual framework (Figure 1). The focus of this study was on variables associated with greater intensity of victimization as measured by frequency.

Older adolescents were selected for this study. This age group was identified to be vulnerable by the Malaysian CyberSAFE programme [50 51].

The following research questions were addressed:

1. What is the prevalence of SNS usage and specific online behaviours among adolescents?
2. What is the prevalence of online or offline victimization and perpetration experienced by adolescents using SNS?
3. Is there an association between frequent online victimization and online behaviour?
4. Is there an association between frequent online victimization and experiences of offline victimization, online perpetration, offline perpetration and parental conflict?

METHOD

Sample

The study was conducted with students from public secondary schools in the state of Negri Sembilan. The multi-ethnic composition within this state resembles that of the national population. Twelve schools (7 urban, 5 rural) were randomly selected from a list of 117 schools. The sample was drawn from Form 4 students aged between 15 and 16 years of age. For each selected school, 4-5 classes of Form 4 students were randomly selected. Sample size was calculated based on previous studies of online victimization reporting prevalence rates ranging from 5% to 55% [9 22 57]. An upper estimate that 55% of students would be likely to experience at least one type of victimization was used. We assumed a confidence interval of 95% and precision of 2.5%, inflated for missing data of 30%. These assumptions yielded a sample size of approximately 1560.

Procedure

Students completed an anonymous self-administered paper and pencil questionnaire. Participation was voluntary with assurances that confidentiality would be maintained and responses would not influence school grades. The surveys were conducted in classes in a single session. Questionnaires were administered without the presence of class teachers. These procedures were necessary to increase response and disclosure. At the end of every survey session, all students were provided with an information sheet containing a list of contacts of available support services and helplines.

Instrument

Details of the questionnaire are provided in a supplementary file. The questionnaire contained items regarding socio-demographic characteristics and details regarding the

use of social networking sites (SNS). A number of items measured risky online behavior relating to the public display of personal information, interaction with individuals encountered online without a prior offline introduction and disclosure of personal information to such individuals. Online victimization as well as online perpetration in the form of harassment and unwanted sexual solicitation in the previous 12 months was measured with questions adapted from the Growing Up with Media Survey and the Youth Internet Safety Survey [22 44]. Lifetime experiences of offline victimization were assessed using the validated ISPCAN Child Abuse Screening tool for young adults [58]. Offline perpetration was measured in 3 domains (psychological, physical, sexual) with 4 stem questions from the Growing Up with Media Survey [22]. A validated version of the Measure of Parenting Style was used to assess parental conflict levels [59].

Ethical considerations

Institutional approval was granted by the Medical Ethics Committee of the University of Malaya Medical Centre (MEC 890.97). Permission for data collection was obtained from the Ministry of Education and the state Department of Education of Negri Sembilan. Informed consent was obtained from school authorities and parents. Students gave their assent to participation.

Statistical Analysis

Data was analyzed using Statistical Package for Social Sciences (SPSS) windows version 22.0. Descriptive statistics of the type and frequency of specific risky online behaviours, victimization and perpetration experiences was reported in proportions. Subgroup analysis focusing on gender differences of these behaviours and

experiences were also examined and reported. Missing data for each variable of interest was less than 5% of the cases, and listwise deletion analysis was conducted for complete cases. Multiple logistic regression analysis was used to estimate the odds of reporting frequent online victimization among SNS users. The odds of frequent online victimization were estimated for specific online behaviour, types of online behaviour and engagement in multiple forms of online behaviour. The odds were adjusted for demographic and SNS use characteristics. Next, odds ratios were estimated to examine the association between offline victimization, parental conflict as well as online perpetration with frequent online victimization by further adjusting for the total number of online behaviours.

RESULTS

Socio-demographic characteristics

The response rate from a total of 1,634 students was 91% after eliminating 3 refusals and 144 incomplete responses. The 1,487 respondents were aged between 15 to 16 years of age, of which 53.9% were female. They comprised predominantly Malay (69.6%) followed by 16.7% Indian, 13.6% Chinese and 0.2% other ethnic groups. Approximately 90% were living with both of their parents. Seventy percent of their parents had completed at least a secondary school education. As there were no significant differences between data from urban and rural schools, results from both groups of schools were merged and analysed together.

Prevalence of SNS usage

Ninety-two percent of respondents had used at least one social networking site (SNS). The rest of the analysis was based on this subset denoted as “SNS users”. More than a

third of SNS users started at the age of 12 years or younger, below the recommended age for SNS use. The most commonly used SNS was Facebook. Approximately half of the adolescents possessed more than one profile and 45.4% accessed their profiles daily. Duration of weekly use ranged from 20 minutes to 100 hours with a median of 3 hours. Two-thirds had more than 300 "friends" or contacts in their profile, with a third reporting more than a 1000 contacts. Communication and social interaction were found to be the most important reasons for SNS use compared to other purposes such as leisure, keeping up with peers and public participation. Half of the respondents (50.2%) acknowledged using SNS to meet new people and make new friends. Three-quarters (74.5%) had accepted requests to include unknown persons into the list of contacts with no significant gender differences.

Prevalence of Specific Risky Online Behaviour

The prevalence of different types of online behaviours involving personal information disclosure, interaction with strangers and online perpetration is shown in Table 1. Of these, the most commonly reported online behaviour was interacting with strangers while the posting of revealing images was the least common. With the exception of sending personal information to strangers, most of the listed behaviours including online perpetration were found to be more common among males. Approximately one in three had engaged in at least one of the 6 listed behaviours while nearly a third had engaged in 3 or more (31.8%). There was a significant upward trend of engagement in multiple risky online behaviours among males compared to females (p<0.001). (See Figure 2).

Table 1 : Prevalence of specific risky online behaviors (N = 1364)

Specific online behaviour	Male (N=646) (%)	Female (N=718) (%)	Total (N=1364) (%)	*p* value
Posting personal information on a public profile	36.1	29.7	32.7	**0.012**
Sending personal information to a stranger[1]	45.2	47.5	46.4	0.397
Posting revealing photographs or videos	2.2	0.8	1.5	**<0.001**
Interaction with stranger[1]	89.9	86.5	88.1	0.050
Perpetration of harassment	37.2	27	31.8	**<0.001**
Perpetration of unwanted sexual solicitation	5.3	0.4	2.7	**<0.001**

p value based on Pearson's chi-square test comparing differences in risky online behaviours between genders
p value in bold significant at $p<0.05$
[1] "stranger" refers to a contact encountered solely through an online SNS without a prior face-to-face meeting

Prevalence of Victimization

The prevalence of online victimization, online perpetration, offline victimization and offline perpetration by gender is shown in Table 2.

Online victimization

More than half of the respondents (52.2%) had experienced some form of online victimization. The prevalence of online harassment was higher than unwanted sexual solicitation. Males were significantly more likely to experience online harassment compared to females. Whilst females were more likely to report unwanted sexual solicitation, the gender difference was not statistically significant. Frequent online victimization was slightly more common among males than females.

Online perpetration

One in three respondents reported engaging in some form of perpetration online. Perpetration of online harassment or aggression was more common than unwanted

sexual solicitation. Males had a significantly higher prevalence of both types of behaviour and were more likely to be frequent perpetrators.

Offline victimization

There was a high prevalence of offline victimization in general (60.3%) reported by the study population with about one-third of SNS users reporting experiences of multiple types of victimization. Physical victimization was the most prevalent, followed by psychological and sexual. There were no significant gender differences found among subtypes of victimization except for psychological victimization which was more prevalent among females.

Offline perpetration

Offline perpetration was reported by 37.5% of the respondents. About a quarter of the respondents reported having perpetrated either psychological or physical aggression towards others. The prevalence of offline sexual perpetration was much lower, at around 3%, and was more commonly reported by males. About one in every 10 respondents had engaged in multiple types of perpetration.

Table 2: Prevalence of victimization and perpetration experiences by types and gender

Type of Exposure	Male (N=646) %	Female (N=718) %	Total (N=1364) %	*p* value
Online victimization	54.8	49.9	52.2	0.068
*Types**				
Online harassment	52.2	43.3	47.5	**<0.001**
Sexual solicitation	17.2	20.8	19.1	0.094
Frequency of victimization				**0.002**
Frequent victimization	19.3	12.4	15.7	
Infrequent victimization	35.4	37.5	36.5	

No victimization	45.2	50.1	47.8	
Online Perpetration	37.6	27.0	32.0	**<0.001**
*Types**				
Online harassment	37.2	27.0	31.8	**<0.001**
Sexual solicitation	5.3	0.4	2.7	**<0.001**
Frequency of perpetration				**<0.001**
Frequent perpetration	14.1	6.8	10.3	
Infrequent perpetration	23.5	20.2	21.8	
No perpetration	62.4	73.0	68.0	
Offline Victimization	58.2	62.3	60.3	0.127
*Types**				
Physical	50.2	47.8	48.9	0.379
Sexual	17.0	17.0	17.0	0.986
Psychological	26.3	39.8	33.4	**<0.001**
Multiple types of offline victimization				
None	37.7	41.8	39.7	0.130
1	30.5	28.7	29.5	
≥2	27.8	33.5	30.8	
Offline Perpetration	39.3	35.8	37.5	0.179
Types*				
Physical	25.9	19.1	22.3	**0.003**
Psychological	23.4	23.5	23.5	0.943
Sexual	5.1	1.5	3.2	**<0.001**
Multiple types of offline perpetration				**0.008**
None	60.7	64.2	62.5	
1	25.9	27.7	26.8	
≥2	12.4	8.1	10.7	

*Categories are not mutually exclusive
p value based on Pearson's chi-square test comparing victimization or perpetration experiences by gender.

Association between risky online behaviour and online victimization

The association between frequent online victimization and online behaviour is summarized in Table 3. Results were adjusted for sociodemographic and SNS use characteristics. The posting of revealing photographs was the only behaviour involving personal disclosure which was associated with a higher risk of online

victimization. Adolescents who engaged in perpetration behaviours were 6 times more likely to report frequent online victimization, compared with online behaviours involving personal disclosure. There was a significant dose-response relationship between engagement in multiple types of online behaviour and the risk of frequent online victimization. Neither the length of time spent on SNS nor the number of people in the respondents' contact lists were found to be associated with frequent online victimization.

Table 3. Association of online victimization with risky online behaviours

Characteristics	Odds of Online Victimization			
	Adjusted for Socio-demographic Characteristics		Adjusted for SNS Use Characteristics	
	AOR (95% Cl)	*p* value	AOR (95% Cl)	*p* value
Specific Online behaviour				
Posting personal information on a public profile	1.1 (0.7-1.4)	0.913	1.1 (0.7-1.3)	0.830
Sending personal information to strangers	1.7 (1.3-2.4)	0.001	1.2 (0.9-1.7)	0.309
Interaction with strangers	1.4 (0.8-2.4)	0.198	1.1(0.6-2.0)	0.682
Posting revealing pictures	**3.0 (1.2-7.5)**	**0.018**	**3.5(1.4-8.9)**	**0.007**
Perpetration of harassment	**6.1 (4.4-8.6)**	**< 0.001**	**5.6 (4.0-7.9)**	**<0.001**
Perpetration of unwanted sexual solicitation	**4.1 (1.9-8.5)**	**< 0.001**	**2.2 (1.1-4.4)**	**0.030**
Types of online behaviour				
Personal disclosure behaviours	1.7 (0.8-3.4)	0.157	1.3 (0.6-2.6)	0.471
Perpetration behaviours	**6.3 (4.5-8.4)**	**< 0.001**	**6.2 (4.5-8.6)**	**< 0.001**
Multiple types of online behaviours				
≤1	1		1	
2	**2.2 (1.4-3.6)**	**0.001**	**2.4 (1.5-3.8)**	**<0.001**
3	**4.1 (2.5-6.7)**	**< 0.001**	**4.2 (2.6-6.7)**	**< 0.001**

≥4	**5.9 (3.4-10.5)**	**< 0.001**	**6.4 (3.7-11.1)**	**< 0.001**

Abbreviations: AOR adjusted odds ratio; CI, confidence interval
Personal disclosure behaviours consist of posting and sending personal information, interacting with strangers and posting revealing pictures
Perpetration behaviours include adolescents perpetrating harassment and unwanted sexual solicitation
Odds ratio are adjusted for (1) socio-demographic characteristics (ethnicity, gender, geographic location, parent's relationship status and parent's education level) and (2) SNS use (frequency & age of SNS access)

Correlates of Frequent Online Victimization

Both online and offline perpetration were found to be associated with an increased risk of online victimization when adjusted for sociodemographic and internet use characteristics. The observed relationship remained strongly significant after adjustment for total number of online behaviours (see Table 4). Specifically, adolescents who engaged in frequent online perpetration were 12 times more likely to report frequent online victimization. Similarly, an upward trend of frequent online victimization was seen among those who engaged in multiple types of perpetration.

While adolescents who were victimized in the offline world were twice more likely to report online victimization, the odds did not increase with exposure to multiple types of offline victimization. Respondents who experienced high levels of parental conflict were twice more likely to be harassed or victimized online.

Table 4. Association between online victimization with offline and online correlates

Characteristics	**Odds of Online Victimization**			
	Model 1 Adjusted for Socio-demographic and SNS Use Characteristics		**Model 2** Adjusted for Total No. of Online Behaviors	
	AOR (95% CI)	*p* value	AOR (95% CI)	*p* value
Online Perpetration				
None	1	NA	1	NA

Infrequent	**2.6 (1.8-4.0)**	**<0.001**	**1.8 (1.5-2.0)**	**<0.001**
Frequent	**21.8 (13.8-34.5)**	**<0.001**	**12.5 (8.2-18.9)**	**<0.001**
Offline Perpetration				
None	1	NA	1	NA
Offline perpetration	**2.0 (1.5-2.8)**	**<0.001**	**1.6 (1.2-2.2)**	**<0.001**
Multiple types of offline perpetration				
0	1	NA	1	NA
1	**1.6 (1.1-2.3)**	**0.013**	1.3 (0.9-1.8)	0.171
2	**2.9 (1.8-4.7)**	**<0.001**	**2.4 (1.5-3.7)**	**<0.001**
3	**12.3 (3.0-50.2)**	**<0.001**	**7.9 (2.3-27.2)**	**0.001**
Offline Victimization				
None	1	NA	1	NA
Offline victimization	**1.8 (1.3-2.6)**	**<0.001**	**1.7 (1.2-2.3)**	**0.001**
Multiple types of offline victimization				
0	1	NA	1	NA
1	1.4 (0.9-2.1)	0.136	1.0 (0.7-1.6)	0.654
2	2.2 (1.4-3.4)	<0.001	1.4 (0.9-2.1)	0.117
3	3.1 (1.8-5.5)	<0.001	1.6 (0.9-2.7)	0.075
Parental Conflict				
Low	1	NA	1	NA
Medium	1.5 (0.9-2.3)	0.067	**1.6 (1.5-1.9)**	**<0.001**
High	**2.2(1.5-3.2)**	**<0.001**	**1.7(1.2-2.51**	**0.003**

AOR, adjusted odds ratio; CI, confidence interval; NA, data not applicable
Model 1: Odds ratios were adjusted for sociodemographic (ethnicity, gender, geographic location, parent's relationship status and parent's education level) and SNS use characteristics (frequency of access and age of 1st access)
Model 2: Odds ratios were adjusted for total number of online behaviours (posting personal information on a public profile, posting revealing photographs or videos, sending personal information to strangers, interacting with strangers, perpetration of harassment and unwanted sexual solicitation), besides demographic and SNS use.

DISCUSSION

The high prevalence of SNS users and reported motivation for use are consistent with studies in Europe and other local studies [54 56 60 61]. Initiation of SNS use at a young age mirrors findings in Europe where 27% of 9-10 year olds said they had a

SNS profile [62]. Knowledge of these demographic patterns should be applied in initiatives to address the overall safety, well-being and development of youth [63].

Higher levels of interaction with unknown persons were found than what has been previously reported in the U.S. [64] or locally [57]. This may be due to adolescents maximizing avenues for social communication and sexual exploration away from adult scrutiny, particularly within the context of a conservative Asian and predominantly Muslim community. It could also be the consequence of boredom, curiosity and social inhibitions in face-to-face encounters [65]. When such behaviour is normative, a communication-based approach to education on safeguarding individual privacy and security is more likely to be effective than a restrictive approach [66].

The prevalence of online harassment in this study falls within the wide range of existing prevalence estimates of 5.5% and 72% [4-11], confirming that the problem extends to youth in this region and needs to be addressed. The odds of experiencing harassment are marginally higher among youth who report online interaction with strangers suggesting that harassment originates predominantly from known persons. This may include peers who concurrently bully them offline as has been reported by others [11 45 67]. This could not be verified within this study design as there was no specific enquiry to determine if respondents were harassed online and offline by the same individuals. The higher prevalence of online harassment compared to unwanted sexual solicitation resembles the pattern of offline victimization found in this study and other studies, where levels of physical and psychological victimization exceed sexual victimization [68 69].

The higher levels of online harassment experienced by boys in this study has also been reported in other Asian studies [11 15]. This is likely to be related to gender differences in online behaviour. In this study, the most important predictors of frequent online victimization were online perpetration of harassment and unwanted sexual solicitation followed by the posting of revealing pictures (Table 3). These behaviours were more prevalent in boys, who also had a significantly higher prevalence of engagement in multiple risky online behaviours (Figure 2). While a number of studies have found increased electronic aggression directed at girls and a few others reported no gender differences, these have been conducted in Western populations [2 14 31 32 34-38]. We postulate that cultural conditioning and expectations may partly account for these differences [11]. In Asian communities including Malaysia, there is greater tolerance for aggressive behaviour in boys, who are encouraged to be assertive. In contrast, rude or aggressive behaviour, initiating sexual conversations or sharing of revealing photographs by girls evokes criticism, even from peers. This may inhibit their online behaviour and lower their risk of online victimization. These differences suggest that victimization patterns may vary across cultures. This reinforces the value of conducting local research to determine the applicability of international data to specific settings.

The prevalence of unwanted sexual solicitation in this study is higher than recent U.S. studies whereas research from Europe has revealed a wide variation [7 9]. The steady decline in the U.S. has been attributed to increased consciousness with the introduction of Internet safety education programmes as well as changing patterns of

use and better law enforcement. In comparison, safety education programmes are in early stages of development in Malaysia. In contrast to other studies, the absence of gender differences in this study is consistent with previous Malaysian studies on offline victimization [70 71]. This could be related to greater involvement of boys with online perpetration and risky behaviour such as posting of revealing images on their SNS profile. With the widespread utilization of SNS by the majority of youth for an ever-growing range of functions related to leisure activities and social communication, it is postulated that the time spent online may not be a discriminator of victimization risk, unlike earlier studies [21]. This may explain why the duration of time spent online was not a predictor of victimization in this study.

Personal information disclosure other than the posting of revealing images was associated with a marginal increase in the odds of online victimization. Marked risk escalation occurred only when this was combined with a number of other behaviours. This extends the evidence found in another U.S.-based study where engagement in 4 types of online behaviour was associated with a steep rise in the risk of online interpersonal victimization [44]. Among component behaviours, uploading personal revealing photographs and online perpetration were major contributors to risk of online victimization in this study. Involvement in 4 or more listed types of behaviour was seen in less than 10% of respondents in this study. Participation in multiple types of risky behaviour may be a possible marker of individuals with a greater willingness to forgo privacy for self-disclosure as well as to provoke others [2 42 66 72]. Instead of targeting individual types of behaviour in isolation, understanding the psyche of adolescents who belong to this high-risk group may yield more useful strategies for prevention and suggests directions for future research.

Demonstration of the association of frequent online victimization with offline victimization experiences and parental conflict underlines the importance of taking into account broader contextual factors in formulating an understanding of contributors to the risk of online victimization. The adverse psychosocial impact of previous victimization may result in emotional dysregulation and lack of social competence. Convergence of psychosocial difficulties with family conflict and weak family ties may increase an individual's risk of becoming a target of victimization in different ways. Affected persons may be drawn into intimate interactions online, exercise less discretion in their uploading of content and have an increased propensity to express hostility in their online exchanges [16 22 43].

The study findings that both online and offline perpetration are important predictors of online victimization adds to evidence from previous studies [43]. Examining underlying motivations and triggers of this form of aggression would be a logical step to address online victimization. As adolescents seek to establish their identity and grapple with issues relating to intimacy and sexuality [48], aggression may be employed as a strategy offline and online to establish and maintain social dominance. This could result in subsequent targeting for victimization by rivals [73].

The following study limitations are acknowledged. Results are based on self-reporting which is subject to distortion from errors in recollection and social-desirability biases that could result in underrerporting [48]. The high response rate and the anonymity assured in the study increased the possibility of reporting an unwanted experience among the adolescents. The cross-sectional design limits inferences regarding the

direction of associations found. The relationship between perpetration and victimization may be bidirectional, i.e. perpetration could result in victimization or be a reaction to victimization, extending across online and offline interaction. In addition, other factors such as academic performance [15 37], sexual orientation [74] and conduct problems [22 45] which have been found to be associated with online victimization were not explored in this study. The narrow age range and predominantly Malay respondents in this sample limits generalizability. Further studies across a wider age group could be a direction for future research.

CONCLUSION

More than half of Malaysian youth SNS users have encountered victimization both online and offline. Approximately one third have engaged in perpetration online and offline. Boys experienced more frequent online harassment compared to girls. However there were no significant gender differences in experiences of unwanted sexual solicitation online. Engagement in online perpetration and multiple types of online risky behaviour was more prevalent in boys and associated with higher odds of frequent online victimization. Experiences of offline victimization, parental conflict and engagement in perpetration offline were also associated with higher odds of frequent online victimization.

The study establishes that perpetration behaviour both online and offline should be an important target for intervention to prevent online electronic aggression, with a particular focus on boys. It also demonstrates the need to equip both genders with coping strategies to deal with unwanted sexual solicitation [43]. While specific affordances within platforms may facilitate victimization and evolve with

development of new technologies, the focus should be on equipping youth with skills in communication and decision-making in relationships that can be applied across a spectrum of contexts both online and offline [63]. The findings of a high prevalence of offline victimization and its association with online victimization suggest that prevention efforts should be directed across a broad spectrum of victimization types instead of diverting resources to focus on online victimization [13]. In addition, adolescent health care professionals should be aware of the need to explore other forms of victimization in adolescents who disclose online victimization [68].

CONTRIBUTORSHIP STATEMENT

Mary J Marret conceived the study design, supervised the data collection and wrote the manuscript.

Wan-Yuen Choo carried out the statistical analysis and co-wrote the manuscript.

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COMPETING INTERESTS

The authors have no competing interests to declare.

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DATA SHARING STATEMENT

The dataset for this research has not yet been uploaded into a data repository.

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Figure 1: Conceptual framework of factors which may affect exposure to online victimization

Figure 2: Cumulative risky online behaviour by gender

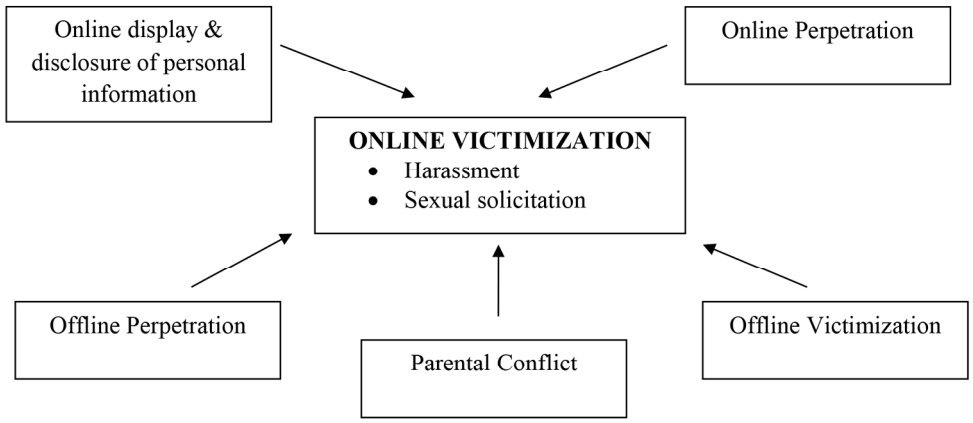

Figure 1: Conceptual framework of factors which may affect exposure to online victimization

172x85mm (300 x 300 DPI)

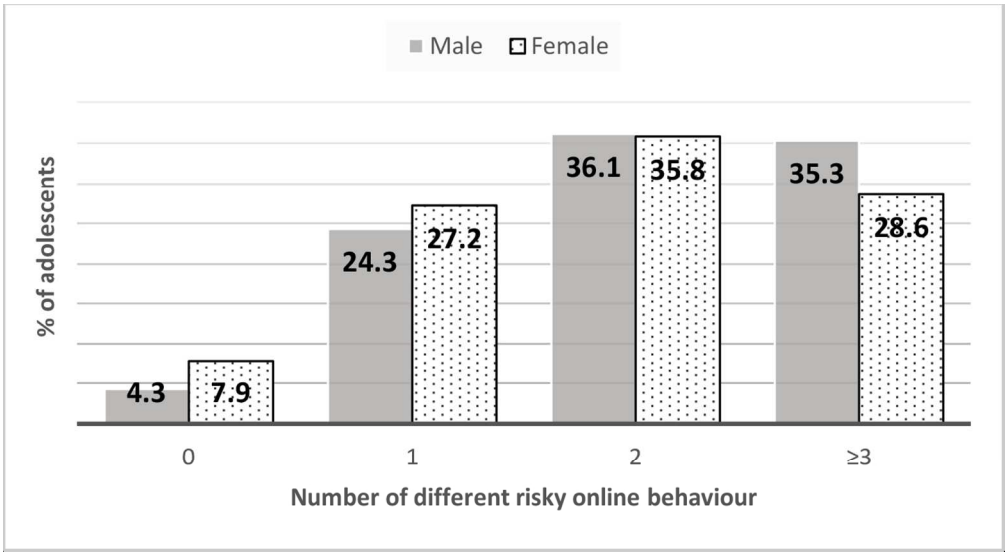

Figure 2: Cumulative risky online behaviour by gender

121x66mm (300 x 300 DPI)

Details of questionnaire used in survey

The following items were included in the questionnaire:

Socio-demographic information. Items included were age, gender, ethnicity, place of residence, parents' marital status and parents' education level.

Use of social networking sites (SNS). Items included were the age of initiation of SNS use, motivation for use, most frequently used SNS, number of SNS profiles, frequency and duration of access to SNS, number of SNS contacts and motivations for use

Privacy settings and disclosure of personal information on SNS. Items included were the use of privacy settings on their SNS profiles and about specific behaviors pertaining to public display of personal information on user profiles as well as the sharing of personal information and interaction with "SNS contacts". The term SNS contacts denoted individuals encountered solely through a SNS without a prior face-to-face introduction.

> Posting of personal information was measured by display of any of the following data on a publicly accessible profile: real name, photograph, residential address, name of school, telephone number
>
> Disclosure of personal information was deemed to occur if any of the following data were sent to an SNS contact: real name, photograph, address, name of school, telephone number
>
> Posting of revealing images was deemed to occur if an image (either a still photograph or video) of the respondent clad only in a swimsuit or undergarments was displayed on a publicly accessible SNS profile

Interaction with strangers was deemed to occur if respondents accepted "friend requests" from individuals unknown to them or communicated with such individuals through chat, replying of messages or posting comments on their wall

Victimization on SNS. The following items assessed victimization within the previous 12 months under categories of harassment and unwanted sexual solicitation. The frequency of these experiences was indicated on a 6-point scale which ranged from "daily or almost daily" to "never". To facilitate statistical analysis, the responses were grouped under three categories: (1) frequent (experiences occurred at least a few times a year) (2) infrequent (experiences occurred once in the past 12 months (3) never

Harassment was measured through 3 questions adapted from the Growing Up with Media Survey (whether someone made rude or mean comments, spread rumours whether they were true or not, made threatening or aggressive remarks [1]

Unwanted sexual solicitation was measured with 3 questions adapted from the Youth Internet Safety Survey (whether someone had forced sexual talk when they were unwilling, whether someone had asked for sexual information about themselves which they were unwilling to share or if someone had asked them to do something sexual against their will) [2].

.

Previous studies have shown high reliability for both instruments. The internal reliability estimated with Cronbach's Alpha was .93 for Internet sexual solicitation victimization and 0.79 for Internet harassment victimization [1 3 4].

Perpetration on SNS. The following items assessed self-reported online perpetration within the previous 12 months under categories of harassment and unwanted sexual solicitation. The frequency of these actions was indicated on a 6-point scale which ranged from "daily or almost daily" to "never". To facilitate statistical analysis, the responses were grouped under three categories: (1) frequent (respondents did this at least a few times a year) (2) infrequent (respondents did this once in the past 12 months (3) never.

Perpetration of harassment was measured with three questions from the Growing Up with Media Survey (making rude or mean comments, spreading rumours about someone whether they were true or not, directing threatening or aggressive comments towards others on SNS) [1].

Perpetration of unwanted sexual solicitation was measured with three questions adapted from the Youth Internet Safety Survey (forcing others to engage in sexual talk, asking for sexual information or asking another to do something sexual when they were unwilling) [1].

The internal reliability for the measures was estimated with Cronbach's Alpha: Perpetration of harassment (Cronbach .82); and Perpetration of unwanted sexual solicitation (Cronbach .93) [1].

Experiences of offline victimization. Lifetime experiences of offline victimization were assessed using the validated ISPCAN Child Abuse Screening tool for young adults Version ICAST-R with 5 stem questions each assessing three domains of offline victimization (sexual abuse, physical abuse or psychological abuse). For each stem question, the response options were: (1) yes; (2) no and (3) cannot remember. For each positive response, follow-up questions enquired about the frequency of maltreatment experiences and the category of the perpetrator. A positive response to at least one stem question denoted victimization in that particular domain. A summary index indicating the number of categories of victimization was created ranging from 0 (none) to 3 (all three types). Previous studies have shown moderate to high reliability [5].

Offline bullying. Lifetime perpetration of offline bullying was assessed using 4 stem questions to measure three domains (1) psychological (not allowing a peer to join in a group out of anger or hostility, spreading rumours about someone whether they were untrue or not) (2) physical (pushing, beating or slapping a peer) (3) sexual (kissing or touching a peer sexually when they did not consent). For each item, respondents were asked the frequency of these actions on a 6-point scale from “daily or almost daily” to “never” [1]. A summary index of the number of types of perpetration was created ranging from 0 (none) to 3 (all three types).

Parental conflict. A validated version of the Measure of Parenting Style (MOPS) was used to assess parental conflict levels with 15 core items assessing Parental Indifference (6 items), Parental Over-Control (4 items), and Parental Abuse (5 items). Responses were scored on a 4-point Likert type scale as follows: 0 = not true at all; 1 = slightly true; 2 = moderately true; 3 = extremely true. A total score was derived from summation of scores for all the items with higher scores indicating greater levels of parental conflict. The instrument has shown moderate to high reliability and validity. Previous studies with Cronbach's alphas ranging from .76 to .93 suggest

that the measures are within acceptable internal consistency while test-retest coefficients for the subscale ranged from 0.74 to 0.94, indicating high to moderate consistency [6].

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2. Ybarra ML, Mitchell KJ, Finkelhor D, et al. Internet prevention messages: Targeting the right online behaviors. Archives of Pediatrics & Adolescent Medicine 2007;**161**(2):138
3. Finkelhor D, Mitchell K, Wolak J. Online Victimization of Youth: Five Years Later. 2007
4. Wolak J, Mitchell K, Finkelhor D. Online Victimization of Youth: Five Years Later. Virginia: National Center for Missing and Exploited Children, 2006.
5. Dunne MP, Zolotor AJ, Runyan DK, et al. ISPCAN child abuse screening tools retrospective version (ICAST-R): Delphi study and field testing in seven countries. Child abuse & neglect 2009;**33**(11):815-25
6. Parker G, Roussos J, Hadzi-Pavlovic D, et al. The development of a refined measure of dysfunctional parenting and assessment of its relevance in patients with affective disorders. Psychological Medicine 1997;**27**(05):1193-203 doi: doi:10.1017/S003329179700545X[published Online First: Epub Date]|.

STROBE 2007 (v4) Statement—Checklist of items that should be included in reports of *cross-sectional studies*

Section/Topic	Item #	Recommendation	Reported on page #
Title and abstract	1	(*a*) Indicate the study's design with a commonly used term in the title or the abstract	Title & abstract 1-2
		(*b*) Provide in the abstract an informative and balanced summary of what was done and what was found	Title & abstract 2
Introduction			
Background/rationale	2	Explain the scientific background and rationale for the investigation being reported	Introduction 4-6
Objectives	3	State specific objectives, including any prespecified hypotheses	Introduction 6-7
Methods			
Study design	4	Present key elements of study design early in the paper	Methods 7-8
Setting	5	Describe the setting, locations, and relevant dates, including periods of recruitment, exposure, follow-up, and data collection	Methods 7-8
Participants	6	(*a*) Give the eligibility criteria, and the sources and methods of selection of participants	Methods 7-8
Variables	7	Clearly define all outcomes, exposures, predictors, potential confounders, and effect modifiers. Give diagnostic criteria, if applicable	Methods 7-9
Data sources/ measurement	8*	For each variable of interest, give sources of data and details of methods of assessment (measurement). Describe comparability of assessment methods if there is more than one group	Methods 7-9
Bias	9	Describe any efforts to address potential sources of bias	Procedure 7-8
Study size	10	Explain how the study size was arrived at	Sample 7
Quantitative variables	11	Explain how quantitative variables were handled in the analyses. If applicable, describe which groupings were chosen and why	Statistical analysis 9
Statistical methods	12	(*a*) Describe all statistical methods, including those used to control for confounding	Statistical analysis 9
		(*b*) Describe any methods used to examine subgroups and interactions	Statistical analysis 9
		(*c*) Explain how missing data were addressed	Statistical analysis 9
		(*d*) If applicable, describe analytical methods taking account of sampling strategy	Not applicable
		(*e*) Describe any sensitivity analyses	Not applicable
Results			

Participants	13*	(a) Report numbers of individuals at each stage of study—eg numbers potentially eligible, examined for eligibility, confirmed eligible, included in the study, completing follow-up, and analysed	Statistical analysis 7 & 9
		(b) Give reasons for non-participation at each stage	Sample 7
		(c) Consider use of a flow diagram	Explained in text 7& 9
Descriptive data	14*	(a) Give characteristics of study participants (eg demographic, clinical, social) and information on exposures and potential confounders	Results 9 - 17
		(b) Indicate number of participants with missing data for each variable of interest	Statistical analysis 9
Outcome data	15*	Report numbers of outcome events or summary measures	Results 9 - 17
Main results	16	(*a*) Give unadjusted estimates and, if applicable, confounder-adjusted estimates and their precision (eg, 95% confidence interval). Make clear which confounders were adjusted for and why they were included	Results 9-17
		(*b*) Report category boundaries when continuous variables were categorized	Results 9 - 17
		(*c*) If relevant, consider translating estimates of relative risk into absolute risk for a meaningful time period	Not relevant
Other analyses	17	Report other analyses done—eg analyses of subgroups and interactions, and sensitivity analyses	Results 9 -17
Discussion			
Key results	18	Summarise key results with reference to study objectives	Discussion 17 - 21
Limitations	19	Discuss limitations of the study, taking into account sources of potential bias or imprecision. Discuss both direction and magnitude of any potential bias	Discussion 17 -21
Interpretation	20	Give a cautious overall interpretation of results considering objectives, limitations, multiplicity of analyses, results from similar studies, and other relevant evidence	Discussion 17 -21
Generalisability	21	Discuss the generalisability (external validity) of the study results	Discussion 17 -21
Other information			
Funding	22	Give the source of funding and the role of the funders for the present study and, if applicable, for the original study on which the present article is based	Funding 23

*Give information separately for cases and controls in case-control studies and, if applicable, for exposed and unexposed groups in cohort and cross-sectional studies.

Note: An Explanation and Elaboration article discusses each checklist item and gives methodological background and published examples of transparent reporting. The STROBE checklist is best used in conjunction with this article (freely available on the Web sites of PLoS Medicine at http://www.plosmedicine.org/, Annals of Internal Medicine at http://www.annals.org/, and Epidemiology at http://www.epidem.com/). Information on the STROBE Initiative is available at www.strobe-statement.org.