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Detecting online grooming at its earliest stages: development and validation of the Online Grooming Risk Scale

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Abstract

Backgrounds: Among the problematic online behaviours, online grooming, that is, a manipulative process leading to sexual solicitation between an adult and a minor, is receiving increasing attention. However, most of the studies come from qualitative data, confirming that a formalized measurement tool is still missing. Moreover, online grooming measurement mostly relies on its latest, advanced stages, when the abuse and the actual exchange of sexual material has already occurred and reported to the authorities. The aim of the present study is to develop and validate a measurement instrument grasping the earlier stages of the phenomenon.

Methods: The psychometric properties of the Online Grooming Risk (henceforth, OGR) scale were assessed in a validation study conducted on 316 adolescents, and its location within a network of psychological constructs relevant to the literature was examined with a non-parametric approach, the Structural Equation Modeling based on Partial Least Squares.

Results: Results confirmed reliability and validity of the OGR scale. Moreover, its association with both protective (e.g., a good family support) and risk antecedents (e.g., low self-esteem), as well as with the development of clearly sexualized references, seems also confirmed.

Conclusions: The OGR tool configures itself as a useful resource in perspective of an early detection of online grooming. The study also highlights the protective role of family support and low self-esteem as a significant risk factor.

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1. Introduction

The term *online-grooming* was first introduced by Salter (1995) to describe a manipulative process in which the groomer, usually an adult, selects, involves and maintains a sexually abusive/exploitative relationship with children and adolescents. According to Salter, the adult represents a potential predator carrying out an emotional seduction, in order to induce minors to take part in sexual activities. The starting point is the use of online platforms, which may lead to the exchange of sexually-nuanced images and videos and, at its worst outcome, to abuse in real life. *Online-grooming* is still a little-known phenomenon, given its recent emergence, which coincides with the spread of the Internet, particularly social networks, chat rooms and other platforms that increasingly characterize everyone's everyday life (Craven et al., 2006). The advent of the Internet is, without doubts, a great educational and entertainment resource. However, the virtual world has a dark side, such as anonymity, a blurred boundary between reality and fiction, as well as unwanted exposure (Boyd et al., 2020).

There are different platforms for online interaction (e.g., chat rooms, blogs, magazines or online social networks): even though they encourage contacts and connections, they also exponentially increase threats, forms of violence, harm and abuse. Problematic behaviours related to the use of the Internet include Internet addiction and cyber-bullying, but little attention has been paid to online grooming. In fact, although most young people communicate online with other people they already know (Gross, 2009; Valkenburg & Peter, 2007), about 14% say they entertain relationships with strangers (Wolak et al., 2003); Ybarra and Mitchell (2008) explored online platforms usage, showing that the most commonly used platforms for sexual solicitation purposes are IM instant messaging (42.5%), chat rooms (31.7%), social networking sites (27.1%), e-mail (21.6%), online games (17.9%) and blogs (5.5%). On the other hand, Ospina and colleagues (2010) highlighted how the most common victims of this phenomenon are young adolescents. However, online grooming does not match with the either online or offline sexual abuse. Rather, it refers to a psychological manipulative process used to lure children online: it is based on “care,” apparent interest and involvement through which the groomer “works” to earn relationship trust, closeness and intimacy with the aim of engaging a minor in sexual activities. The illusion of a private and anonymous context provides young people a pretext to interact with strangers, who sometimes turn out to be malicious and to take advantage of an initial friendship to deceive the victim (Davidson et al., 2012). Groomers usually leverage psychological fragilities of the troubled subject, dragging him or her into a confidential space where it is possible to open up about family issues or teenage crises with a “person of trust.”

The emotional support received in the relationship plays a key role in this process: the stronger the emotional connection, the stronger the dependence from the persecutor, who seizes the personal vulnerabilities of the victim (e.g. lack of self-confidence, need for approval/acceptance). A common characteristic of vulnerability is that it progressively pulls one away from himself/herself: when others become a source of attention, care, value and self-esteem, and they can “pull the right strings,” being manipulated is easier (Braiker, 2004). The vulnerability aspect has been documented in grooming victims, who were more prone to groomer’s manipulation (Whittle et al., 2013a; 2013b).

Due to its own nature, strongly focused on the potential for increased risk when unfolding a “digital” identity, online grooming, as well as other similar phenomena (e.g. cyberbullying), can lead to important bio-psycho-social effects (Machimbarrena et al., 2018). The clinical and psychological repercussions of online grooming can be observed in a variety of studies that connected it to internalisation problems (i.e., emotional and behavioural disorders and the urge to exert hyper-control over the events of one's life) and externalisation ones, such as aggressiveness, impulsiveness and hyperactive behaviors, a lack of attention span, poor compliance and provocation, decline in an adequate quality of life, suicidal ideation and strong interference, with relative deterioration, in educational, social and family life (Berliner, 2018; Gámez-Guadix et al., 2013; Temple et al., 2014; Van Geel et al., 2014). The clinical impact becomes extremely important mostly from an individual point of view: indeed, the victim often experiences feelings of guilt, shame and presumed unconscious complicity towards the abuser, which can result either in structural personality disorders, or in depression (Berliner, 2018) and paranoid ideation of always being the object of stereotyping (Calvete et al., 2021; Gámez-Guadix et al., 2018). Finally, other psychopathological outcomes frequently associated with online grooming are anxiety disorders and post-traumatic stress disorder (Calvete et al., 2021). This empirical evidence confirms that online grooming is an increasingly frequent and critical issue. Therefore, it is becoming more important to assess the risk factors related to this phenomenon, which would be useful to plan appropriate action when exposure to the situation is already manifest.

1.1 Grooming processes and techniques

Online sexual solicitation techniques are different and multifaceted. The same solicitors act with different motivations and modus operandi. The victim's contact with the adulterers usually takes place through either online chats or the use of the above-mentioned platforms, mainly at night. The online predator is adept at collecting personal information from vulnerable individuals who

are possible targets of abuse. The developing relationship is characterized by a power imbalance between the executioner and victim, in which friendship and intimacy are exploited for the purpose of sexual interaction. O'Connell (2003) identified sequential phases in the process:

- 1) *Friendship forming stage*, in which the lookout approaches the victim with intent to establish a confidential relationship. He/she aims at gaining the victim's trust through personal and emotional openness/disclosure.
- 2) *Relationship forming stage*: after gaining trust, the groomer works actively to strengthen the relationship, becoming a reference point for the victim.
- 3) *Risk assessment stage*, where the cyber-predator tries to obtain as much information as possible about any potential risk by asking, for example, whether victim's parents are aware of this "friendship" or whether they are used to check his/her online activity.
- 4) *Exclusivity stage*, in which, after establishing that risks are absent or of no concern, a relationship of secrecy and exclusivity is established.
- 5) *Sexual stage*, in which the seducer asks intimate, personal questions, begins to express his/her "feelings" towards the victim. In this last phase, there is usually a mutual exchange of intimate photos and speeches about sexual activity (O'Connell, 2003).

In the current literature, measurement tools and scales recently developed mainly focus and assess the latter phase: a scientific example is the *Batería En-Red-A2*, recently developed and validated by Peris and Maganto (2018), while in most of the Italian contexts, data come from either ad-hoc questionnaire, interviews and, in most cases, from abuse reports. (SOS Telefono Azzurro ONLUS, 2019).

1.2 Risk factors and protective factors

Although recent apparitions, online grooming is still little studied and deepened (De Santisteban et al., 2018). Literature does not offer a wide range of results on what risk factors might increase the development of the phenomenon. Moreover, grooming is better known and analysed in its final stages, i.e., in the phases of explicit material exchange and possible offline meetings. However, the phenomenon includes much more, and identifying potential risks in a preliminary phase also becomes fundamental for a timely prevention or intervention, also in the light of the potential clinical implications outlined in the above-mentioned paragraphs. The main purpose of this study is to develop and validate a scale to measure online grooming risk and its relationship with either protective or risk factors. With respect to the latter, literature highlighted

how low or total lack of self-esteem could increase the risk of online grooming (Whittle et al., 2013a; 2013b). Ospina and colleagues (2009) stated that low self-esteem could be an important antecedent of emotional immaturity, depressive symptoms, introversion and social or learning difficulties. According to the authors, low self-esteem is among factors predisposing children and young people to sexual abuse. Sociodemographic factors associated with online sexual solicitation include gender (in particular female, older than 14). Çam and Isbulan (2012) found out that adolescents with low levels of social skills and self-esteem are exposed to a greater risk of engaging in problematic use of social networking sites. Having a vulnerable personality, suffering the judgment of others in a significant way are considered risk factors that could make users more likely to develop online problems. People with low levels of self-esteem and high social anxiety may experience difficulties in face-to-face communication, and may tend to prefer online interaction (e.g. via Facebook), that is, a much more comfortable context (Boyce & Parker 1989).

In addition, teenagers often navigate online with little to no adult control. According to McAfee (2012), 70% of children hide their online behaviour to the parents. At the same time, parents themselves tend to underestimate potential risks of the online environment, on the belief that there is no substantial difference between online and offline dangers. Yet, according to data provided by ISTAT (Safe Internet Centre Italy, MIUR; 2016), most adolescents (32% of boys and 41% of girls) received unwanted proposals or messages, followed by finding themselves in illegal situations (22% M and 16% F) and unpleasant content that concerned them personally (18% M and 14% F). Different European quantitative surveys channelled into the European Kids Online (www.eukidsonline.net), a multinational research network, found that 61% of parents of children who met an online contact are unaware of this, and 56% of parents of children who received offensive messages online are unaware that this has happened as well (Livingstone et al., 2011). Mishna and colleagues (2009) better explored the abused adolescents' perspective: by analysing different male and female participants' posts on a counselling website, children and adolescents engaged in online relationships very quickly, despite their apparent awareness of the dangers inherent on the Internet. Results revealed the regularity and importance of both Internet and other communication technologies for socialisation, the impact of cyber abuse and especially children' and young people's being afraid to disclose it to adults, especially to parents. Young people stated parents' exclusion was related to concerns about possible reactions and consequences, (e.g., deleting their accounts).

Deleterious effects of cyber abuse include depression, confusion, humiliation, remorse, shame, self-harm and detachment from companions and relatives. Being a victim of sexual exploitation can also cause feelings of shame and guilt as well as a seriously damaged self-esteem (Palmer & Stacey, 2004). Rosen and colleagues (2008) stated that pre-adolescents in the 10-17 age group in the USA experienced sexual solicitation with psychological repercussions affecting 19% of the cases.

Promptly identifying and reducing these risks becomes very important. A good, opened, positive communication inside the family and the subsequent support could represent a protective factor against the online grooming risk (Dorasamy et al., 2018). Support can infuse emotional security (García Mendoza et al., 2019), self-confidence perceptions (Fu et al., 2020) and early warnings about Internet behaviours.

In line with the literature about online grooming assessment and measurement, as well as protective and risk factors, the present work focuses on the early stages of the online grooming process. This research has a twofold purpose: first, validating a measurement tool to grasp online grooming as it unfolds. Insights from a qualitative investigation will guide identification and operationalization of most indicative aspects of an exposure to the phenomenon. In light of the tool's development, the examination of psychometric robustness as well as the conceptual framework concerning grooming-related triggers, the following hypotheses are formulated:

- **H₁**: *family support* negatively influences (protects from) the *online grooming risk*;
- **H₂**: a *low self-esteem* positively influences (exposes to) the *online grooming risk*;
- **H₃**: the *online grooming risk* directly impacts on the *exchange of sexual material* with a stranger online.

In line with the literature concerning the measurement of unobservable concepts and the examination of their relationships, a Structural Equation Modeling approach was used to test research hypotheses (Jöreskog & Wold, 1982).

2. Materials and Methods

The first version of the *Online-Grooming-Risk Scale* (OGR-S) was developed from a qualitative work based on focus group discussion with privileged witnesses: adolescents of different age groups (from 14 to 18 years old) were invited to reflect on the online grooming topic and to brainstorm as much questions as possible, with the aim to unfold and detect the phenomenon. Redundancies removal and textual formulation derived from a joint debate between the key

witnesses and research methodology/psychometrics experts: the resulting scale was tested in a pilot study conducted on 77 adolescents between 14 and 19 years old (60% female, 40% male), average age of 17 years old, belonging to a High School in Apulia (Italy). After debriefing teachers and directors, as well as getting the necessary authorizations to conduct a research, students were asked to fill out a questionnaire for research purposes (transparent information about the research project was provided by the school through the *newsletter no. 235* addressed to parents and students and published on January 22nd, 2020). Parents of minors gave their informed consent.

The validation sample consisted of 316 high-school students between 13 and 18 years old (female, 54.1%, male 45.9%), average age of 15.6 years old ($SD = 1.37$). At the very beginning of the psychological intervention and after getting parents' authorization for minors to take part in the intervention, the goals were disclosed, and then the questionnaires were administered. The research activities of both studies were conducted in accordance with the ethics guidelines of the Helsinki Declaration and the procedures that apply in Italy.

Measurements included:

- *Online-Grooming Risk Scale*: an 8-item questionnaire on a 5-point Likert scale: 1 (*never*), 2 (*rarely*), 3 (*sometime*), 4 (*often*), 5 (*very often*). Given a description of “stranger” on the Internet (that is, an unknown, over 18 years old person in real life, with whom one may communicate/interact with), adolescents were asked to indicate how often they performed some behaviours over the last 6 months (the original items are reported in the Appendix). In the pilot study, the factorial structure of the OGRS was exploratively assessed through two non-parametric dimension reduction techniques: Principal Components Analysis and Cluster of Variables around Latent Variables (CLV; Carpita et al., 2020; Vigneau & Qannari, 2003). Both confirmed the presence of two internal sub-dimensions of the scale: one, named *Relationship Intimacy*, reflects the degree of openness, interaction and intimacy with a stranger met online; the other one, named *Secrecy*, reflects the lie somewhat associated with this online relationship (either discovered or acted by the adolescent), as well as the psychological pressure of being unable to talk about it. Results of the assessment of the factorial structure are reported in Table 1.

Table 1. Assessment of the factor structure of the OGRS scale

OGRS items	PCA		CLV	
	(60% var. explained)		(60% var. explained)	
OGR ₁	0.721	-0.418	0.81	-
OGR ₂	0.861	-0.327	0.92	-
OGR ₃	0.791	-0.261	0.84	-
OGR ₄	0.817	-0.147	0.83	-
OGR ₅	0.585	0.441	-	0.71
OGR ₆	0.503	0.520	-	0.72
OGR ₇	0.511	0.345	-	0.64
OGR ₈	0.512	0.416	-	0.67

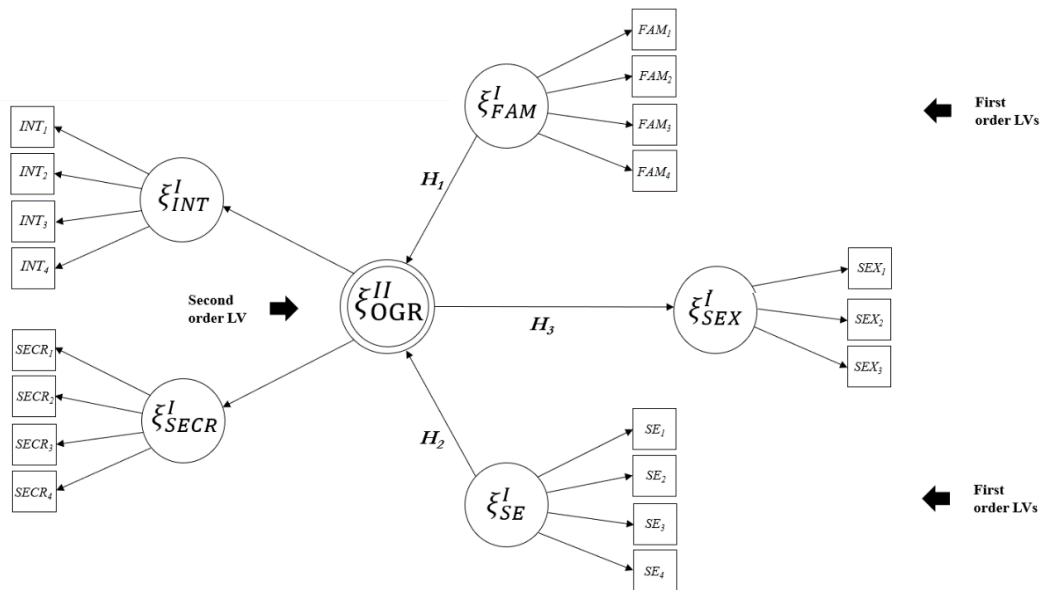
- *Sexual solicitation/interaction*: drawing from the *Bateria En-Red-A2* by Peris and Maganto (2018), 3 items about sexual solicitation were used to assess the latter of the *grooming* phases (that is, explicit sexual references). The items assessed whether adolescents received sexual text messages, pictures/videos, as well as whether they met the stranger in person.
- *Low Self-Esteem*: to assess self-esteem, the Italian adaptation of the *Rosenberg Self-Esteem Scale* (RSE; Prezza et al., 1997; Rosenberg, 1965) was used. It consists of 10 items measured on a 4-points Likert scale (1 - strongly disagree, 4 - strongly agree). Low self-esteem is a known vulnerability factor in exposing adolescents to online grooming. Therefore, it has been considered as the antecedent that mitigates the risk of ending up into an openly sexualized interaction with a stranger online.
- *Perceived Family Support*: as one of the most important factors influencing the adolescent's willingness to open up with a stranger are social and family issues, family seemed to be a fundamental element to be investigated and included. Therefore, the *Perceived Family Support* (4 items on a 5-point Likert scale, where 1 - totally disagree and 5 - totally agree) was drawn from the *Multidimensional Scale of Perceived Social Support* (MSPSS; Zimet et al., 1988).

The analyses were conducted using a non-parametric approach to Structural Equation Modeling: the PLS-SEM. Originally developed by Wold (1966; 1975; 1985), PLS-SEM is increasingly gaining ground in the social sciences from both a methodological and conceptual standpoint. It lends itself to theoretical and psychometric development yet relaxing the strong assumptions typical of the traditional parametric Factor Analysis methods based on the common factor model (Hair et al., 2016). PLS-SEM allowed to simultaneously examine relationships among measured variables (the OGRS items, particularly) and latent variables (the *online grooming risk*, conceptualized as a 2nd order latent variable henceforth referred to as ξ^{II}_{OGR} and composed by the two above-mentioned dimensions, ξ^I_{INT} and ξ^I_{SECR} , respectively) as well as to assess measurement invariance and found various applications in psychology due to the possibility to investigate exploratory and predictive connections between non-observable constructs (Macchitella et al., 2020; Signore et al., 2019; Signore et al., 2020). In fact, it is important to establish that the latent variables of the OGR-S scale are the same across groups which, in the present study, are represented by participants' gender. Hair and colleagues (2017) formalized the MICOM procedure, consisting of 3 hierarchically interrelated steps:

1. *configural invariance*, that is, the use of the same indicators, scales and data treatment across groups;
2. *compositional invariance*, assessed through a correlation score c and confirmed when the composite scores of the latent variables are the same across groups;
3. *equality of composite mean values and variances*, that is, the final step to confirm full measurement invariance and therefore that any effect will not be due to different meanings attributed to the items of the OGR-S scale.

Finally, to test how the present scale is located with respect to relevant psychological aspects emerging from literature, the *grooming risk* ξ^{II}_{OGR} was entered in a model where low *self-esteem* ξ^I_{SE} represents a risk factor which may facilitate exposure to *grooming* (Craven et al., 2006; Ioannou et al., 2018; Schoeps et al., 2020; Wachs et al., 2016) and, perhaps to sexual interactions with a stranger. On the other hand, and in line with the literature, *family support* ξ^I_{FAM} is conceived as a protective factor (Berson, 2003; Whittle et al., 2013a, 2013b; Liu et al., 2015). *Figure 1* shows the structural relationships hypothesized.

Figure 1. Full model overview



In particular:

- H_1 : ξ_{FAM}^I negatively influences (protects from) ξ_{OGR}^{II} ;
- H_2 : ξ_{SE}^I positively influences (exposes to) the ξ_{OGR}^{II} ;
- H_3 : ξ_{OGR}^{II} directly impacts on ξ_{SEX}^I with a stranger online.

All the above-mentioned analyses were carried out through the SmartPLS 3 software (Ringle, Wende & Becker, 2015).

3. Results

Table 2 reports the assessment of the measurement model for the OGR-S scale.

Table 2. OGRS: Measurement model evaluation

Labels	ρ_A	AVE	Weight	Loadings (Bootstrap)	SD	t statistic	Confidence Intervals
ξ_{INT}^I	0.790	0.611					
INT ₁			0.322***	0.785***	0.042	18.757	[0.688; 0.851]
INT ₂			0.341***	0.824***	0.029	27.972	[0.753; 0.874]
INT ₃			0.293***	0.746***	0.054	13.901	[0.627; 0.831]
INT ₄			0.324***	0.769***	0.037	20.992	[0.677; 0.826]

ξ_{SECR}^I	0.683	0.506				
SECR ₁			0.393***	0.747***	0.055	13.718 [0.615; 0.835]
SECR ₂			0.355***	0.700***	0.045	15.754 [0.609; 0.776]
SECR ₃			0.363***	0.754***	0.046	16.566 [0.636; 0.826]
SECR ₄			0.287***	0.620***	0.094	6.659 [0.365; 0.757]

* $p < .05$; ** $p < .01$; *** $p < .001$; Numbers in brackets display the 95% bias-corrected percentile confidence intervals derived from bootstrapping with 1000 subsamples.

All the latent constructs measured reflectively their manifest variables (Cheah et al., 2019). Almost all the items showed loadings higher than the traditional threshold for the PLS-SEM context (0.70), indicating a good indicator reliability. The only loading lower than the threshold was also retained in that its removal did not consistently improve the other psychometric properties of the scale, as suggested by Hair et al. (2016). *Online grooming risk* (ξ_{OGR}^{II}) was estimated as a second-order latent variable through two-step approach (Ciavolino & Nitti, 2010; Ciavolino & Nitti, 2013a; Ciavolino & Nitti, 2013b) and showed significant coefficients both with subdimensions and single items of the scale. Composite reliability, instead, can be assessed through Cronbach's α and the Dijkstra-Henseler's ρ_A . In both cases, values are above the recommended range, that is, between 0.70 and 0.90. In particular, $\rho = 0.790$ for ξ_{INT}^I and $\rho = 0.683$ for ξ_{SECR}^I , suggest a satisfactory composite reliability, as well as non-redundant items, which is better than the expected, considering the developmental nature of the OGRS scale. Convergent validity, instead, can be assessed through the Average Variance Extracted (AVE), reflecting the amount variance of the different indicators explained by the latent constructs. As can be noted, both subdimensions explain at least 50% of the indicators' variability, therefore confirming a good convergent validity. In line with the latest developments by Henseler and colleagues (2015), the heterotrait-monotrait (HTMT) ratio of correlations was used to examine discriminant validity (see Table 3), which appears to be confirmed, with a construct's correlation of 0.590, far below the more conservative threshold of 0.85, indicating distinct constructs. Results of the structural model, resulting from a bootstrap procedure (1000 samples), are reported in Table 4 and illustrated in Figure 2.

Table 3. HTMT matrix

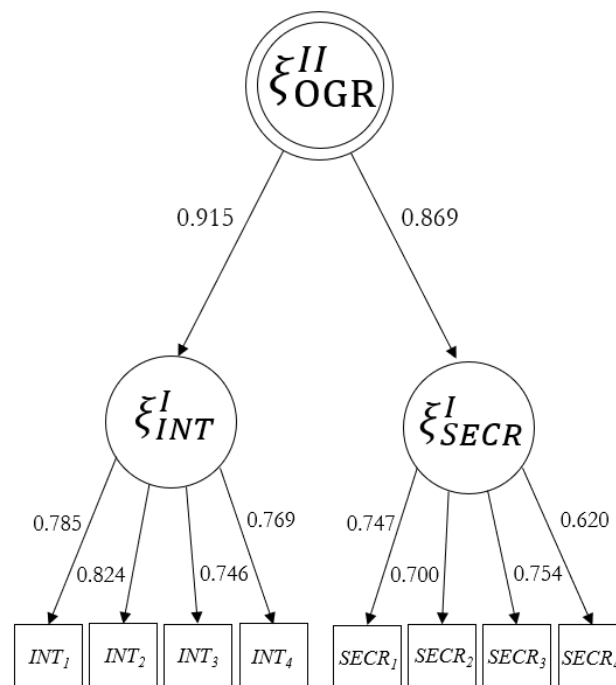
	ξ_{INT}^I	ξ_{SECR}^I
ξ_{INT}^I	0.711	
ξ_{SECR}^I	0.590	0.782

Table 4. Higher-order measurement model (structural model estimates)

Paths	Bootstrap Sample mean	SD	t statistic	Confidence Intervals
$\xi_{OGR}^{II} \rightarrow \xi_{INT}^I$	0.915***	0.016	58.749	[0.877; 0.940]
$\xi_{OGR}^{II} \rightarrow \xi_{SECR}^I$	0.869***	0.023	38.386	[0.809; 0.901]

* $p < .05$; ** $p < .01$; *** $p < .001$; Numbers in brackets display the 95% bias-corrected percentile confidence intervals derived from bootstrapping with 1000 subsamples.

Figure 2. Theoretical structure of the OGRS scale with the estimated path coefficients



The assessment of measurement invariance, whose results are reported in *Table 5*, confirmed full gender invariance.

Table 5. Results of the MICOM procedure (1000 permutations)

	Compositional Invariance (Step 2)			Equal Means and Variances (Step 3)			
	M	vs	F	Means		Variances	
Latent Variables	c	5% quantile of c_u	p value	Mean difference	Confidence Interval	Mean difference	Confidence Interval
ξ_{INT}^I	0.999	0.996	0.261	0.002	[-0.223, 0.213]	0.023	[-0.633, 0.702]
ξ_{SECR}^I	0.994	0.982	0.645	-0.001	[-0.226, 0.214]	0.013	[-0.705, 0.745]

Numbers in brackets display the permutation-based 95% percentile confidence intervals.

In particular, the 1st step was preliminarily confirmed, the 2nd is confirmed in that the c value for the latent variables falls within the 95% permutation-based confidence interval, therefore not allowing to reject the null hypothesis of compositional invariance ($c = 1$). The 3rd step, itself based on a permutation test as well, confirms full gender invariance for the OGR-S. *Table 6* reports the estimates of the direct and indirect effects of the structural model in which the *online-grooming risk* is related to relevant psychological constructs.

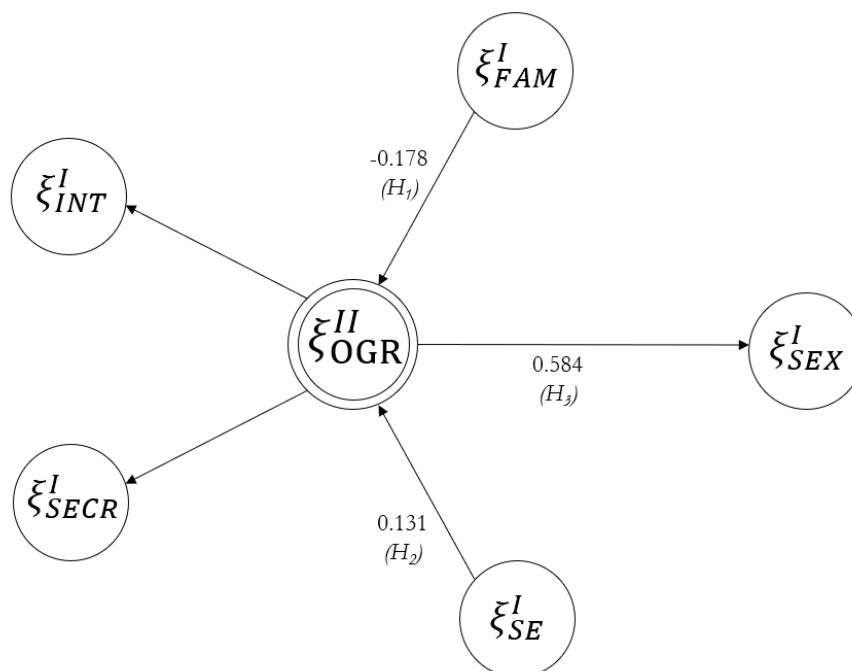
Table 6. Structural model. Bootstrapped estimates of the direct and indirect effects

Paths	Bootstrap Sample mean	SD	t statistic	Confidence Intervals
<i>Direct Effects</i>				
$\xi_{FAM}^I \rightarrow \xi_{OGR}^{II}$ (H_1)	-0.178*	0.069	2.545	[-0.310; -0.050]
$\xi_{SE}^I \rightarrow \xi_{OGR}^{II}$ (H_2)	0.131*	0.057	2.083	[0.016; 0.215]
$\xi_{OGR}^{II} \rightarrow \xi_{SEX}^I$ (H_3)	0.584***	0.046	12.523	[0.471; 0.653]
<i>Indirect Effects</i>				
$\xi_{SE}^I \rightarrow \xi_{OGR}^{II} \rightarrow \xi_{SEX}^I$	0.076*	0.033	2.043	[0.017; 0.123]
$\xi_{FAM}^I \rightarrow \xi_{OGR}^{II} \rightarrow \xi_{SEX}^I$	-0.104*	0.042	2.416	[-0.191; -0.028]

* $p < .05$; ** $p < .01$; *** $p < .001$; Numbers in brackets display the 95% bias-corrected percentile confidence intervals derived from bootstrapping with 1000 subsamples.

A graphical representation is provided in *Figure 3*.

Figure 3. Estimated path coefficients of the structural model.



As can be noted, *family support* negatively affects online grooming risk ($\beta_1 = -0.178$, bootstrap CI: [-0.310; -0.050]), representing an important protective factor. Thus, increasing *family support* could buffer the risk of developing online grooming risk and therefore sexual interaction intentions. H_1 hypothesis results supported. At the same time, in line with the current literature, low self-esteem showed a positive coefficient respect to online grooming risk ($\beta_2 = 0.131$, bootstrap CI: [0.016; 0.215]). Results highlighted how personal negative self-confidence and personal image could increase the risk of grooming behaviours, confirming hypothesis H_2 . Finally, the structural relationship between online grooming risk and sexual interaction frequency is positive and significant. H_3 is confirmed as well: the risk of online grooming increased the intention to establish online sexual interactions ($\beta_3 = 0.584$, bootstrap CI: [0.471; 0.653]). Accordingly, the proposed scale measure seems to detect online grooming risk.

4. Discussion

As online risks have exponentially increased due to children's early exposure/use of Internet and information/communication technologies (ICT), online grooming has become more and more relevant issue. For this reason, it is crucial to have tools and instruments aimed at a preventive detection of dangerous situations, as well as a timely intervention. Current literature on the topic, in fact, did not provide a scale to measure online grooming risk, but rather focused on the latest, more evident and severe stages of the process.

As thoroughly exposed in this study, literature on online grooming highlighted different risk factors correlated with this phenomenon, such as low self-esteem and low family support (Schoeps et al., 2020; Whittle et al., 2013a, 2013b). In a preventive perspective rooted on primary intervention, family support could be considered a protective factor, as its increase may protect from online grooming risk (Berson, 2003; Whittle et al., 2013a, 2013b). The goal of this work was to develop and validate a new scale to identify Online Grooming Risk (OGR) as the process is potentially unfolding. To do so, the PLS-SEM modeling allowed the psychometric assessment of the OGR-S scale and the broader structural relationships with relevant psychological aspects: the hypothesized connections were between self-esteem, family support, online grooming risk and exchange of sexual material with online strangers. All the relationships were in line with the literature: family support negatively influences online grooming risk, thus confirming itself as an important protective factor. As suggested by Liu and colleagues (2015), multi-family group therapy can develop adolescents' supportive interaction and create a suitable context to fulfill their psychological needs. Furthermore, the lack of parental involvement could increase the young person's Internet use, therefore exhibiting a more consistent grooming risk (Whittle et al., 2013a, 2013b). Concurrently, low self-esteem positively correlated with online grooming risk. This result is in line with various studies (Craven, et al., 2006; Wachs et al., 2016; Ioannou et al., 2018; Schoeps et al., 2020), which highlighted how a low self-esteem level had a key role in developing online grooming intentions and behaviours. The last latent variable assumed is sexual interaction, which measured the trend to implement exchange of sexual material with strangers online. The goodness of the scale was confirmed through the significance and intensity of the relation between online grooming risk and sexual interaction behaviours, which was positive. Overall, the higher risk of online grooming (understood as relational intimacy and secrecy) was linked to higher sexual interactions. Due to these findings, we can conclude that our scale configures itself as a suitable short brief measure of the online grooming risk in adolescents, even though its development is at the early stages and might be improved. An earlier detection of the phenomenon, as well as the emerging importance of protective and risk factors might help to set up prevention programs starting from adolescents' personal and interpersonal world, in order to buffer the online grooming risk. As highlighted in our analysis, in fact, the risk is strictly positively correlated with low self-esteem and negatively associated with family support. Recognising the first signs of problematic behaviours could play a key role in preventing sexual exchanges with strangers, improving adolescent's well-being and the perception of a supporting family context in everyday life. The qualitative study of Whittle and colleagues (2013c) evidenced that online grooming's consequences could impact different

crucial areas of adolescents' personality development, such as the self (shame, loss of confidence, psychological sufferings – depression, anxiety), family (impact on family relationships, lack of trust), friends (bullying, difficult relationships), school and Internet use. Thus, a brief scale aimed at detecting the first stages of online grooming risk should help to identify subjects in distress.

Finally, the two subdimensions which composed the scale, named “*Relationship intimacy*” and “*Secrecy*” (both showing a suitable psychometrics reliability and invariance) showed evident connections with current literature about this issue. As suggested by O’Connell (2003), as well as by Choo (2009) the online grooming phenomenon is characterized by a progressive sexualisation of the relationship by bringing up sexual matters and the request to keep secret the new-born relationship between the interactants. The study enabled us to measure how much these dimensions are present in the adolescent in order to instantly find dangerous factors in his/her everyday life. The analysis of invariance of the scale was therefore confirmed by considering gender, thus the measure can be considered valid and sensible. In summary, this investigation intended to extend literature about online grooming risk and its connection with two important aspects of adolescents' everyday life, as family support and self-esteem, providing a new way to detect potential grooming victims to quickly act on them through adequate prevention interventions.

5. Conclusions

The current study aims to provide an assessment tool to gauge the risk of developing online grooming behaviours. In particular, after investigating the main psychometric characteristics and confirming the validity of the scale, the latter was used to test theoretical relationships with constructs that several studies have shown to be related to online grooming. The results appear to be in line with the existing literature: in particular, having a positive family support proves to be an extremely strategic protective factor against online grooming (Livingstone & Helsper, 2008). As the studies by Pettit and colleagues (2001), Ybarra and Mitchell (2004) and Wang and colleagues (2005) suggested, family support is a very strong deterrent in curbing cyber grooming behaviour. More specifically, in fact, parents play an essential role in terms of restrictions, limiting their children's use of the Internet, monitoring, through the control of the time spent online in sites or chats, acting as a reference point for reflection on dangerous activities that can be carried out on the Internet (Valcke et al., 2010; Wang et al. 2005). Similarly, as widely reported in the literature (Craven, et al., 2006; Ioannou et al., 2018; Schoeps et al., 2020; Wachs et al., 2016) among the factors that can be deemed as grooming risk triggers are the characteristics of

the period most involved and most common in this phenomenon, that is, adolescence. Adolescents are amongst the most frequently targeted groups for online grooming since they find themselves at a time when they struggle with low self-esteem, and predators attempt to use this vulnerability to an advantage. According to Whittle and colleagues (2014) having low self-esteem, feeling lonely, and hitting a low point in life are crucial predictors of online grooming risk. In short, the “natural” weaknesses of this period of transition and growth into the adult life, marked by far-reaching shifts in oneself and in one's relationship with others, provide a pivotal environment on which to focus a great deal of attention for possible preventive programmes against this risk.

Finally, the conceptual solidity of the scale was further substantiated by the relationship, already stated in the literature, between online grooming and the likelihood of experiencing sexual interactions. The phenomenon of grooming, in fact, is already characterized as a process by which an adult, using digital media, lures a minor with the purpose of obtaining sexual material (images, videos) or to sexually abuse through an emotional connection (Berliner, 2018). The feasibility of engaging in sexual interactions, therefore, is a temporal consequence of failing to deal with the risk of being a victim of online grooming behaviour (Calvete et al., 2021). As stated in the literature on the topic, in practice, the solicitor's intention is to entertain sexual conversations online or via text messages, send explicit material (photos, videos or films via webcam) or meet in person for sexual intercourse. Regardless of the age and gender of the interlocutor, therefore, the main aim of the groomer is to entertain relationships, virtual or real, with a precise sexual facet. For this reason, it is important to carefully assess the risk of incurring in online grooming behaviour, in order to prevent the impact of such behaviour from a bio-psycho-social point of view.

5.1 Limitations and strengths

This study has some limitations which must be considered. First, the sample size and the convenient nature of it. Although PLS-SEM does not imply a minimum sample size and assumption on the data distribution, future research could implement studies based on a larger sample size, as well as on randomization criteria. Furthermore, the adolescent population involved in the study could be more heterogeneous in further investigations by involving subjects of different geographical areas and age groups. This limitation has partially been overcome by using bootstrapping procedure, which allows to consider different resampling ($n = 1000$ in this case) of the initial population involved in the study.

An additional limitation of the study is the focus on only family support and self-esteem, two important factors playing a crucial role in online grooming. Further research could consider other personal, social, and contextual aspects suggested by the current literature, as disinhibition or sexting (Schoeps et al., 2020) and poor Internet literacy or information sharing (Livingstone, 2008; Wood & Wheatcroft, 2020). Finally, the cross-sectional design of the study. To detect causal relationships between variables, longitudinal studies might be conducted.

Nevertheless, this research started from the assumption that there is no current literature which can provide a measure of the risk level in developing online grooming behaviours. Therefore, even though the contribution of privileged witnesses in scale development helped to grasp important aspects of online grooming, it is still at the early stages and could be improved.

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Author Contributions

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Conflict of Interest Statement

The authors declare that the research was conducted in the absence of any potential conflict of interest.

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Appendix

Online-Grooming Risk Scale (OGR-S)

How much, over the past six months, you:

1. Regularly chatted with a stranger online.
2. Shared his/her personal information with a stranger online.
3. Shared personal pictures/videos with a stranger online.
4. Opened up with a stranger online.
5. Hid the friendship with a stranger (online) to your parents.
6. Got a compliment from a stranger online.
7. Hoped to talk to somebody about a person you met online.
8. Discovered a person you met online lied to you.

Figure 1 (Legend). ξ_{OGR}^{II} represents the 2nd order Latent Variable, *Online Grooming Risk*. Its constituents, *Intimacy* and *Secrecy*, are labeled as ξ_{INT}^I and ξ_{SECR}^I , each of which with their manifest variables (INT₁, INT₂, INT₃, INT₄, and SECR₁, SECR₂, SECR₃, SECR₄). ξ_{FAM}^I (measured by FAM₁, FAM₂, FAM₃ and FAM₄) represents the perceived *Family Support*, while ξ_{SE}^I stands for *Self-Esteem (low)*, measured by SE₁, SE₂, SE₃, SE₄. Finally, ξ_{SEX}^I represents the *Sexual solicitation/interaction* construct, measured by SEX₁, SEX₂, SEX₃.