From 'Friends with Benefits' to 'Sextortion:' A Nuanced Investigation of Adolescents' Online Sexual Risk Experiences

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Sexual exploration is a natural part of adolescent development; yet, unmediated internet access has enabled teens to engage in a wider variety of potentially riskier sexual interactions than previous generations, from normatively appropriate sexual interactions to sexually abusive situations. Teens have turned to online peer support platforms to disclose and seek support about these experiences. Therefore, we analyzed posts ($N = 45,955$) made by adolescents (ages 13–17) on an online peer support platform to deeply examine their online sexual risk experiences. By applying a mixed methods approach, we 1) accurately (average of $AUC = 0.90$) identified posts that contained teen disclosures about online sexual risk experiences and classified the posts based on level of consent (i.e., consensual, non-consensual, sexual abuse) and relationship type (i.e., stranger, dating/friend, family) between the teen and the person in which they shared the sexual experience, 2) detected statistically significant differences in the proportions of posts based on these dimensions, and 3) further unpacked the nuance in how these online sexual risk experiences were typically characterized in the posts. Teens were significantly more likely to engage in consensual sexting with friends/dating partners; unwanted solicitations were more likely from strangers and sexual abuse was more likely when a family member was involved. We contribute to the HCI and CSCW literature around youth online sexual risk experiences by moving beyond the false dichotomy of "safe" versus "risky". Our work provides a deeper understanding of technology-mediated adolescent sexual behaviors from the perspectives of sexual well-being, risk detection, and the prevention of online sexual violence toward youth.

Content Warning: *Sensitive topics, including sexual risk behaviors involving minors and sexual abuse, are discussed in this paper. Readers should use their discretion as to whether they would like to proceed.*

CCS Concepts: • **Online Safety** → **Adolescents Online Sexual Experiences**; • **Artificial Intelligent** → *Natural Language Processing (NLP).*

Additional Key Words and Phrases: Sexting, Sexual Risks, Sexual Risk Detection, Adolescents Disclosures, Artificial Intelligence, Social Media

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1 INTRODUCTION

A significant portion of adolescents' social growth and development has been mediated through the extensive usage of social media platforms [77]. For instance, easy access to these online platforms has enabled adolescents to express and explore their sexuality in new ways [85, 96]. "Sexting," or engaging in sexual conversations, sharing flirtatious comments, or sending sexual self-images online has been a topic of research inquiry for over a decade [61, 92]. More recent literature [28, 31, 74] has broadened the definition of sexting to also include sending, receiving, and forwarding any kind of sexual messages (e.g., text, images, videos) across various technology-mediated platforms (e.g., text messages, email, social media). Although adolescent sexual exploration is considered developmentally normal [82], public discussions of adolescents' online sexual behavior have focused primarily on its possible risks, harm, and detrimental consequences. Research on adolescent sexting has focused on examining its association with adverse consequences, such as substance use, risky sexual behaviors, coercion, anxiety, depression, and suicide [4, 15, 20, 110]. However, other researchers have found no association between adolescents' sexting and negative consequences [51, 72]. Therefore, a broader perspective of adolescents' online sexual experiences should be explored by going beyond treating these experiences as either *risky* or *safe* and by contextualizing these online sexual experiences in a nuanced way [75].

The spectrum of online sexual experiences of teens may range from normatively healthy relationship exploration to risky sexual behavior that could lead to negative consequences (e.g., pregnancy, sexually transmitted disease), sexual abuse, and "sextortion," which includes "threats to expose sexual images to coerce victims to provide additional pictures, sex, or other favors" [108] and has been identified as a new online threat to youth. Yet, an overly generalized view of adolescent online sexual experiences and risk can impede prevention efforts, and intervention plans to protect teens from experiencing adverse life events that could negatively impact them into adulthood. For instance, the development of machine learning algorithms that predict and detect online sexually risky behavior, such as child pornography, sexual harassment, predation, or solicitations [13, 43, 109] may cause unintentional harm, particularly to more vulnerable users, if these experiences are not appropriately contextualized. This is why organizations like the American Civil Liberties Union (ACLU) [87] have taken a strong stance that teens who engage in sexting (i.e., voluntarily sending an explicit self-image) should not be prosecuted as sex offenders, even though distribution of child pornography is a federal crime, as this would have lifelong consequences that are not commensurate with the offense.

Prior research has shown that youths' online sexual risk experiences vary significantly based on whether the interaction was consensual or non-consensual [30, 104] and on whether the relationship was between intimate partners or strangers [17, 47]. We conducted an in-depth examination of teens' (ages 13–17) disclosures about their online sexual risk experiences to address the following research questions:

- **RQ1:** *Can adolescent online disclosures about their online sexual risk experiences be accurately identified from their posts? If so, can these posts be further classified by a) level of consent and b) relationship type?*
- **RQ2:** *Are there distinguishable differences and/or patterns in adolescent sexual risk experiences based on level of consent and relationship type?*

- **RQ3:** *What unique linguistic patterns (i.e., topics) in the posts lend more nuanced insight into the differing contexts in which these sexual risk experiences unfold?*

To answer these research questions, we licensed a dataset from an online peer-support platform that is mainly used by youth and young adults to seek support from and provide support to others. To answer RQ1, machine learning models were trained based on manually labeled data ($N = 8,271$) to first identify disclosures of online sexual risk experiences from other types of posts, then to classify these posts based on the expressed level of consent (i.e., consensual, non-consensual, sexual abuse) and by relationship type (i.e., stranger, friend/dating, family). The final classifiers achieved an average Area Under the ROC Curve (AUC) of 0.90. The classifiers were then used to machine label a larger corpus of posts ($N = 45,955$) for further analysis.

For RQ2, between-group differences were examined through a Chi-square (χ^2) analysis of the larger dataset. Our analysis revealed that consensual sexting was significantly more likely to occur between teens and their friends/dating partners, while non-consensual sexting was significantly more likely to occur with strangers. When sexting involved a family member, it was more likely to be indicative of sexual abuse. We then leveraged topic modeling and our own qualitative insights to delve into RQ3. Overall, we found that there were beneficial reasons for teens to engage in consensual sexting, such as when exploring their sexuality, seeking romantic partners within the LGBTQ+ community, or in long-distance relationships. However, in other cases, even consensual online sexual experiences were often due to underlying mental health conditions. Teens engaged in sexting with strangers, for instance, as a coping mechanism for depression or to seek love and acceptance; similarly, teens were pressured to engage in sexting to alleviate their friends/dating partners' mental health problems, who often threatened self-harm if they did not comply. In some cases, both consensual and non-consensual sexting led to more severe forms of sexual abuse that resulted in physical and psychological harm. Our results demonstrate the complexities around technology-mediated consent, online sexual risks, and how these experiences cannot be studied in isolation from the mental health and well-being of youth. Our research makes several important contributions to the fields of Human-Computer Interaction (HCI) and the literature of adolescents' online safety:

- We accurately classified the levels of consent and relationship types within these disclosures (average AUC=90), demonstrating the importance of the underlying architecture of machine learning models to achieve accurate classifications.
- We uncovered key patterns related to teens' online sexting behaviors based on the level of consent and relationship types, showing that teens experienced more consensual sexting with friends/dating partners, non-consensual sexting with strangers, and sexual abuse committed by family members.
- We highlighted the nuances unpacked from teens' disclosure that went beyond the explicit consent statement to understand the underlying factors (e.g., mental health issues) that surround and may undermine consent.

2 BACKGROUND

In this section, we provide an overview of previous research on adolescent online safety and sexual risks, the state of computational approaches for sexual risk detection, and how our work complements this line of research. [2]. Thus, the literature on adolescents' online safety has primarily focused on [104].

2.1 Adolescent Online Safety and Sexual Risk

Adolescence is characterized by risk-taking, experimentation, and limited understanding of the adverse consequences of potentially risky behaviors [2]. Thus, the literature on adolescent online safety has primarily focused on protecting adolescents from exposure to possible threats [105]. As such, research on adolescents' sexting behaviors is often motivated by the potential risks, adverse consequences, and legal considerations [4, 6, 29, 54, 103]. For instance, legal scholars have generated a substantial body of work on laws to criminalize and appropriately respond to technology-facilitated sexual offenses [24, 48, 49]. These works highlight how civil and criminal laws have fallen behind on how to respond effectively to online sexual risks, especially those involving minors, due to the lack of comprehensive understanding of these risks and the harms associated with them [24, 49]. Henry and Powell [49] defined a subset of commonly encountered sexual risk behavior that is facilitated by technology. This included the non-consensual distribution of sexual content, unwanted sexual solicitations, sextortion, and "rape by proxy," which is a new trend where an individual solicits a third-party online to commit a sexual crime on a victim. While these works make great strides in addressing the potential legal consequences, complexities, and pitfalls of online sexual risk behavior, they are not always grounded in the first-person online experiences of youth.

Empirical studies directly involving youth tend to highlight the adverse outcomes associated with the online sexual risk behavior of minors. For example, Gamez et al. [37] found that adolescents who have experienced sexting in the past will most likely experience a significant increase in the number of sexual solicitations over the next year. Galvete et al. [18] found that adolescents who were solicited by adults online engaged in more sexting experiences with others. Other studies have highlighted the negative outcomes and life consequences of online sexual risk behaviors, including mental health problems, teen pregnancy, sexually transmitted diseases, and drug and alcohol abuse [4, 15, 20, 95]. Medrano et al. [66] also reported that online sexting behaviors have a significant association with increased cyber-victimization, which resulted in mental health issues related to depression and suicidal ideation. Another major line of research suggests that online sexual experiences with adult strangers (i.e., sexual predators) can entail the most serious adverse consequences, such as sexual solicitations [71, 100, 101]. Overall, these studies emphasize the heightened risk associated with teens engaging in sexual behaviors online, which in turn highlights the need for effective risk mitigation and prevention strategies to protect youth online.

Acknowledging the potential consequences of adolescent sexting can help in mitigating risks; however, it also paints an incomplete picture by treating most online sexual behavior of youth as problematic or deviant. Yet, scholars [75, 84] have recently started to push back on the intense "moral panic" around the technology-mediated risks posed to youth, suggesting we take a more child- and teen-centric approach to studying risk-related online phenomena. For instance, Gewirtz-Meydan et al. [39] surveyed youth to understand their perceptions and attitudes around sexting and found that adolescents who engaged in sexting did not view it as a crime. Instead, Razi et al. [85] recently found that teens viewed sexting as a normal progression of their romantic relationships and garnered some benefit from these experiences. Similarly, Choi et al.'s [22] four-year longitudinal study found that adolescents' engagement in online sexual behavior steadily increased from adolescence into emerging adulthood, suggesting developmental progress over time. As such, researchers have begun to advocate for the importance of acknowledging both positive and negative developmental outcomes associated with adolescent sexting with a focus on educating adolescents about safe sexting practices [74, 80]. Therefore, addressing the perception gap between overly risk-focused research and adolescents' personal experiences regarding their online sexual

encounters necessitates a deeper and more nuanced examination and teen-centered understanding of these experiences.

2.2 Computational Approaches to Detecting Sexual Risks

In recent years, researchers have started to apply deep learning methodologies, such as Convolutional Neural Network (CNN), to detect sexual risks in social media data [23, 55, 56, 62, 109]; with promising results. For instance, Chowdhury et al. [23] applied various deep learning models to identify disclosures of sexual harassment using public Twitter posts and achieved 96% accuracy. Hassan et al. [46] proposed data-driven supervised learning for identifying sexual violence reports from the #MeToo movement on social media to examine these types of disclosures more deeply. These researchers detected whether the posts included sexual violence, distinguished among different types of sexual violence (e.g., Unwanted Sexual Contact, Non-contact Unwanted Sexual Experiences, Sexual Violence, Completed or Attempted Forced Penetration, Alcohol or Drug Facilitated Penetration, Forced Acts, Alcohol or Drug Facilitated Acts), and identified the relationship between the perpetrator and the victim(s) (e.g., Intimate Partner, Family Member, Person in Position of Power/Authority/Trust, Friend or Acquaintance, Stranger) [46]. Their best F1 score reported for detecting sexual violence was 80%, with 58% for specific type of sexual violence and 62% for the perpetrator-victim relationship. A recommendation from this study was to address the lower accuracy of the classifiers by adopting a deep learning approach.

We build upon and address the limitations of these related works in several ways. First, prior work was not focused specifically on detecting the online sexual risk disclosures of adolescents, who are a particularly vulnerable class of internet users. In contrast, our work focuses specifically on teens (ages 13–17) and on their first-hand online sexual risk experiences. Second, we contextualized our classifiers based on the level of consent expressed in the post (i.e., consensual sexting, non-consensual sexting, sexual abuse) and relationship type (i.e., Stranger, Friend/Dating Partner, Family), obtaining accuracy levels that were better or on par with past studies. Third, we move beyond the risk classification problem to further unpack statistical differences and qualitative insights from the digital trace data of teens who sought advice or support regarding their online sexual risk experiences. In doing so, we take a more holistic approach to detecting and understanding the myriad online sexual risk experiences encountered by modern-day teens.

3 METHODS

Our main goal was to unpack adolescents' online sexual risk experiences by deeply analyzing their posts disclosing these situations. To accomplish this goal, we first describe our dataset, scoping process, and data annotations for ground truth. Then, we describe how we addressed each of our research questions.

3.1 Dataset

3.1.1 An Online Peer Support Platform for Youth and Young Adults. We licensed a dataset from an online peer support platform that caters to youth and young adult users, who are interested in discussing topics related to mental health, relationships, sexuality, religion, and more. We chose to anonymize the name of this platform to protect the identities of the youth whose data we analyzed. On this platform, youth post pseudonymously (i.e., by username rather than by real name [63]), and we took care to remove any personally identifiable information from quotations shared in this paper. The dataset originally contained around five million posts and 15 million comments made by approximately 400,000 users. The posts' time frame ranged from 2011 to 2017. Approximately 70% of the platform users were between the ages of 15–24. Although the dataset did not contain any information about nationality, most platform users were English speakers. Our Institutional Review

Board (IRB) deemed this study to be 'non-human subjects' research because we analyzed a dataset without personally identifiable information (e.g., usernames). For the protection of users' privacy, the quotes included in this paper were paraphrased or slightly altered (e.g., adding abbreviations and introducing false details that do not affect the context [16]) to make sure the quotes could not be linked to specific people.

3.1.2 Data Scoping and Relevancy Coding. The dataset was scoped and annotated as part of our prior published work (anonymized for review). Therefore, we will provide the necessary details needed below for review and reference our prior work upon publication. In order to scale down the five million posts into a practical number of posts for data annotation, we took the following steps. First, we filtered the posts based on user-labeled categories provided by the platform when a user created a new post. The relevant categories included sex, relationships, friends, family, ask girls, and ask guys. We determined the most relevant categories based on a manual inspection of the data. Second, we filtered the posts to include only users who were between the ages of 13 and 17 based on their profile information that was provided with the dataset. The resulting dataset contained 54,226 posts. Third, we filtered the posts to include those that contained both sexual and technology-related words. To do this, we created a lexicon of popular sexual jargon used by adolescents [94] combined with technology-oriented terms, such as the names of popular social media platforms. These search terms were also supplemented by additional keywords extracted after a manual review of five thousands posts. The keywords used were grouped conceptually into "social media platform," "online," and "sexual" categories and listed in Table 1. Then, a SQL query was written based on these keywords to filter the 54,226 posts, resulting in a set of 8,271 posts made by 6,351 adolescents about their online sexual risk experiences.

Types	**Keywords**
Social Media Platforms	Facebook, Instagram, Tinder, Bumble, Grinder, Snapchat, Craigslist, Skype, Hinge, Whatsapp, Kik, Discord, Messenger, Omegle, Vimeo, Vine, Tumblr, Myspace, 4chan, Reddi, forum, blog, Facetime, ft
Online/Technology Terms	video chat, message, dm, sent, send, pm, online, meet on, met on, webcam, gaming, cyber, blackmail, internet, AMOSC, f2f, LMIRL
Sexual Jargon	Sex, nude, naked, flirt, STI, STD, grooming LDR, predator, rape, solicit, dick, threesome, 3some, pussy, vagina, penis, cock, cunt, anal, clit, clitros, thick, boob, breast, tit, nipple, oral, sodomy, finger, handjob, touch, balls, fondle, birth control, BCP, plan b, condom, #metoo, non-consensual, pedophile, catfish, BDSM, bondage, dominant, sadism, masochism, lesbian, gay, cougar, smash, virgin, underage, minor, nsfw, make out, made out, sugarbaby, horny, LEWD, blowjob, BJ, friends with benefits, DFT, hentai, porn, dry hump, Netflix and chill, thirsty, TDTM, cum, sperm, semen, cunnilingus, dildo, ejaculate, masturbate, erect, fellatio, foreplay, foreskin, genital, hepatitis, herpes, homo, hymen, IUD, lube, morning after, morning wood, libido, hickey, lick, one night stand, orgasm, rimming, scrotum, vibrator.

Table 1. Scoping Search Terms. The acronyms' definitions are listed in Appendix A.

Next, we reviewed the 8,271 posts for relevancy. Posts were deemed relevant if they described some kind of sexual experience that involved an online component. Posts were divided among five

annotators, and each post was reviewed by two coders. The raters showed a substantial agreement (Cohen's kappa = 0.71). A consensus was formed among all five coders to resolve conflicts. The resulting dataset contained 4,180 (51%) disclosures about online sexual experiences and 4,091 (49%) posts that did not meet this criterion. These labels (online sexual disclosure/not online sexual disclosure) were then used as ground truth labels for addressing RQ1.

3.1.3 Ground Truth Annotations. The 4,180 relevant posts disclosing teens' online sexual risk experiences were further annotated based on 1) *level of consent* and 2) the *relationship type* between the teen and the individual in which they described sharing the sexual experience. Two independent annotators coded each post and reached substantial (Cohen's kappa > 0.70) to complete (1.00) agreement. We describe these dimensions and codes in more detail below.

Levels of Consent. While consent is a complex concept when dealing with minors, who are by legal definition under the age of consent [60], our work acknowledges the importance of taking into account the agency and first-person perspective of teens when disclosing their personal sexual experiences. Further, prior work on adolescent online risk behavior has shown that teens' online risk experiences vary significantly based on whether they considered themselves victims, willing participants, or initiators of a given risk experience [106, 107]. Through a grounded analysis of the data, we derived the following distinct levels of consent:

- *Consensual Sexting:* Posts where teens explicitly stated that they pursued or willingly participated in an online sexual exchange with another person.
- *Non-consensual Sexting:* Posts where teens explicitly stated that the online sexual exchange was unwanted, unwelcomed, or unsolicited.
- *Sexual Abuse:* Posts that disclosed non-consensual online sexual exchanges evolved into a physical sexual interaction in real life (e.g., statutory rape).
- *Consent Status Unknown:* Posts where the level of consent was not expressly specified or discussed in an interpretable way, or posts where consent as a concept was unknown.

As noted above, we used this definition of consent, where teens had to explicitly state a willingness to engage in a sexual exchange for it to be coded as 'consensual.' Our rationale for this decision was that interpreting implied consent from a single post is problematic from both an ethical and legal standpoint [7]. Thus, posts had to be clear that the sexting behavior was either initiated by the teen or done willingly (without undue coercion). For example:

> *"Anyone sext? I've been sexting for a year and it's like an addiction to flirt with people online once I'm feeling bored" –Female 14 years old.*

Regarding non-consensual sexting, we found that teens were often fairly direct about their lack of consent, which aided in coding these instances:

> *"Why do guys just send nudes? All I said was hey and then you sent me a dick pic without asking! What makes you think I would want that? I'm not a hoe, and sorry I'm not gonna entertain you" –Female 16 years old.*

Sexual abuse involved non-consensual sexting that resulted in an offline sexual encounter with the teen. While we acknowledge that all non-consensual sexting can be viewed as a form of sexual abuse [24], these situations were different in that they were *physically* harmful to youth and would potentially rise to the level of mandated child abuse reporting [67]; therefore, a separate category for these types of sexual risk experiences was warranted. As an example, many teens disclosed their personal stories about being victims of rape:

> *"My relationship with my boyfriend started when i was 13. after about a week I sent him videos... I was happy to make him feel good. After that he started to touch me in class...*

> *Later on he raped me. I didnt want it happening again. He told me I was worthless girl with only a body and a slut. I became extremely suicidal I took pills and I tried to cut" – Female 14 years old.*

We coded a total of 1,136 posts as consensual sexting, 705 as non-consensual sexting, 243 as sexual abuse, and 2,043 as not applicable.

Relationship Types. Relationship type is another important aspect of teens' online sexual experiences, as the assessment of the sexual riskiness attached to these experiences may vary based on the relationship between youth and with whom they sext [85, 97]. The relationships between teens and others involved in the online sexual risk experience disclosure posts were:

- *Strangers:* Posts that describe experiences between an adolescent and a stranger.
- *Dating Partners:* Posts that describe experiences between an adolescent and a dating partner in a romantic relationship.
- *Friends:* Posts that describe experiences between an adolescent and a friend or acquaintance.
- *Family Members:* Posts that describe experiences between an adolescent and a family member.
- *Not Applicable:* Posts that were ambiguous as to the relationship between the teen and the individual or did not specify.

Quotations presented in section 4.4 are conceptually grouped by the relationship types described in the posts to illustrate examples of how we coded based on relationship type. While these categories were relatively straightforward to code for, during our preliminary analysis of the data set we noticed enough similar patterns between the "Dating" and "Friend" categories that it was often difficult to ascertain the differences between the two. Further examination of the literature revealed that past studies also found the boundary between friendship and romantic relationships was often blurred in adolescence [25, 26]. For instance, as in the following quotation, teens often talked about romantic feelings towards someone described as a close friend.

> *"So I've liked this guy for 6 years and he's like my best friend and we love each other so much but like as friends. He's 14. And he just asked me to send pictures to him. Like naked. And he sent me a pic of his d**k and it kinda turned me on. I kinda sent him a pic back. What does that mean?" –Female 14 years old.*

Further, when conducting an initial analysis for RQ2, the χ^2 test of independence found no significant differences between the 'Dating' and 'Friend' categories [χ^2 (df = 4, N = 2084) = 210.36, p = 0.87]. For these reasons, we decided to combine the two into one Friend/Dating category for the analysis presented in this paper. Therefore, we coded 2,084 disclosures about online sexual experiences that occurred with strangers, 841 within friend/dating relationships, and 80 with family members. These codes were used to train a relationships classifier model (as part of RQ1) to machine label a larger dataset for further analysis in RQs 2 & 3, while the posts that were coded as not applicable were treated as missing values for the machine learning algorithms.

3.2 Classifying Online Sexual Risk Disclosure Posts

In the following sections, we explain our data pre-processing and the supervised machine learning approach for answering RQ1.

3.2.1 Data Pre-processing and Models. Multiple steps were performed to pre-process the datasets before running the models. First, any post with one or two words was removed since context cannot be extracted from two words. Then, the posts were converted to all lowercase. A preliminary exploration was done for the classification framework with stopwords and stemming, and we found no noticeable differences in the accuracy of the classifiers. Therefore, we opted to keep the stopwords and the original form of the words to preserve how adolescents express themselves. The

next step was using a Python library called Keras Tokenizer to convert the posts into tokens that can be fed to the models. Both interpretable models (SVM, Random Forest, and Logistic regression) and deep learning models were preliminarily explored, and the initial results yielded from training the models showed that deep learning models significantly outperformed the interpretable models; therefore, we opted to move forward using deep learning models. The first step was to train and optimize the classification models using the manually labeled dataset. In this work, we applied deep learning models for predicting the following:

- *Online Sexual Risk Disclosures/Not Online Sexual Risk Disclosures*: Binary classification models used to predict whether or not a post contained an online sexual risk disclosure.
- *Level of Consent*: Multi-class classification models were used to predict the types of sexual risk experiences based on the levels of consent, which were consensual sexting, non-consensual sexting, and sexual abuse.
- *Relationship Types*: Multi-class classification models were used to predict the relationship types, which included stranger, friend/dating, and family.

Deep learning models are known to decrease the false rates for text classification [9]. Based on this fact, the Long Short-Term Memory (LSTM) model and the Convolutional Neural Network (CNN) model have been widely applied for text classification. Recently, CNN and LSTM have been used for Natural Language Processing of small text classification [59, 81]. Therefore, the performance of CNN and LSTM across the three text classification tasks was used, explored, and compared in this study. A 5-fold cross-validation was conducted along with a random search to tune the hyperparameters for each model. In each fold, 80% of the data was used for training (out of this 80% of the data, 10% was used as the validation set) and 20% of the data was used for testing. The next section will discuss in more detail the evaluation matrices we applied to compare the models' performance.

3.2.2 Evaluation. Since we applied the 5-fold cross validation, the average accuracy of the models, the standard deviation of the accuracy, the class-specific precision and recall, the F1-measure, and the area under the receiver operating characteristic (ROC) curve (AUC) were used to evaluate our models using the test sets. The accuracy and F1 scores provide general insight into the performance of the models; therefore, only AUC was analyzed in this study since it can provide more detailed insights. We report the performance metrics of our classifiers in section 4.1.

3.2.3 Machine Labeling. After training and evaluating the models based on the manually annotated ground truth data, the trained classifiers with the best accuracy performances were then used to machine label the rest of the dataset beyond the manually annotated data. We labeled the entire dataset ($N = 45,955$) based on the classifiers for online sexual disclosures/not online sexual disclosures, levels of consent, and relationship types, which identified a total of ($N = 25,808$) posts that contained an online sexual risk disclosure made by teens. Machine labeling the entire dataset increased our power to detect significant differences for the χ^2 tests in RQ2, and the larger number of posts gave us the ability to detect more nuanced topics (RQ3) and better understand adolescents' online sexual disclosures across the dimensions of levels of consent and the relationship types.

3.3 Examining Between-Group Differences

To examine whether there were differences between the three types of sexual risk experiences and the three relationship types (RQ2), we performed a χ^2 test of independence, which are between-group (rather than within-group) tests applied when there are two or more nominal variables, each with two or more possible values [91]. The standardized residuals are calculated by dividing the product of subtracting expected from observed values by the square root of the expected value as

an estimate of the raw residual's standard deviation [91]. The standardized residuals were used in this study to show the significant differences between the relationship type and the types of sexual risk experiences. The χ^2 test was conducted for the combined dataset ($N = 27,892$) comprising the manually annotated and machine labeled posts.

3.4 Topic Modeling Approach

For RQ3, we leveraged topic modeling [41] to further unpack teens' online sexual disclosures across the differing levels of consent and relationship types. Topic modeling, which has become a popular approach in the HCI literature [42], is a useful unsupervised approach to identify topics in teens' online sexual disclosures based on a textual analysis of these documents. Similar to prior works [5, 40], we complemented the topics extracted by the algorithms with our own qualitative interpretations of the data. To do this, we analyzed the top 15 words contributing to the topic and then read through the top 50 ranked posts (with the highest probability for each topic) through an iterative and inductive qualitative content analysis [50] approach to further interpret contextual details contained within the disclosures. We semantically labeled our topics to assign high level descriptors to them based on our understanding of the top 15 keywords and the qualitative interpretation of the top 50 posts.

For creating the topics, the posts were cleaned based on the following steps: 1) removing stopwords that did not add any semantic value, 2) stemming, 3) tokenizing. After the normalization step, the topic model was iteratively run and kept removing words that were not specific enough or meaningful to the analysis, such as "the," "and," "or," and common pronouns. We then proceeded to run the model on the rest of categories. We reported the average coherence score for each number of topics to identify the number of topics that would provide succinct cohesion for a particular category of posts as shown in Table 3.

Two different topic modeling approaches were experimented with for this study: 1) Latent Dirichlet Allocation (LDA) [12] and 2) Dirichlet Mixture Model (DMM), which is specifically designed for overcoming the sparse and high-dimensional problem of clustering short texts [111]. To choose the best one, we experimented with the two selected approaches by applying them across categories with different numbers of posts: Stranger and Consensual Sexting, Friend/Dating and Consensual Sexting, and Family and Sexual Abuse. To evaluate the quality of the yielded topics, we used coherence score, which measures the degree of semantic similarity between the top keywords of the topic [69]. We ran the two models with different starting numbers of topics (from 2 to 15) to compare the performance of these models based on the average coherence scores. LDA performed poorly compared to DMM across the selected categories, especially the category of family and sexual abuse, which had the smallest number of posts (comparing with the three selected categories). The best average coherence score for LDA was for the stranger and consensual sexting category (the category with the largest number of posts), but this was less than DMM (a larger coherence score means the topics are more coherent). Overall, the DMM showed the best average coherence scores (avg.coherence: -79.39) and yielded more semantically interpretable topics in comparison with the LDA model (avg.coherence: -98.02) as shown in Table 2. Therefore, we proceeded with the DMM algorithm. For the rest of the categories, we followed the same procedure by running the DMM algorithm with different numbers of topics (from 2 to 15) to determine the best number of topics for that category based on the best average coherence score as listed in Table 3.

For each topic, we then conducted qualitative analysis to gain further insights. We did this by first analyzing the top 15 most probable keywords for a given topic, then the first author did a qualitative reading to analyze the top 50 representative posts with the highest probability for each topic. We used this qualitative understanding of the posts and top keywords to answer RQ3. Section 4.4 presents the topic models for the dimensions that yielded strong statistical significance in our

Model	Topic 1	Topic 2	Topic 3
LDA	school, thought, happen, everything, rachel, wrong, anyway, problem, another, almost, kik, skype, send, among.	listen, dear, okay, world, happy, left, haven, guy, story, have, know, couple, comment, best, what.	sexual, weird, scare, gonna, kinda, worth, sound, internet, problem, video, conversation, comment, video, start, hard.
DMM	bisexual, crush, question, single, lesbian, skype, attract, account, roleplay, advice, kik, gay, anyone, flirt, send.	depress, sext, addict, attention, want, suicide, random, wonder, feel, cut, change, understand, better, help, need.	older, sext, snapchat, ugly, talk, pretend, instagram, account, restrict, creep, flirt, hot, age, men, lie.

Table 2. The top 15 words in topics discovered by LDA and DMM.

Category	K=2	K=3	K=4	K=5
Consensual Sexting & Stranger	-99.56	**-79.39**	-108.60	-89.32
Non-consensual Sexting & Stranger	**-133.65**	-199.02	-167.87	-168.98
Consensual Sexting & Friend/Dating	**-57.43**	-84.12	-102.34	-190.45
Non-consensual Sexting & Friend/Dating	**-65.23**	-87.21	-91.62	-88.43
Sexual Abuse & Family	**-43.12**	-66.80	-79.32	-94.21

Table 3. Average coherence score on the K number of topics for each category. A larger coherence score means the topics are more coherent.

RQ2 analyses and includes illustration quotes to contextualize each topic. For smaller categories (i.e., sexual abuse by strangers and friends/dating), where there were low counts that affected the topic modeling to not yield strong coherence scores, we provided our own qualitative insights to characterize the posts in these categories.

4 RESULTS

In this section, we begin by answering RQ1 and demonstrating how CNN outperformed LSTM for the three classifiers we built for online sexual disclosures, levels of consent, and relationship types. Then, we present the significant different patterns of associations between the levels of consent and relationship types to answer RQ2. Finally, we explore the different topics yielded from the significant associations based on the between group analysis to unpack the different levels of consent and relationship types.

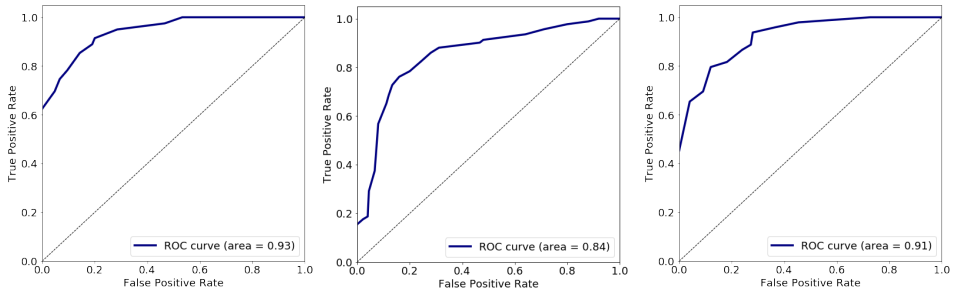
4.1 Identifying Online Sexual Posts (RQ1)

The first step to evaluate the overall accuracy performance of the two deep learning models was calculating the baseline accuracy, which was 51% for the online sexual disclosures/not online sexual disclosures classifier, 36% for levels of consent classifier, and 37% for the relationship types classifier. Table 4 reports the accuracy metrics for the three classifiers; it clearly shows that the overall performance is better than the baseline accuracy for the three classifiers. For the online sexual posts classifier, the CNN model performed better than LSTM ($AUC = 0.93$) in identifying online sexual posts (refer to Figure 1 for ROC curve of online sexual classifier and to Table 4). For class-specific performances, we observed that CNN yielded a higher precision and recall results for both classes than LSTM, which confirms the accurate predictions of CNN for each class. The online

sexual classifier labeled 56% (25,808 out of 45,955) as online sexual disclosures and 44% (20,147 out of 45,955) as not online sexual disclosures.

Models	Target	Classes	Avg.Acc	SD	Prec	Recall	F1	AUC
CNN	Online Sexual Disclosures	Online sexual	0.91	0.47	0.94	0.92	0.93	**0.93**
		Not online sexual			0.88	0.90	0.89	
LSTM		Online sexual	0.82	0.69	0.83	0.91	0.87	0.85
		Not online sexual			0.88	0.72	0.79	
CNN	Levels of Consent	Consensual Sexting	0.80	1.02	0.85	0.89	0.87	**0.84**
		Non-consensual Sexting			0.60	0.62	0.61	
		Sexual Abuse			0.81	0.83	0.81	
LSTM		Consensual Sexting	0.72	1.91	0.78	0.74	0.75	0.75
		Non-consensual Sexting			0.43	0.38	0.40	
		Sexual Abuse			0.50	0.71	0.58	
CNN	Relationship Types	Stranger	0.88	1.79	0.91	0.95	0.93	**0.91**
		Friend/Dating			0.92	0.85	0.88	
		Family			0.79	0.80	0.79	
LSTM		Stranger	0.80	1.42	0.83	0.79	0.81	0.85
		Friend/Dating			0.76	0.81	0.78	
		Family			0.72	0.80	0.75	

Table 4. Metrics of deep learning classifiers in k-fold (k=5) cross-validation.



(a) Online Sexual Disclosures (b) Levels of Consent (c) Relationship Types

Fig. 1. ROC Curves of the classifiers with the best accuracy

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The CNN also outperformed LSTM ($AUC = 0.84$) in predicting types of levels of consent (consensual sexting, non-consensual sexting, sexual abuse) as shown in Table 4. Figure 1 shows the ROC curve of the levels of consent classifier. Out of the 25,808 online sexual disclosures, we obtained 60% ($N = 16,616$) as consensual sexting, 28% ($N = 7,933$) as non-consensual sexting, and 12% ($N = 3343$) as sexual abuse.

Finally, in identifying relationship types in the posts (stranger, friend/dating, and family), CNN also performed better than LSTM (AUC = 0.91) as shown in table 4. The ROC curve of the relationship types classifier is shown in Figure 1. For the relationship classifier, we obtained 59% ($N = 16,355$) labeled as stranger, 34% ($N = 9,466$) labeled as friend/dating, and 7% ($N = 2071$) as family. The analysis for RQ2 and RQ3 will proceed with a combined dataset of the manually annotated and the machine labeled posts ($N = 27,892$). Figure 2 (A) shows the distribution of the combined dataset across the types of levels of consent and relationship types.

4.2 Characteristics of the Combined Dataset (Machine and Manually Labeled)

The 27,892 relevant online sexual disclosures were written by teens who were between 13 and 17 years old, with an average age of 15 years old (at the time of posting). Fifteen-year-old teenagers were represented the largest percentage of posts (27%), followed by users who were 16 (20%), 14 (19%), 17 (18%), and 13 (16%). Most of the posts were written by female users (78%), followed by male users (12%) and non-binary or unspecified gender users (10%). These teens had been active in the platform for an average of 7.5 months from the date they first posted. Based on the teens' posts, 36% mentioned using other social media platforms, such as Kik (39%), Skype (15%), Snapchat (12%), Facebook (12%), Instagram (9%), a peer support platform (8%), Tumblr (3%), and Omegle (2%).

4.3 Sexual Risk Experiences Significantly Differ Based on Level of Consent and Relationship Type (RQ2)

A χ^2 test indicated a significant association between relationship type and levels of consent [$\chi^2 (df = 4, N = 27,892) = 3357.4, p < 0.001$, Cramer's $V = 0.245$]. Post hoc testing revealed all three relationship types were significantly different from each other in terms of the level of consent. Specifically, after p-values were adjusted using Bonferroni correction, there were significant differences between stranger and friend/dating ($p < 0.001$), between stranger and family ($p < 0.001$), and between friends/dating and family ($p < 0.001$). As illustrated in Figure 2, when comparing proportions of level of consent disclosures for each relationship type, for consensual sexting, the friend/dating category had the highest relative proportion (i.e., 77% of experiences involving friend/dating relationships were consensual sexting), followed by stranger (53%) and family (29%). For non-consensual sexting, stranger had the highest relative proportion (36% of stranger-related experiences were non-consensual sexting), followed by family (33%) and friend/dating (14%). For sexual abuse, the family category had the highest relative proportion (39% of adolescents' online sexual experiences with family were sexual abuse), stranger (10%) and friend/dating (9%).

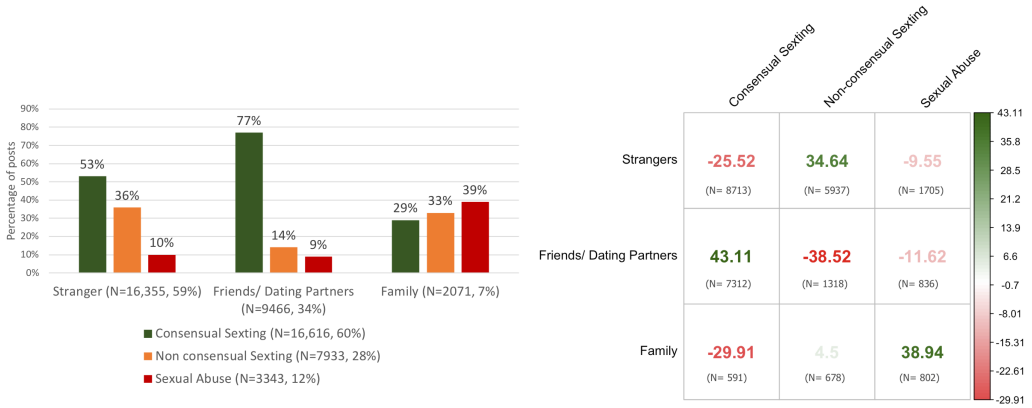

Fig. 2. (A) Distribution of levels of consent and relationship types of the combined dataset ($N = 27,892$). The bars are standardized to 100% for each category. (B) Correlation matrix of Pearson's standardized residuals between the levels of consent and relationship types.

Next, we used the standardized residuals to more closely examine associations between each relationship type and levels of consent. Each pairwise comparison showed a significant association (shown in Figure 2, all adjusted p-values < 0.001 using Bonferroni correction). First, for experiences involving strangers, there was a strong negative association between strangers and consensual

sexting and a strong positive association between strangers and non-consensual sexting. These diverging associations suggest that when teens post about sexting with strangers, discussions are more likely to involve non-consensual interactions. In contrast, for experiences involving friends/dating partners, we observed the opposite pattern for consensual and non-consensual sexting. Specifically, there was a strong positive association between friend/dating and consensual sexting and a strong negative association between friend/dating and non-consensual sexting, suggesting teens are more likely to have or discuss consensual sexting as a positive experience with friends or dating partners, while non-consensual sexting was less likely in these relationships. Both stranger and friend/dating relationships had a relatively weak negative association with sexual abuse. In contrast, for experiences involving family, there was a strong positive association between family and sexual abuse, suggesting discussions about family on the peer support platform studied may be relatively more likely to involve sexual abuse compared to discussions about other relationships. Additionally, there was a strong negative association between family and consensual sexting, and a weak positive association between family and non-consensual sexting. These findings provide interesting insights and allow us to unpack these strong associations to examine the nature of these discussions, which we explore in the following section.

4.4 Unpacking the Online Sexual Risk Experiences of Teens (RQ3)

In this section, we discuss the topic modeling results and qualitative interpretations to unpack the differences between the levels of consent and relationship types reflected in the posts from the combined dataset (manually and machine labeled data). The high level descriptor of the resulting topics along with the top 15 keywords of adolescents' online sexual disclosures across levels of consent and relationship types are displayed in Table 5.

4.4.1 Sexting with Strangers. In this section, we unpack the emerged topics from youths' posts about their consensual and non-consensual sexting experiences with strangers online.

LGBTQ+ and sexuality ($N = 4,443$, 51%). The largest percentage of posts regarding consensual sexting with strangers were posts made by teens who identified as part of the Lesbian, Gay, Bisexual, Trans-gendered, and other sexual minority (LGBTQ+) community. These adolescents referenced using online private messaging platforms, predominantly Kik, to connect with and solicit attention from others within the LGBTQ+ community (e.g., crush, single, attract, flirt, roleplay). For example, teens often asked to connect with others of a specific sexual orientation to engage in sexual interactions ranging from simple flirtations to sexual 'hook-ups.' A common pattern among these posts was that these teens often did not specify their gender in their profiles, likely as a way to signal their non-conformance to gender norms.

> *"I want a flirting buddy .. any takers? bisexual or lesbian .. only girls. send your kik."*
> *–Unspecified gender 15 years old.*

In many cases, these teens were using a platform that meant for mental health support as a dating app by posting requests to connect with other teens for sexual interplay. While most of the posts were from LGBTQ+ teens looking for partners to sext, in other cases, teens sought to explore their sexual identities through sexual roleplaying with strangers. It was less clear in these cases whether the teens identified as part of the LGBTQ+ community or simply wanted to explore different sexual orientations. For example, a 14-year-old (unspecified gender) asked the following question in a post:

> *"anyone wanna do gay roleplay with me on skype? Ill still love you if you dont ??"*
> *–Unspecified gender 14 years old.*

In other cases, teens sought advice from strangers about their sexuality and/or sexual orientation.

Relationship Type	Topics	Top 15 Keywords
With Strangers ($N = 16,355, 59\%$)		
Consensual Sexting ($N = 8713, 53\%$) (avg. coherence: -79.39)	LGBTQ+ and sexuality ($N = 4443, 51\%$)	bisexual, crush, question, single, lesbian, skype, attract, account, roleplay, advice, kik, gay, anyone, flirt, send.
	Mental health motivated sexting ($N = 2962, 34\%$)	depress, sext, addict, attention, want, suicide, random, wonder, feel, cut, change, understand, better, help, need.
	Sexting with/as adults ($N = 1306, 15\%$)	older, sext, snapchat, ugly, talk, pretend, instagram, account, restrict, creep, flirt, hot, age, men, lie.
Non-consensual Sexting ($N = 593, 36\%$) (avg. coherence: -133.65)	Harassment and sextortion ($N = 3767, 62\%$)	threaten, blackmail, stupid, pic, scare, screenshot, videoed, rape, police, snapchat, convince, internet, donot, send, demand.
	Unsolicited Exposure ($N = 2170, 38\%$)	guy, pic, send, dick, kik, nude, scare, random, ask, pervert, talk, puke, me, traumatise, get.
With Friends/Dating Partners ($N = 9466, 34\%$)		
Consensual Sexting ($N = 7312, 77\%$) (avg. coherence: -57.43)	Sexting within a close relationship ($N = 4314, 59\%$)	flirt, ldr, cheat, sext, skype, sexual, distance, happy, pic, together, trust, fun, hate, boyfriend, friend.
	Mental health motivated sexting with friends/dating partners ($N = 2997, 41\%$)	suicide, sex, picture, attention, reason, send, bipolar, better, differ, bad, depress, feel, friend, commit, ask.
Non-consensual Sexting ($N = 1318, 14\%$) (avg. coherence: -65.23)	Peer pressure to sext ($N = 843, 64\%$)	pressure, trust, bestfriend, threaten, send, ex, scare, kill, fault, sex, reason, photo, dont, friend, confuse.
	Feeling betrayed by trusted others ($N = 579, 36\%$)	send, pissed, stupid, upset, block, mad, off, trust, horrible, bullshit, friendship, disturb, hate, nude, friend.
With Family Members ($N = 2071, 7\%$)		
Sexual Abuse ($N = 802, 39\%$) (avg. coherence: -43.12)	Sharing stories of past/current abuse ($N = 425, 53\%$)	parent, memory, afraid, stupid, brother, older, sexual, harass, again, dad, night, sudden, father, abuse, disgust.
	Coping with the aftermath of abuse ($N = 376, 47\%$)	abuse, dad, touch, scare, anorexia, cut, molest, stori, harm, again, stomach, suicide, threat, depress.

Table 5. Emerged topics across levels of consent and relationship types ($N = 27,892$).

> *"Bisexual & Gay Males I need your advice- I'm 16 and questioning my sexuality- I have a question: Is it strange that I am attracted to: the idea of online sexual relationships with guys, the idea of giving and receiving oral sex from a guy, BUT I am not okay with other forms of sex, and I don't know how id feel about kissing." –Unspecified gender 16 years old.*

While seeking out strangers to become sexual partners had the potential to lead to risky sexual interactions, many of the posts in this topic also illustrated the benefit of being able to connect with a like-minded community to ask questions, get advice, and explore and exercise their sexual orientation in a way that was true to their identities.

Mental health motivated sexting ($N = 2,962$, 34%). The second largest topic for consensual sexting with strangers contained posts about sexting that on the surface seemed consensual, but upon further examination appeared to be motivated by underlying mental health conditions, such as depression (e.g., depress, suicide, cut). These teens appeared to use sexting with strangers as a way to cope with low self-esteem, depression, anxiety, and the desire to be loved, accepted, and seen (e.g., feel, better, help, attention, need). These posts often were made as a confession with an undertone of regret and shame, like the following quote from a teen with a mental illness who was not proud of the nudes she sent.

> *"[want to say the truth] I've cut and had depression and I've sent nudes before I'm not proud of. I did send it to people cause I thought it would help me to live more and feel better ..." –Female 15 years old.*

These posts often include teens' experiences with their mental health, including suicidal ideation, self-harm, and loneliness, combined with a desperate need for relief from these issues. Often, these teens knew that their sexting behaviors were unhealthy; they just wanted to feel good and be wanted, similar to the 17-year-old female below who knew she was being used for male pleasure but admitted that it made her feel wanted.

> *"...I know guys just use me to get off but at least someone wants me..." –Female 17 years old.*

Many teens began sexting with strangers as a way to cope with heartbreak or rejection. Then, they became addicted to the attention and could not stop. Unfortunately, engaging in sexting often had the opposite effect by making teens feel worse about themselves instead of better. Many of the posts, like the one below, expressed a deep-seated self hatred due to these experiences.

> *"... he was all I ever wanted and more but now ... he doesn't even talk to me. I changed so much over the year. i started sending people nudes ... but now I'm addicted and getting on. you made me a fucking hoe ... I'm a bisexual depressed fucking bean" –Female 14 years old.*

Although these posts were labeled as consensual because teens willingly sought out and engaged in these sexual interactions, it was clear that these experiences were harmful to them. Later, we discuss the implications of this finding in terms of the complexities around the concept of consent when dealing with minors, particularly those who have mental health challenges, as well as the potential unintended harm of inaccurate risk classifications (i.e., false negatives for identifying consent) when developing risk mitigation interventions.

Sexting with/as adults ($N = 1,306$, 15%). The other topic that emerged from consensual sexting with strangers revolved around the concept of age. Age indicators (e.g., older, age, men) were often associated with sexting keywords (e.g., sext, flirt) across different social media platforms (e.g., snapchat, instagram, account) in these sexual disclosures. Teens discussed various platforms' age restriction rules (e.g., talk, restrict, age). In these posts, teens talked about online sexual exchanges

with adults or adults pretending to be teens. In some cases, teens pretended to be adults themselves for the purpose of sexting with strangers (e.g., pretend, lie, creep). In many cases, teens appeared motivated to disclose about these sexual risk experiences because they felt "in over their heads" and needed advice on what to do:

> *"An older female on meetme wants me to sext with her not knowing I'm a lot younger then her ... I had created my account to say I'm older than what I am though I'm only 15 and I know meetme has strict rules but I do not know what to do I asked her if she has kik and of course she said no but I don't feel comfortable at all" –Male 15 years old.*

Many teens expressed a preference to interact sexually with older strangers because they treated them better/different than people who were in their age. In these posts, teens often were attempting to develop caring relationships with people who were older than them, rather than engage in sexting for the act itself. In some cases, their feelings were reciprocated, but in other situations, like the one below, the outcome was unclear:

> *"I'm the kid @ school, who's considered to be the 'ugly girl.' I've always been attracted to older men cuz they don't see me as ugly. They see me as beautiful, sexy, etc... I started a conversation with a man. one of the first things he asked me was can we trade nudes... after a while I gave him a photo of my butt, in a cheeky bodysuit. I truly care about him, and I hope that he truly cares about me too." –Female 16 years old*

Overall, the power differential stemming from the age difference between teens and adults was fairly apparent as the youth often expressed uncertainty or concern and asked others on the platform how best to proceed, as in the following quote from a 17 years old female who sought an advice about the age difference between her and someone who was 10 years older than her.

> *"I have very strong feelings towards a guy I know online. We have sexted and such for a couple months. He's 10 years older than me. He says he likes me. Idk the problem is the age difference. Advice?" –Female 17 years old*

Harassment and sextortion ($N = 3,767$, 62%). Non-consensual sexting was the most prominent and statistically significant pattern we observed when teens engaged with strangers. These posts disclosed risky sexual experiences that occurred on online platforms (e.g., snapchat, internet) that were threatening and/or aggressively charged (e.g., threaten, blackmail, rape, police). Teens described how strangers manipulated and tried to control them (e.g., convince, demand) due to sexual content shared (e.g., pic, screenshot, videoed). Teens expressed fear (e.g., scare) about how to handle these situations and asked others what they should do.

> *"I did something really stupid. I was on a chat site talking to a cute boy when he asked for a bra pic, which I sent, and like an idiot I told him my town and school. Then, everything changed he threatens to take my pic and post it to everyone..." –Female 14 years old.*

As shown above, this type of sextortion often occurred after teens made the mistake of sending a nude or partially nude photo to someone whose affection they were hoping to attract. In more severe cases, teens were then coerced to continue engaging in non-consensual sexting for fear that their past mistakes would be exposed and used against them.

> *"This guy on omegle and he said if I show my tits he will show his dick so I was like okay whatever. I wanted to leave but he said that he videoed me doing it and if I don't do more he will post it on the Internet. So I kept doing and I was scared that he would post them." –Female 16 years*

Strangers used several strategies to harass teens and force them to interact sexually with them. Teens' posts described how strangers blackmailed them by saying they would send pictures or

videos of the teen to people they knew with the intention of embarrassing them or getting them in trouble. To do this, the strangers also had to obtain personal information from the teen, such as the names or contact information of their friends or the location of their school and/or home. By the time the person had this information and made their intentions transparent to the teen, it was often too late for the teens to protect themselves from this kind of harassment and abuse. They felt helpless, scared, and ashamed.

Unsolicited Exposure ($N = 2170$, 38%). The other type of non-consensual sexting with strangers involved receiving unsolicited explicit imagery (e.g., pic, send, dick, nude, random, me, get) from random people (e.g., pervert) online (e.g., kik). Teens often expressed negative emotions about these online sexual risk experiences, including fear and disgust (scare, traumatize, puke). These unsolicited messages included nude pictures and pornographic videos. In many cases, teens received these messages 'out-of-the-blue' from strangers they had never talked with before. Because of this, younger teens, in particular, found these experiences surprising, disturbing, and even traumatizing.

> *"I'm 13 and someone just sent me nudes I am really traumatised." –Female 13 years*

Many of the teens said that they blocked the account of the offender, and others also reported the message and the account to the social media platform. It was rare for these unsolicited sexual messages to lead to further sexual exchanges because teens felt blindsided and violated as to why a stranger would expose them to unwanted sexual content in the first place.

Sexual Abuse by Strangers. Sexual abuse by strangers yielded weak statistical association in our RQ2 analysis and had a low post count overall. This may be because teens who engaged with others to the point of physical sexual contact no longer considered the other person a stranger. As such, teens' sexual abuse disclosures in this category mostly described how teens were raped by a stranger that they met online. Teens reached out on the peer support platform to garner support and share their stories to connect with other survivors. As to not trigger the reader, we chose not to include any quotations that depicted these graphic disclosures of rape.

4.4.2 Sexting with Friends/Dating. In this section, we present teens' consensual sexting, non-consensual sexting, and sexual abuse experiences that involved friends/dating partners online.

Sexting within a close relationship ($N = 4,314$, 59%). Over half of the consensual sexting posts in this category involved a romantic partner (e.g., boyfriend, friend). Many of these online sexual experiences (e.g, flirt, sext, sexual, pic) occurred due to long-distance relationships (e.g., ldr, distance) on private messaging platforms (e.g., skype). Unlike sexual disclosures with strangers, teens described deeper relationships (e.g., trust) and more sexual experiences that evoked positive emotions (e.g., happy, fun) within this topic.

> *"I just sexted with my boyfriend for the first time and he's 14 and I'm 15 but omg. idk. it was actually kinda fun..." –Female 15 years old.*

In long-distance relationships, particularly when teens first met their partners online, sexting was often used as a way to set body expectations and ensure mutual physical attraction before taking the step to meet in person. This meant that sexual exchanges would occur before the two people met in real life, which in some cases made teens more vulnerable, but in other situations, like in the post below, made them feel more secure that they were not wasting their time and affection.

> *"Wanting to send ldr boyfriend who is visiting for first time soon a pic of me in underwear but covering boobs so he can really see what my body looks like and if he likes me for who I am and he's not wasting his time you know? I'm chubby... I think I may feel more relieved about it." –Female 17 years old.*

Teens used consensual sexting as a way to build intimacy and strengthen their relationships. Teens often explained that sexting was a way to make others feel happy or sexually gratified. Interestingly, these exchanges took place not only between partners in a monogamous dating partnership. Close friends or "friends with benefits" also engaged in sexting. However, in these cases, there was more ambivalence and uncertainty in the posts. Teens often worried if they were getting their desired outcome, as in the following quote from a teen who did not feel that sending nudes to his lover made her happy.

> *" I feel as though me sending nudes to this girl I love as a best friend would make her happy and she likes them but I don't feel they make her happy." –Male 16 years old.*

In other cases, sending friends nude pictures backfired when the recipient betrayed the sender's trust by sharing the sexual image with other people without the sender's consent.

> *"I sent nudes to my friend. I know it's stupid but the compliments were so nice and made me not hate myself for awhile, I trusted him. But at school he showed half my grade. I am so embarrassed I cut when I got home and filled the tub with blood. No ones going to look at me the same. I hate him so much, but I hate myself more." –Female 15 years old.*

Situations like the one illustrated above poignantly highlight how expressions of a deep sense of betrayal often were accompanied by disclosures of suicidal ideation and/or self-harm.

Mental health motivated sexting with friends/dating partners ($N = 2,997$, 41%). A need for love and acceptance motivated teens to engage in sexting not only with strangers but with friends and dating partners. Disclosures about sexting (e.g., sex, picture) with friends/partners often described mixed emotions (e.g., better, bad, feel), attention-seeking behavior (e.g., attention, ask), and indicators of mental health issues (e.g., suicide, bipolar, depress, commit). In contrast to what we observed with strangers, teens often described engaging in sexting with friends/partners in order to meet the mental health and self-esteem needs of the other person.

> *"My boyfriend makes me feel bad every now and then, always asks to see it when we have cyber sex, when I say soon he now begs and pleads, I like to show in my own time even though he's seen it before …. When he makes me feel bad he blames it on his bipolar and promises the next day to be okay … What should I do ?" –Female 16 years old.*

If these teens did not want to engage in sexting, they did genuinely want to to help the people who were close to them and were concerned for their safety and well-being. Teens cited suicidal ideation, self-harm, and mental illness as reasons why they felt compelled to sext with friends and/or dating partners.

> *"one of my friends came to me saying how he was going to commit suicide … then he started talking about pu$$y and sex. Tonight he started asking for pictures and I felt bad for saying no and I sext with him" –Female 15 years old*

This topic sheds more light on the pitfalls of sexual consent, as teens agreed to engage in sexting but did so because they felt guilty and responsible for the mental health and well-being of the people they cared about.

Peer pressure to sext ($N = 843$, 64%). Non-consensual sexting disclosures between teens and their friends and/or dating partners shared the same pressure to make the other person happy but with less of a perceived threat of the other person harming themselves as a result of saying "no." In this topic, teens described sexting (e.g., send, sex, photo) experiences associated with more aggressive keywords (e.g., pressur, threaten) with their friends/dating partners (e.g., bestfriend, ex, friend). In most cases, negative emotional keywords appeared in these disclosures (e.g., scare, fault, confuse) as they were non-consensual and unwanted.

> *"my ex boyfriend threatened to leak my nudes that I sent to him when we were dating because I refused to send him more after we broke up" –Female 16 years old.*

In these cases, the sexting encounter had the potential to ruin trust relationships as teens often expressed anger and surprise that their friends would "cross-the-line." As such, teens vented their surprise and frustration by describing how that the experience led them to distance themselves from the other person, who they originally thought could be trusted as a friend.

Feeling betrayed by trusted others (N = 579, 36%). Many teens went beyond distancing themselves from a friend who tried to engage them in non-consensual sexting to expressing anger, rage, and a sense of betrayal. High levels of negative emotions appeared in teens' posts expressing strong feelings (e.g., pissed, upset, mad, off, horribl, disturb) about their non-consensual sexting experiences (e.g., send, nude) with their friends/dating partners (e.g., friendship, friend). They described these experiences in an unequivocally negative light (e.g., stupid, bullshit, horribl, hate). Some teens had extreme reactions, such as being 'done with life' or hating their situation due to such betrayal from a trusted other:

> *"When you trust your friend, then they ask for nudes. I hate my life!" –Female 16 years old.*

In these posts, adolescents expressed disappointment that their friends did not have more respect for them, which negatively impacted their self-worth and friendship. The unsolicited sexual imagery sent by friends/dating partners made teens feel shocked and violated.

> *"HELP!!!! A friend of mine just sent me nudes over snapchat, I ignored it the first time.. But then he does it again so I block him.. He's a good friend of mine but I'm not into this! And I find it disturbing he would send me something like that.. What should I do??" –Female 14 years old.*

Sexual abuse by friends/dating partners. While sexual abuse by friends/dating partners was not as common (weak significance in RQ2 and low post count), these posts often disclosed stories of rape by someone the teen knew and/or loved. In many cases, the abuse started with consensual sexting between the known person and the teen, but then went too far when the person forced the teen to have physical sex with them.

4.4.3 Sexting with Family Members. While less common than online sexual disclosures with strangers and friend/dating partners, teens also shared about their sexual experiences with family members. In this case, most sexual interactions with a family member were considered sexual abuse, but there were instances of consensual and non-consensual sexting as described below.

Consensual sexting with young family members. Most posts that described a consensual online sexual risk experience with a family member involved similarly aged (i.e., other youth) relatives (e.g., cousins, brother) who wanted to sexually experiment with one another in a non-romantic but sexual way. In many cases, the teens justified the sexual exchange based on their feelings of love or closeness with the other person and how they were sexually aroused by the experience:

> *"My bro is currently doing his studies overseas. We chat on skype almost everynight. Last night, he asked if he could masturbate on cam with me. We are very close to each other since we were little. i confess, i was really turned on watching him." –Female 14 years.*

However, some teens developed romantic feelings towards family members with whom they sexted. In these situations, teens often described a situation where they connected with a cousin online who made them feel loved. Given the familial relationship, these disclosures often were intermingled with a level of confusion about whether the other person reciprocated their feelings or whether a budding romance with a cousin was wrong.

> *"I think I am in love with my cousin. He is 2.5 years older than me and we started talking recently because he popped up on Facebook. We flirt so much and he calls me his baby girl and his princess and tells me that I'm beautiful. but I'm so confused. He's also asked me to toss him off when I see him. Do I love him? Does he love me? " –Female 13 years.*

As shown in the example above, older cousins often engaged their younger cousins in sexting. Young teens may have "consented" to the sexual exchange but were often ambivalent and confused because of it. Some teens also disclosed about their parents finding out about these relationships and punishing them by forbidding the relationship and/or revoking their technology privileges.

Sharing stories of past/current abuse (N = 42, 53%). When teens disclosed about non-consensual online sexual risk experiences with family members, it was most often sexual abuse. Teens recounted their memories of sexual abuse and rape (e.g., memory, sexual, harass, abuse) committed by an older family member (e.g., parent, brother, older, dad, father) and described the trauma from these experiences (e.g., afraid, stupid, disgust). These experiences often happened regularly and mostly during the night (e.g., again, night). In some cases, other family members were aware of what happened but failed to protect the teen. In many cases, teens disclosed a repetitive pattern of abuse that occurred over months or even years.

> *"my older brother sexually harasses me and once i told my parents then he stopped for 2 months and he kept doing it again" –Female 14 years*

In most cases, these sexual abuse stories involved an interwoven pattern of online and offline sexual abuse that unfolded over time. Similar to the case below, teens were often tricked into sexual exchanges with family members who pretended to be an alternate identity online:

> *"my brother who raped me last summer made a fake facebook account and was messaging me an i didnt know it was him, and we sexted … i had no idea who it was." –Female 14 years old.*

This type of duplicitous digital sexual abuse was worsened because the family member then has leverage over the teen to further blackmail them into performing other sexual acts against their will. Teens in these situations felt trapped as they were scared of getting exposed for their mistake of sexting in the first place. For this reason, teens often felt like they could not identify their abuser to get help.

Coping with the aftermath of abuse (N = 376, 47%). Teens used the online peer support platform not only to disclose their abuse but also try to cope with the aftermath. The top keywords that appeared in this topic were indicative of abuse (e.g., abuse, touch, molest) by adult family members (e.g., dad). Mental health indicators associated with these experiences (e.g., anorexia, cut, harm, stomach, suicide, depress) highlight the negative outcomes of enduring childhood sexual abuse.

> *"My mother had a new boyfriend. One night, I was sitting on my bed … He touched me in ways I never want to be touched again. He hurt me. He threatened me. I was scared. I didn't tell anyone. … I had enough of feeling worthless. I took about 78 pills, thinking it'd be enough…" –Female 15 years old.*

Teens recounted how these experiences personally affected them (e.g., scare, threat), often mentioning suicidal ideation and self-harm as a response to their abuse. While these experiences were traumatic for the youth, a silver-lining, perhaps, was that the online peer support platform gave teens a place where they could disclose, make sense of, seek support for, and hopefully heal from their abuse. Yet, in many cases, it was unclear from the posts whether the teens were able to get the help they needed to break out of the cycle of abuse and recover.

5 DISCUSSION

In this section, we discuss the important implications of our findings. We also present implications for design that move towards support teens' healthy and safe sexual development in online spaces.

5.1 Accurately Classifying Sexual Risk Experiences and Relationship Types

For RQ1, our work built upon the body of research that has focused on the automatic identification of online sexual posts using deep learning models. These types of models started to receive more attention in the last three years due to their promising accuracy performance on text classification tasks [21]. CNN was found to outperform other models (either traditional or deep learning), on identifying predatory behavior patterns, predatory conversations, and sexual harassment [33, 70, 109]. These works presented less accuracy of CNN binary classifiers (up to 0.86) than the average accuracy CNN yielded in this study (0.90). While LSTM architecture is designed for capturing long-term dependency in a sequence of words, CNN focuses mostly on the informative and most useful *n*-grams or keywords from the whole input text [112]. The posts in our dataset are considered short-length, which may have contributed to the higher CNN accuracy performance. Although CNN yields state-of-the-art results, it is not one of the most applied machine learning algorithms for detecting sexual risk or its context. Therefore, we recommend using CNN more in sexual risk detection research to provide more evidence that CNN is an appropriate model for this field.

Understanding the differences between CNN and LSTM can help rationalize their different performances. One explanation might be explained by the different architectures of these two models, which illustrates the importance of understanding the semantics of a sentence, something key to deciphering the underlying meaning of postings about teens' sexual experiences. Therefore, CNN was suitable for our dataset since keywords are useful enough to identify the class of each post. In contrast, LSTM's focus on the dependency of words can create noise that make it less useful for terse, casual language used in social media posts. Additionally, sentence length has an impact on the results' accuracy. CNN can take advantage of short sentences while LSTM depends heavily on longer sentences [112]. Moreover, stories, social media posts, or conversations are among the most popular examples of the input text types provided for machine learning algorithms to identify sexual risks in general. All these texts can be considered short in length compared to news articles, documents, Wikipedia articles, and other forms of longer text found online. Therefore, future sexual risk detection research could consider examining the performances of these models across the text length and the classification goals (e.g, identifying risky patterns within text) to choose the best classifier to be used based on either keywords in sentences (CNN) or the dependency between the words and/or sentences (LSTM).

5.2 Online Sexual Risk Experiences of Teens Vary Based on Relationship

For RQ2, we found statistical significance in teens disclosing proportionally more often about consensual sexting with friends/dating partners, non-consensual sexting with strangers, and sexual abuse with family members. There are several key implications from these findings. First, while prior work has been heavily skewed toward studying teens' sexting behavior with friends and dating partners as a form of peer pressure [10, 45, 102], we found that teens were often consenting participants in these exchanges. This suggests a potential narrative shift in sexual health education towards treating sexting as a normative and developmentally appropriate part of intimate relationships that should be done with safety in mind [14], rather than viewing these experiences as deviant or risky sexual behavior that should be restricted and punished. We also urge scholars to perform longitudinal research to investigate the effect of consensual sexting between friends and dating partners on teens' relationships, relationship skills, and future sexual lives over time.

While sexting with friends/dating partners as a *sexual behavior* may not be unhealthy within teen relationships, from a technical standpoint, the *privacy risk* remains high due to the persistence, replicability, and discoverability [79] of digitally shared sexual information, including nude imagery of minors that could be construed as child pornography. As consensual sexting becomes more prevalent and a common culture among teens, when unpacking the consensual sexting experiences, a concern was warranted regarding the subsequent non-consensual distribution of sexual content that was originally shared consensually between two individuals (known in the literature as "revenge pornography" [89]), which could lead to sextortion and sexual abuse. Therefore, additional research on how best to facilitate *digitally secure* sexual exchanges between consenting adolescents is needed to reduce these types of privacy violations and disentangle privacy risks from sexual risks. For instance, policymakers and legal authorities should find practical ways to lower the burden for teens to report non-consensual distribution of their sexual imagery (i.e., nudes) without fear of legal repercussions for having created and distributed such content. Legal protection holding teens' digital rights to sext with other consenting teens and preventing the unauthorized distribution of this content to others would empower youth to report offenders when unauthorized sharing occurred, which in turn, would prevent sextortion and even subsequent sexual abuse by taking away power from their abusers.

In terms of sexting with strangers, a clear pattern emerged where in teens were frustrated by non-consensual/unsolicited sexual advances from strangers. Our finding contributes to the developing picture of teens' sexting experiences with strangers online, suggesting that teens' struggles might not be related to their consenting to these experiences; rather, the problem might lie with online platforms providing easy ways for for strangers to reach out to teens. This finding supports recent decisions by social media platforms to block strangers from direct messaging minors who are not following them [52]. Yet, while such design choices might protect many teens from the potential risks associated with non-consensual sexual interactions with strangers, such changes may also unintentionally hinder the sexual development of LGBTQ+ youth, as we found that sexual exchanges with strangers were sometimes a necessary means for these youth to explore their sexual identity and find like-minded sexual partners. Similar to how prior work has highlighted how content moderation algorithms have unintentionally silenced the voices of those in the LGBTQ+ community [78], we would not recommend implementing blanket policies (e.g., blocking all strangers) that protect heteronormative youth at the expense of youth. Instead, we advocate for providing all youth safer online communities (e.g., verified by age), where they can seek social support and healthy romantic partnerships. As consensual sexting creates the need to raise awareness of the privacy risks involved (e.g., making sure to not show one's face in a nude image [44]), it follows that talking to teens about the potential positive and negative effects of exploring sexuality with strangers requires more nuanced and trauma-informed practices [11].

Importantly, our findings emphasize on how teens leverage online platforms to disclose their sexual abuse experiences. Consistent with prior literature [53], teens in our study often disclosed that sexual abuse was perpetrated by family members. Furthermore, teens described repeated, prolonged, and graphic abuse that occurred in both cyberspace and in the physical world due to a power dynamic they were unable to escape. Consistent with prior research [3], our findings highlight that teens are disclosing their sexual abuse in semi-public virtual spaces, where we might be able to detect these experiences and intervene. Given that teens often do not report their sexual abuse to legal authorities due to shame, fear of retribution, or getting in trouble [90], online platforms could be a first line of defense for teens who may be victims of sexual abuse by delivering just-in-time help resources that either connect them with professionals to report the abuse or educate them on how to take evidence-based measures to protect themselves from sexual violence. These touch-points could prevent such abuse from lasting longer and potentially mitigate

the serious long-term impact of extended abuse on teens' mental health. Future research should consider using social media trace data to investigate familial sexual abuse in particular, in line with our findings. These disclosures may provide additional details about the incidents described by the victims themselves and could help supplement gaps in the sexual abuse literature due to a primary reliance on small retrospective reports of sexual abuse obtained from clinical or legal samples [65, 83]. Empowered with insights gleaned from these online disclosures, online platforms may find themselves in a better position to support youth in taking an active role in their protection.

5.3 A Spectrum of Online Risk Experiences Ranging from Healthy to Harmful

Overall, we found that adolescents experienced a wide range of online sexual encounters, from normatively healthy sexual exploration to sexual abuse. In the sections below, we unpack two complex, intertwined concepts that emerged as important factors when studying these sexual experiences: consent and mental health.

The concept of consent, especially for minors, is inherently complicated and laden with potential misinterpretation, especially when it relates to sexual interactions [8]. In our RQ3 results, we unpacked some nuanced examples where explicit consent was given by the teen in their post but the emergent topics within this coded data illustrated that consent was undercut by indicators of mental health problems (e.g., depression, low self-esteem, self-harming behaviors, suicidal ideation). In many cases, teens consented to sext with friends/dating partners due to underlying mental health factors (e.g., threats of self-harm), which raises the question about their ability to give unfettered and well-informed consent for the consequences of their actions. Therefore, we urge future legal and social science research to reconceptualize consent in terms of going beyond the explicit statement of consent to examine the the underlying factors that surround and may undermine it.

In prior work, unwanted sexting (but not overall sexting frequency) has been associated with a higher risk of negative mental health outcomes [98]. Other studies have found that sexting is correlated with mental disorders and high-risk behavior [73, 99]. The assumption is often that sexting leads to negative mental health outcomes. In our work, however, the topic modeling results uncovered that mental health concerns often acted as an *antecedent* that led teens to engage in sexting as we found teens with mental health issues sought attention by engaging in sexting with others or acquiesced to a sexting request due to concern for the mental health of someone else. An important implication of this finding is that online sexual risk prevention and mental health are intertwined public health issues that must be considered in tandem. While the association between sexual risk-seeking behavior and mental health problems in offline contexts is well-established [1, 36], less work [38] has acknowledged that online sexual risk-seeking behavior may be an actionable way that some teens have found to cope given their mental health concerns. Therefore, instead of focusing on restricting teens' online sexual behavior and/or punishing them for it, we should expand youth mental health services so that youth have the support they need to make healthy sexual decisions both online and offline.

On the other hand, our findings also uncovered some legitimate scenarios where adolescents engaged in consensual sexting with other teens that was not motivated by mental health concerns or necessarily harmful to teens. For instance, LGBTQ+ youth use online peer support platforms to make one-to-one connections for support; yet, their sexual identities are often confounded with the types of support they seek in online spaces [57]. Therefore, as we saw, support and intimacy may coincide, making such interactions appear more "risky" to outsiders who do not understand the challenges youth face when attempting to understand and explore their sexual identities. Similarly, our analysis uncovered how teens are expanding their dating horizons to foster new relationships online that they might not have had the opportunity to form in their local circles. Researchers

argue that online relationships may benefit youth [85], particularly those who have difficulty forming romantic relationships, such as those who are on the autism spectrum [64]. Therefore, we recommend future research take a broader, more nuanced perspective that includes both positive and negative aspects of online sexual experiences for adolescents, rather than only considering risks. In particular, our work highlights how sexting may be considered a normative behavior within healthy adolescent relationships but can quickly become problematic when one party believes the interaction is consensual, while the other party feels pressured into it.

As such, our findings suggest a need to move beyond assessing risks and negative outcomes of teens' sexual behaviors and work toward a better understanding of the benefits of sexting. In the case of consensual sexting with strangers, online anonymity and accessibility [93] might make it easier for teens to explore their sexuality and connect with other teens with the same sexual orientation. As coming out to families is usually difficult for adolescents [32], online platforms provide a space for teens to discuss these issues with peers. On the other hand, consensual sexting with strangers carries potential risks. For example, posts in our dataset revealed how online anonymity allowed teen users to seek out older strangers for sexting, in some cases by presenting themselves as older than their actual age—either to deceive other users or to evade platform age restrictions. This suggests measures taken by social media platforms to limit access by minors may be insufficient if they rely solely on self-reported age. In general, it would be helpful to transition the conversation away from unequivocally viewing all adolescent sexting behavior as negative to identifying the pathways in which it can be done safely and beneficially. The multifaceted nature of online sexual risk experiences should thus be considered in the research and design of social media platforms to better serve adolescent users.

5.4 Implications for Design

Based on our results, we make the following design-based recommendations for online sexual risk detection, prevention, and mitigation for teens:

5.4.1 Algorithmic Sexual Risk Detection Systems. We recommend that, if automated risk detection systems are deployed in real-world contexts, they take into account contextual features, such as levels of consent and relationship types when determining how best to support adolescents in navigating online sexual risk experiences. For instance, any indication that an online sexual exchange is non-consensual, regardless of the type of relationship, could immediately nudge a teen to take protective measures and/or seek help. Even consensual sexual experiences between teens and a stranger and/or family member may also indicate that risk mitigation procedures are needed. In the case that a sexual exchange is consensual, even among friends and/or dating partners, but the context indicates mental health problems (e.g, depression, suicide, self-harm), different risk mitigation strategies (e.g., trauma-informed) may be more appropriate. Further, if consensual sexting results in non-consensual sharing of sexual imagery, measures could be taken to prevent unauthorized distribution to third-parties. For instance, Meta recently announced that their private messaging platforms will be implementing end-to-end encryption and notify users when recipients of their disappearing messages take screenshots [113]. While such privacy features may help discourage unauthorized sharing of sensitive content, researchers also need to carefully evaluate whether such features may unintentionally harm vulnerable users who take screenshots to document their abuse. Finally, if any sexual abuse of a minor is detected online, platforms should have specific procedures in place to proactively report such situations to the proper authorities for immediate investigation. Recent legislation makes online platforms culpable for sex trafficking that occurs on their platforms [68]; similarly these platforms should also bear responsibility for sexual abuse propagated on their sites.

5.4.2 Intelligent Defaults for Sexting with Strangers. Based on our findings, we recommend future research investigate the feasibility and user acceptance of an "opt-out" privacy default, where social media platforms block strangers from privately contacting minors; however, these platforms should also give teens the ability to override this default. Further, risk awareness notifications should be included to inform teens about the potential benefits and risks associated with sexting with strangers. This design would be more powerful in providing both safety notices and choices [88] for teens to proactively manage their private interactions with strangers, rather than blocking strangers after receiving unsolicited sext messages.

5.4.3 Age Verification Systems. Another topic that emerged from our analysis was that of age, both in terms of teens engaging in sexually risky behavior with adults online and/or posing as adults to engage in sexual experiences with unknowing others. While researchers in the European Union (EU) have recently advocated for age verification systems [76] to ensure that internet users are of age to legally consent to the terms of use for various online platforms, we extend the recommendation of age verification as a way to ensure teens are not engaging with or as adults in online sexual exchanges that could potentially lead to illegal sexual activities involving minors. Such systems may help protect teens from "catfishing" attempts from adults posing as teens and protect adults from mistakenly getting sexually involved with a minor. Further research could focus on building efficient age verification systems and studying the feasibility of integrating these systems into online platforms to help implement ethical and personalized restrictions.

5.4.4 Designing for Computer-Mediated Consent. We also encourage more scholarship examining and designing better models for facilitating computer-mediated consent [114] by design, rather than leaving room for ambiguity. For instance, dialogues to determine whether a sexual exchange is consensual could include lightweight mental health evaluations to raise a teens' self-awareness of their underlying motivations to sext. Such self-reflections have been found to be a helpful approach for helping teens make better-informed decisions in other risk contexts. [27]. Consent-based dialogues could also be embedded in the process of sharing of explicit content. General Data Protection Regulation (GDPR) [86] requires online platforms that operate in the EU to give users the right to remove their personal data, but this does little to enable teens who share explicit imagery with others to retroactively withdraw consent. One potential area for future research would be to explore the use of blockchain technologies [34], so that teens (and other internet users) can protect, manage, and remove their sexually explicit digital trace data from the internet. By creating intentional models for handling the complexities of computer-mediated consent, researchers and practitioners can take the needed strides to prevent online child sexual exploitation.

5.5 Limitations and Future Work

We recognize some limitations in this work. The posts used in this study were written by adolescents on a single, albeit large, mental health peer support platform. Therefore, the generalizability of this study may be limited given the nature of the platform. We likely came across more negatively sexual experiences and abuse disclosures based on the platform's purpose and norms, which may not be as prevalent on general purpose social media platforms. Future research should take into account different platforms to verify that our results can be replicated to a more diverse population of adolescents. Secondly, while we were able to build and train machine learning classifiers and deeply analyze self-disclosures of online sexual risk experiences, we did not have the victims' own interpretations of these experiences, i.e., how risky they perceived these experiences to be an aspect that can be valuable in training machine learning-based risk detection models [58]. Therefore, future research should consider adolescents' perspectives on their disclosures of online sexual risk experiences by asking them to flag or comment on their own posts. Third, since we trained the

models after combining friends and dating partners as one class, the models classified it as one class for the rest of the dataset. Therefore, we might have lost some qualitative differences between friends and dating partners that future research can investigate within a large dataset.

Conducting studies of sensitive data from a vulnerable population is a critical matter within the social computing and HCI communities [19, 35]. While the platform's terms of service stated that the posts may be used for research purposes, we took more precautionary measures to protect youth from potential harm. We made sure to anonymize the data and paraphrase example posts to prevent them from being publicly searchable or traceable to a specific individual. Privacy and ethics in the context of this type of research, including the suggested design implications above, need to be persistent topics of discussion in the years coming.

6 CONCLUSION

Unpacking adolescents' online sexual experiences by taking context into account provides a precise understanding of these experiences, which also lead to more precise sexual risk prevention and detection approaches. In this paper, we demonstrated how CNN yielded the best accuracy (Avg. $AUC = 0.90$) in classifying types of sexual experiences and relationship types of adolescents posts about online sexual experiences. Youth tend to have different disclosure patterns about sexual experiences, describing non-consensual sexting with strangers, consensual sexting with friends/dating partners, and sexual abuse with family members. By analyzing the disclosures in terms of consent and relationship types, we uncovered nuances that demonstrate the complexity of consent. Discussions of consent must consider the underlying factors (e.g, mental health) that affect teens' decision to engage in sexting within different relationships (i.e, strangers, friends/dating partners, and family members).

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REFERENCES

[1] Anette Agardh, Elizabeth Cantor-Graae, and Per-Olof Östergren. 2012. Youth, Sexual Risk-Taking Behavior, and Mental Health: a Study of University Students in Uganda. *Int'l Journal of Behavioral Medicine* 19, 2 (June 2012), 208–216. https://doi.org/10.1007/s12529-011-9159-4

[2] Nancy R Ahern, Jeanne Kemppainen, and Paige Thacker. 2016. Awareness and knowledge of child and adolescent risky behaviors: A parent's perspective. *Journal of Child and Adolescent Psychiatric Nursing* 29, 1 (2016), 6–14.

[3] Nazanin Andalibi, Oliver L Haimson, Munmun De Choudhury, and Andrea Forte. 2016. Understanding social media disclosures of sexual abuse through the lenses of support seeking and anonymity. In *Proceedings of the 2016 CHI Conf. on human factors in computing systems*. ACM, San Jose, CA, USA, 3906–3918.

[4] Aboluwaji D Ayinmoro, Endurance Uzobo, Bodisere J Teibowei, and Joyce B Fred. 2020. Sexting and other risky sexual behaviour among female students in a Nigerian academic institution. *Journal of Taibah University Medical Sciences* 15, 2 (2020), 116–121.

[5] Eric PS Baumer, Shion Guha, Emily Quan, David Mimno, and Geri K Gay. 2015. Missing photos, suffering withdrawal, or finding freedom? How experiences of social media non-use influence the likelihood of reversion. *Social Media+ Society* 1, 2 (2015), 2056305115614851.

[6] Susanne E Baumgartner, Patti M Valkenburg, and Jochen Peter. 2010. Unwanted online sexual solicitation and risky sexual online behavior across the lifespan. *Journal of Applied Developmental Psychology* 31, 6 (2010), 439–447.

[7] Melanie A Beres. 2007. 'Spontaneous' sexual consent: An analysis of sexual consent literature. *Feminism & Psychology* 17, 1 (2007), 93–108.

[8] Melanie Ann Beres. 2014. Rethinking the concept of consent for anti-sexual violence activism and education. *Feminism & Psychology* 24, 3 (2014), 373–389.

[9] Rupal Bhargava, Yashvardhan Sharma, and Shubham Sharma. 2016. Sentiment analysis for mixed script indic sentences. In *2016 Int'l Conf. on advances in computing, communications and informatics (ICACCI)*. IEEE, 524–529.

[10] Dora Bianchi, Mara Morelli, Maria R Nappa, Roberto Baiocco, and Antonio Chirumbolo. 2021. A bad romance: Sexting motivations and teen dating violence. *Journal of interpersonal violence* 36, 13-14 (2021), 6029–6049.

[11] Pamela J. Black, Michael Woodworth, Moreen Tremblay, and Tara Carpenter. 2012. A review of trauma-informed treatment for adolescents. *Canadian Psychology/Psychologie canadienne* 53, 3 (2012), 192–203. https://doi.org/10.1037/a0028441 Place: US Publisher: Educational Publishing Foundation.

[12] DM Blei, Andrew Y Ng, and Michael I Jordan. 2003. Latent dirichlet allocation: the Journal of machine Learning research, v. 3. (2003).

[13] Patrick Bours and Halvor Kulsrud. 2019. Detection of cyber grooming in online conversation. In *2019 IEEE Int'l Workshop on Information Forensics and Security (WIFS)*. IEEE, 1–6.

[14] Cora C Breuner, Gerri Mattson, William P Adelman, Elizabeth M Alderman, Robert Garofalo, Arik V Marcell, Makia E Powers, Krishna Kumari Upadhya, Michael W Yogman, Nerissa S Bauer, et al. 2016. Sexuality education for children and adolescents. *Pediatrics* 138, 2 (2016).

[15] Dawn Y Brinkley, Robert A Ackerman, Samuel E Ehrenreich, and Marion K Underwood. 2017. Sending and receiving text messages with sexual content: Relations with early sexual activity and borderline personality features in late adolescence. *Computers in human behavior* 70 (2017), 119–130.

[16] Amy Bruckman. 2002. Studying the amateur artist: A perspective on disguising data collected in human subjects research on the Internet. *Ethics and Information Technology* 4, 3 (2002), 217–231.

[17] Jonas Burén and Carolina Lunde. 2018. Sexting among adolescents: A nuanced and gendered online challenge for young people. *Computers in Human Behavior* 85 (2018), 210–217.

[18] E Calvete, L Fernández-González, E Royuela-Colomer, A Morea, M Larrucea-Iruretagoyena, JM Machimbarrena, J Gónzalez-Cabrera, and I Orue. 2021. Moderating factors of the association between being sexually solicited by adults and active online sexual behaviors in adolescents. *Computers in Human Behavior* (2021), 106935.

[19] Stevie Chancellor, Michael L Birnbaum, Eric D Caine, Vincent MB Silenzio, and Munmun De Choudhury. 2019. A taxonomy of ethical tensions in inferring mental health states from social media. In *Proceedings of the Conf. on fairness, accountability, and transparency*. 79–88.

[20] Pooja Chaudhary, Melissa Peskin, Jeff R Temple, Robert C Addy, Elizabeth Baumler, and Shegog Ross. 2017. Sexting and mental health: a school-based longitudinal study among youth in Texas. *Journal of Applied Research on Children* 8, 1 (2017), 11.

[21] Xue-Wen Chen and Xiaotong Lin. 2014. Big data deep learning: challenges and perspectives. *IEEE access* 2 (2014), 514–525.

[22] Hye Jeong Choi, Camille Mori, Joris Van Ouytsel, Sheri Madigan, and Jeff R Temple. 2019. Adolescent sexting involvement over 4 years and associations with sexual activity. *Journal of Adolescent Health* 65, 6 (2019), 738–744.

[23] Arijit Ghosh Chowdhury, Ramit Sawhney, Puneet Mathur, Debanjan Mahata, and Rajiv Ratn Shah. 2019. Speak up, fight back! detection of social media disclosures of sexual harassment. In *Proceedings of the 2019 Conf. of the North American chapter of the Association for Computational Linguistics: Student research workshop*. 136–146.

[24] Danielle Keats Citron and Mary Anne Franks. 2014. Criminalizing revenge porn. *Wake Forest L. Rev.* 49 (2014), 345.

[25] W Andrew Collins and Brett Laursen. 2004. Changing relationships, changing youth: Interpersonal contexts of adolescent development. *The Journal of Early Adolescence* 24, 1 (2004), 55–62.

[26] Jennifer Connolly and Adele Goldberg. 1999. Romantic relationships in adolescence: The role of friends and peers in their emergence and development. (1999).

[27] Anthony David. 2017. Self-reflection in illness and health: literal and metaphorical? *Palgrave Communications* 3, 1 (2017), 1–6.

[28] Rosario Del Rey, Mónica Ojeda, José A Casas, Joaquín A Mora-Merchán, and Paz Elipe. 2019. Sexting among adolescents: the emotional impact and influence of the need for popularity. *Frontiers in psychology* 10 (2019), 1828.

[29] Allyson L Dir, Melissa A Cyders, and Ayca Coskunpinar. 2013. From the bar to the bed via mobile phone: A first test of the role of problematic alcohol use, sexting, and impulsivity-related traits in sexual hookups. *Computers in Human Behavior* 29, 4 (2013), 1664–1670.

[30] Nicola Döring. 2014. Consensual sexting among adolescents: Risk prevention through abstinence education or safer sexting? *Cyberpsychology: Journal of Psychosocial Research on Cyberspace* 8, 1 (2014).

[31] Caoimhe Doyle, Ellen Douglas, and Gary O'Reilly. 2021. The outcomes of sexting for children and adolescents: A systematic review of the literature. *Journal of adolescence* 92 (2021), 86–113.

[32] Brianna Dym, Jed R Brubaker, Casey Fiesler, and Bryan Semaan. 2019. "Coming Out Okay": Community Narratives for LGBTQ Identity Recovery Work. *Proceedings of the ACM on Human-Computer Interaction* 3, CSCW (2019), 1–28.

[33] Mohammadreza Ebrahimi, Ching Y Suen, and Olga Ormandjieva. 2016. Detecting predatory conversations in social media by deep convolutional neural networks. *Digital Investigation* 18 (2016), 33–49.

[34] Benedict Faber, Georg Cappelen Michelet, Niklas Weidmann, Raghava Rao Mukkamala, and Ravi Vatrapu. 2019. BPDIMS: A blockchain-based personal data and identity management system. (2019).
[35] Casey Fiesler, Jed R Brubaker, Andrea Forte, Shion Guha, Nora McDonald, and Michael Muller. 2019. Qualitative methods for CSCW: Challenges and opportunities. In *Conf. Companion Publication of the 2019 on Computer Supported Cooperative Work and Social Computing*. 455–460.
[36] Cecilia Fredlund, Carl Göran Svedin, Gisela Priebe, Linda Jonsson, and Marie Wadsby. 2017. Self-reported frequency of sex as self-injury (SASI) in a national study of Swedish adolescents and association to sociodemographic factors, sexual behaviors, abuse and mental health. *Child and Adolescent Psychiatry and Mental Health* 11, 1 (Feb. 2017), 9. https://doi.org/10.1186/s13034-017-0146-7
[37] Manuel Gámez-Guadix and Estibaliz Mateos-Pérez. 2019. Longitudinal and reciprocal relationships between sexting, online sexual solicitations, and cyberbullying among minors. *Computers in Human Behavior* 94 (2019), 70–76.
[38] Aina M. Gassó, Bianca Klettke, José R. Agustina, and Irene Montiel. 2019. Sexting, Mental Health, and Victimization Among Adolescents: A Literature Review. *Int'l Journal of Environmental Research and Public Health* 16, 13 (Jan. 2019), 2364. https://doi.org/10.3390/ijerph16132364 Number: 13 Publisher: Multidisciplinary Digital Publishing Institute.
[39] Ateret Gewirtz-Meydan, Kimberly J Mitchell, and Emily F Rothman. 2018. What do kids think about sexting? *Computers in Human Behavior* 86 (2018), 256–265.
[40] Crystal Gong, Koustuv Saha, and Stevie Chancellor. 2021. " The Smartest Decision for My Future": Social Media Reveals Challenges and Stress During Post-College Life Transition. *Proceedings of the ACM on Human-Computer Interaction* 5, CSCW2 (2021), 1–29.
[41] Justin Grimmer and Brandon M Stewart. 2013. Text as data: The promise and pitfalls of automatic content analysis methods for political texts. *Political analysis* 21, 3 (2013), 267–297.
[42] Shion Guha, Eric PS Baumer, and Geri K Gay. 2018. Regrets, I've had a few: When regretful experiences do (and don't) compel users to leave Facebook. In *proceedings of the 2018 ACM Conf. on Supporting Groupwork*. 166–177.
[43] Fergyanto E Gunawan, Livia Ashianti, Sevenpri Candra, and Benfano Soewito. 2016. Detecting online child grooming conversation. In *2016 11th Int'l Conf. on Knowledge, Information and Creativity Support Systems (KICSS)*. IEEE, 1–6.
[44] Heidi Hartikainen, Afsaneh Razi, and Pamela Wisniewski. 2021. Safe Sexting: The Advice and Support Adolescents Receive from Peers regarding Online Sexual Risks. *Proceedings of the ACM on Human-Computer Interaction* 5, CSCW1 (2021), 1–31.
[45] Heidi Hartikainen, Afsaneh Razi, and Pamela Wisniewski. 2021. 'If You Care About Me, You'll Send Me a Pic'-Examining the Role of Peer Pressure in Adolescent Sexting. In *Companion Publication of the 2021 Conf. on Computer Supported Cooperative Work and Social Computing*. 67–71.
[46] Naeemul Hassan, Amrit Poudel, Jason Hale, Claire Hubacek, Khandaker Tasnim Huq, Shubhra Kanti Karmaker Santu, and Syed Ishtiaque Ahmed. 2020. Towards Automated Sexual Violence Report Tracking. In *Proceedings of the Int'l AAAI Conf. on Web and Social Media*, Vol. 14. 250–259.
[47] Lori Henderson. 2011. Sexting and sexual relationships among teens and young adults. *McNair Scholars Research Journal* 7, 1 (2011), 9.
[48] Nicola Henry and Anastasia Powell. 2015. Embodied harms: Gender, shame, and technology-facilitated sexual violence. *Violence against women* 21, 6 (2015), 758–779.
[49] Nicola Henry and Anastasia Powell. 2016. Sexual violence in the digital age: The scope and limits of criminal law. *Social & legal studies* 25, 4 (2016), 397–418.
[50] Hsiu-Fang Hsieh and Sarah E Shannon. 2005. Three approaches to qualitative content analysis. *Qualitative health research* 15, 9 (2005), 1277–1288.
[51] Heather K Hudson and Joyce V Fetro. 2015. Sextual activity: Predictors of sexting behaviors and intentions to sext among selected undergraduate students. *Computers in Human Behavior* 49 (2015), 615–622.
[52] Instagram. 2021. Continuing to Make Instagram Safer for the Youngest Members of Our Community. https://about.instagram.com/blog/announcements/continuing-to-make-instagram-safer-for-the-youngest-members-of-our-community
[53] Eva Jonzon and Frank Lindblad. 2004. Disclosure, reactions, and social support: Findings from a sample of adult victims of child sexual abuse. *Child maltreatment* 9, 2 (2004), 190–200.
[54] Vasileia Karasavva. 2020. *iPredator: Image-based Sexual Abuse Risk Factors and Motivators*. Ph.D. Dissertation. Carleton University.
[55] Sweta Karlekar and Mohit Bansal. 2018. Safecity: Understanding diverse forms of sexual harassment personal stories. *arXiv preprint arXiv:1809.04739* (2018).
[56] Aparup Khatua, Erik Cambria, and Apalak Khatua. 2018. Sounds of silence breakers: Exploring sexual violence on twitter. In *2018 IEEE/ACM Int'l Conf. on Advances in Social Networks Analysis and Mining (ASONAM)*. IEEE, 397–400.
[57] W. J. Kiekens, L. Baams, J. N. Fish, and R. J. Watson. 2021. Associations of Relationship Experiences, Dating Violence, Sexual Harassment, and Assault With Alcohol Use Among Sexual and Gender Minority Adolescents. *Journal of*

Interpersonal Violence (March 2021), 08862605211001469. https://doi.org/10.1177/08862605211001469 Publisher: SAGE Publications Inc.

[58] Seunghyun Kim, Afsaneh Razi, Gianluca Stringhini, Pamela Wisniewski, and Munmun De Choudhury. 2021. You Don't Know How I Feel: Insider-Outsider Perspective Gaps in Cyberbullying Risk Detection. In *Proceedings of the Int'l AAAI Conf. on Web and Social Media*, Vol. 15. 290–302.

[59] Yoon Kim. 2014. Convolutional Neural Networks for Sentence Classification. arXiv:1408.5882 [cs.CL]

[60] Panagiota Korenis and Stephen Bates Billick. 2014. Forensic implications: Adolescent sexting and cyberbullying. *Psychiatric quarterly* 85, 1 (2014), 97–101.

[61] Amanda Lenhart. 2009. *Teens and sexting*. Vol. 15. Pew Internet & American Life Project Washington, DC.

[62] Yingchi Liu, Quanzhi Li, Xiaozhong Liu, Qiong Zhang, and Luo Si. 2019. Sexual harassment story classification and key information identification. In *Proceedings of the 28th ACM Int'l Conf. on Information and Knowledge Management*. 2385–2388.

[63] Anna Lysyanskaya, Ronald L Rivest, Amit Sahai, and Stefan Wolf. 1999. Pseudonym systems. In *Int'l Workshop on Selected Areas in Cryptography*. Springer, 184–199.

[64] Sarah J Macoun, Buse Bedir, Kevin Runions, Laurissa Evancio Barker, Drew Halliday, and Jessi Lewis. 2021. Information & communication technologies use by children & youth with autism spectrum disorder: Promise and perils. *Journal of Psychiatry & Behavioral Sciences* 4, 1 (2021), 1047–1056.

[65] Rosaleen McElvaney, Katie Moore, Keith O'Reilly, Rhonda Turner, Betty Walsh, and Suzanne Guerin. 2020. Child sexual abuse disclosures: Does age make a difference? *Child abuse & neglect* 99 (2020), 104121.

[66] José Luis Jasso Medrano, Fuensanta Lopez Rosales, and Manuel Gámez-Guadix. 2018. Assessing the links of sexting, cybervictimization, depression, and suicidal ideation among university students. *Archives of suicide research* 22, 1 (2018), 153–164.

[67] Gary B Melton. 2005. Mandated reporting: a policy without reason. *Child abuse & neglect* 29, 1 (2005), 9–18.

[68] Valentina Mia. 2020. The Failures of SESTA/FOSTA: A Sex Worker Manifesto. *Transgender Studies Quarterly* 7, 2 (2020), 237–239.

[69] David Mimno, Hanna Wallach, Edmund Talley, Miriam Leenders, and Andrew McCallum. 2011. Optimizing semantic coherence in topic models. In *Proceedings of the 2011 Conf. on empirical methods in natural language processing*. 262–272.

[70] Kanishka Misra, Hemanth Devarapalli, Tatiana R Ringenberg, and Julia Taylor Rayz. 2019. Authorship Analysis of Online Predatory Conversations using Character Level Convolution Neural Networks. In *2019 IEEE Int'l Conf. on Systems, Man and Cybernetics (SMC)*. IEEE, 623–628.

[71] Kimberly J Mitchell, David Finkelhor, and Janis Wolak. 2005. The Internet and family and acquaintance sexual abuse. *Child maltreatment* 10, 1 (2005), 49–60.

[72] Mara Morelli, Dora Bianchi, Roberto Baiocco, Lina Pezzuti, and Antonio Chirumbolo. 2016. Sexting, psychological distress and dating violence among adolescents and young adults. *Psicothema* (2016), 137–142.

[73] Camille Mori, Jeff R Temple, Dillon Browne, and Sheri Madigan. 2019. Association of sexting with sexual behaviors and mental health among adolescents: A systematic review and meta-analysis. *JAMA pediatrics* 173, 8 (2019), 770–779.

[74] Dawn Marie Murphy and Becky Spencer. 2021. Teens' Experiences with Sexting: A Grounded Theory Study. *Journal of Pediatric Health Care* (2021).

[75] Marijke Naezer. 2018. From risky behaviour to sexy adventures: Reconceptualising young people's online sexual activities. *Culture, Health & Sexuality* 20, 6 (2018), 715–729.

[76] London School of Economics and Political Science. [n.d.]. Euconsent - A child-rights approach to online age assurance and parental consent solutions. https://www.lse.ac.uk/media-and-communications/research/research-projects/eu-consent

[77] Gwenn Schurgin O'Keeffe, Kathleen Clarke-Pearson, et al. 2011. The impact of social media on children, adolescents, and families. *Pediatrics* 127, 4 (2011), 800–804.

[78] Thiago Dias Oliva, Dennys Marcelo Antonialli, and Alessandra Gomes. 2021. Fighting hate speech, silencing drag queens? artificial intelligence in content moderation and risks to LGBTQ voices online. *Sexuality & Culture* 25, 2 (2021), 700–732.

[79] Leysia Palen and Paul Dourish. 2003. Unpacking" privacy" for a networked world. In *Proceedings of the SIGCHI Conf. on Human factors in computing systems*. 129–136.

[80] Justin W Patchin and Sameer Hinduja. 2020. It is time to teach safe sexting. *Journal of Adolescent Health* 66, 2 (2020), 140–143.

[81] Sojwal Patil, Aishwarya Gune, and Mayura Nene. 2017. Convolutional neural networks for text categorization with latent semantic analysis. In *2017 Int'l Conf. on Energy, Communication, Data Analytics and Soft Computing (ICECDS)*. IEEE, 499–503.

[82] Lynn E Ponton and Samuel Judice. 2004. Typical adolescent sexual development. *Child and Adolescent Psychiatric Clinics* 13, 3 (2004), 497–511.
[83] Laura Elvira Prino, Claudio Longobardi, and Michele Settanni. 2018. Young adult retrospective reports of adverse childhood experiences: Prevalence of physical, emotional, and sexual abuse in Italy. *Archives of sexual behavior* 47, 6 (2018), 1769–1778.
[84] Jenny Radesky and Alexis Hiniker. 2021. From moral panic to systemic change: Making child-centered design the default. *Int'l Journal of Child-Computer Interaction* (2021), 100351.
[85] Afsaneh Razi, Karla Badillo-Urquiola, and Pamela J Wisniewski. 2020. Let's Talk about Sext: How Adolescents Seek Support and Advice about Their Online Sexual Experiences. In *Proceedings of the 2020 CHI Conf. on Human Factors in Computing Systems*. 1–13.
[86] General Data Protection Regulation. 2016. Regulation EU 2016/679 of the European Parliament and of the Council of 27 April 2016. *Official Journal of the European Union* (2016).
[87] Amy Roe. 2017. Teens who engage in 'sexting' should not be prosecuted as sex offenders. https://www.aclu.org/blog/privacy-technology/teens-who-engage-sexting-should-not-be-prosecuted-sex-offenders
[88] John A Rothchild. 2016. *Research handbook on electronic commerce law*. Edward Elgar Publishing.
[89] Michael Salter and Thomas Crofts. 2015. Responding to revenge porn: Challenges to online legal impunity. *New views on pornography: Sexuality, politics, and the law* (2015), 233–256.
[90] Nadera Shalhoub-Kevorkian. 2005. Disclosure of child abuse in conflict areas. *Violence Against Women* 11, 10 (2005), 1263–1291.
[91] Donald Sharpe. 2015. Chi-square test is statistically significant: Now what? *Practical Assessment, Research, and Evaluation* 20, 1 (2015), 8.
[92] Kaveri Subrahmanyam and David Smahel. 2010. *Digital youth: The role of media in development*. Springer Science & Business Media.
[93] Lalita K Suzuki and Jerel P Calzo. 2004. The search for peer advice in cyberspace: An examination of online teen bulletin boards about health and sexuality. *Journal of applied developmental psychology* 25, 6 (2004), 685–698.
[94] The Bark Team. [n.d.]. Teen Text Speak Codes Every Parent Should Know. https://www.bark.us/blog/teen-text-speak-codes-every-parent-should-know/
[95] Jeff R Temple, Vi Donna Le, Patricia van den Berg, Yan Ling, Jonathan A Paul, and Brian W Temple. 2014. Brief report: Teen sexting and psychosocial health. *Journal of adolescence* 37, 1 (2014), 33–36.
[96] Deborah L Tolman and Sara I McClelland. 2011. Normative sexuality development in adolescence: A decade in review, 2000–2009. *Journal of research on adolescence* 21, 1 (2011), 242–255.
[97] Sarah E Ullman. 2007. Relationship to perpetrator, disclosure, social reactions, and PTSD symptoms in child sexual abuse survivors. *Journal of child sexual abuse* 16, 1 (2007), 19–36.
[98] Sally Valiukas, MacKenzie Pickering, Thomas Hall, Nilasi Seneviratne, Amy Aitken, Franklin John-Leader, and Sabrina W Pit. 2019. Sexting and mental health among young Australians attending a musical festival: a cross sext-ional study. *Cyberpsychology, Behavior, and Social Networking* 22, 8 (2019), 521–528.
[99] Joris Van Ouytsel, Ellen Van Gool, Koen Ponnet, and Michel Walrave. 2014. Brief report: The association between adolescents' characteristics and engagement in sexting. *Journal of adolescence* 37, 8 (2014), 1387–1391.
[100] Joris Van Ouytsel, Michel Walrave, Lieven De Marez, Bart Vanhaelewyn, and Koen Ponnet. 2020. A first investigation into gender minority adolescents' sexting experiences. *Journal of Adolescence* 84 (2020), 213–218.
[101] Joris Van Ouytsel, Michel Walrave, Koen Ponnet, and Wannes Heirman. 2015. The association between adolescent sexting, psychosocial difficulties, and risk behavior: Integrative review. *The Journal of School Nursing* 31, 1 (2015), 54–69.
[102] Mariek Vanden Abeele, Scott W Campbell, Steven Eggermont, and Keith Roe. 2014. Sexting, mobile porn use, and peer group dynamics: Boys' and girls' self-perceived popularity, need for popularity, and perceived peer pressure. *Media Psychology* 17, 1 (2014), 6–33.
[103] Carolina Villacampa. 2017. Teen sexting: Prevalence, characteristics and legal treatment. *Int'l Journal of Law, Crime and Justice* 49 (2017), 10–21.
[104] Sebastian Wachs, Michelle F Wright, Manuel Gámez-Guadix, and Nicola Döring. 2021. How are consensual, non-consensual, and pressured sexting linked to depression and self-harm? The moderating effects of demographic variables. *Int'l journal of environmental research and public health* 18, 5 (2021), 2597.
[105] Pamela Wisniewski, Haiyan Jia, Na Wang, Saijing Zheng, Heng Xu, Mary Beth Rosson, and John M Carroll. 2015. Resilience mitigates the negative effects of adolescent internet addiction and online risk exposure. In *Proceedings of the 33rd Annual ACM Conf. on Human Factors in Computing Systems*. 4029–4038.
[106] Pamela Wisniewski, Heng Xu, Mary Beth Rosson, and John M Carroll. 2017. Parents just don't understand: Why teens don't talk to parents about their online risk experiences. In *Proceedings of the 2017 ACM Conf. on computer supported cooperative work and social computing*. 523–540.

[107] Pamela Wisniewski, Heng Xu, Mary Beth Rosson, Daniel F Perkins, and John M Carroll. 2016. Dear diary: Teens reflect on their weekly online risk experiences. In *Proceedings of the 2016 CHI Conf. on Human Factors in Computing Systems*. 3919–3930.

[108] Janis Wolak, David Finkelhor, Wendy Walsh, and Leah Treitman. 2018. Sextortion of minors: Characteristics and dynamics. *Journal of Adolescent Health* 62, 1 (2018), 72–79.

[109] Peng Yan, Linjing Li, Weiyun Chen, and Daniel Zeng. 2019. Quantum-inspired density matrix encoder for sexual harassment personal stories classification. In *2019 IEEE Int'l Conf. on Intelligence and Security Informatics (ISI)*. IEEE, 218–220.

[110] Michele L Ybarra and Kimberly J Mitchell. 2014. "Sexting" and its relation to sexual activity and sexual risk behavior in a national survey of adolescents. *Journal of adolescent health* 55, 6 (2014), 757–764.

[111] Jianhua Yin and Jianyong Wang. 2014. A dirichlet multinomial mixture model-based approach for short text clustering. *Proceedings of the 20th ACM SIGKDD Int'l Conf. on Knowledge discovery and data mining* (2014).

[112] Yifan Zhou. 2020. A Review of Text Classification Based on Deep Learning. In *Proceedings of the 2020 3rd Int'l Conf. on Geoinformatics and Data Analysis*. 132–136.

[113] Mark Zuckerberg. [n.d.]. New update for end-to-end encrypted Messenger. https://www.facebook.com/zuck/posts/10114267839666731

[114] Douglas Zytko, Nicholas Furlo, Bailey Carlin, and Matthew Archer. 2021. Computer-Mediated Consent to Sex: The Context of Tinder. *Proceedings of the ACM on Human-Computer Interaction* 5, CSCW1 (April 2021), 189:1–189:26. https://doi.org/10.1145/3449288

A THE DEFINITION OF THE ACRONYMS IN TABLE 1

Abbreviation	Definition
dm	Direct Message
IDK	I Do not Know
OMG	Oh My God
ft	Face Time
AMOSC	Add Me On Snap Chat.
f2f	Face to Face.
STI	Sexually transmitted infections.
STD	Sexually transmitted disease.
LDR	Long Distance Relationship.
3some	A sexual activity involving a group of three persons or things.
BCP	Birth Control Pill.
BDSM	An overlapping abbreviation of Bondage and Discipline (BD), Dominance and Submission (DS), Sadism and Masochism (SM).
nsfw	Not safe for work.
LEWD	Crude and offensive in a sexual way.
BJ	Blow Job.
DFT	Dick Fucking Titties.
DTM	Doing too much.
IUD	Intrauterine Device.

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