Original Research Article

The Relationship of DNA Evidence to Prosecution Outcomes in Sexual Assault Cases

Violence Against Women
2022, Vol. 28(15-16) 3910–3932

DOI: 10.1177/10778012221077124
journals.sagepub.com/home/vaw
SAGE

Theodore P. Cross[1], Laura Siller[2], Maja Vlajnic[2], and Megan Alderden[3]

Abstract

This study examined the relationship between DNA evidence and outcomes of prosecution of sexual assault. Researchers coded data from prosecutor and crime laboratory files for sexual assault cases referred to prosecutors between 2005 and 2011 in a metropolitan jurisdiction in the northeastern United States. Cases with a DNA match were significantly more likely to move forward and result in conviction, even with other predictor variables statistically controlled. Analyses suggest DNA evidence contributes to case progression but also is a result of it. These findings strengthen the case for quality forensic medical examinations, investment in DNA analysis, and increased prosecutor training.

Keywords

DNA, forensic evidence, sexual assault, prosecution

Research suggests that DNA evidence from sexual assault medical forensic evidence kits (also known as rape kits) has the potential to influence the outcomes of prosecuting sexual assault (see, e.g., Campbell et al., 2009; Davis & Wells, 2019). Yet, the analysis of the relationship between DNA and these outcomes is limited, and several studies do not address the possibility that DNA evidence

[1]University of Illinois at Urbana-Champaign, Urbana, IL, USA
[2]Northeastern University, Boston, MA, USA
[3]DePaul University, Chicago, IL, USA

Corresponding Author:
Theodore P. Cross, University of Illinois at Urbana-Champaign, Children and Family Research Center, 1010 W. Nevada St., Urbana, IL 61801, USA.
Email: tpcross@illinois.edu

could be either a contributing factor influencing prosecutor actions or a result of law enforcement and prosecution actions. The current article explores the relationship between DNA evidence and criminal justice outcomes in a district attorney's office in a metropolitan area in the northeastern United States, while controlling for other potentially confounding factors like the presence of other evidence. It also includes analyses designed to capture more effectively the influence of DNA evidence on the outcome of prosecuting sexual assault. Our hypothesis is that DNA evidence is both a contributing factor influencing prosecutor actions and outcomes and a result of prosecution action. Unlike some studies, the key DNA variable is DNA match to suspect, since a DNA profile in itself has limited utility until it is matched to a suspect.

Interviews with police and prosecutors in several qualitative studies detail how DNA is used (Alderden et al., 2021; Menaker et al., 2017; Peterson et al., 2010; Peterson et al., 2012; Spohn & Tellis, 2012). Sexual assault cannot be prosecuted unless an assailant is identified, and a match to previously collected DNA may be the only way to identify a stranger who commits sexual assault (Henry & Jurek, 2020; Nesvold et al., 2011). Davis and Wells (2019) studied a sample of hundreds of sexual assault "cold" cases in which DNA identified the assailant. A number of these resulted in prosecution and conviction, supporting the value of testing DNA. DNA testing can also link cases committed by serial sex offenders (Campbell et al., 2019; Lovell et al., 2017), if DNA matches across multiple cases. DNA may also identify assailants in cases in which the victim is nonverbal, such as some cases involving children (Alderden et al., 2021; Menaker et al., 2017). DNA evidence derived from samples collected during a forensic sexual assault medical examination can also rebut suspects' claims that they did not have sexual contact with the victim (Henry & Jurek, 2020). Sexual contact is typically the only plausible explanation for finding the suspect's DNA in the victim's genital areas. Nesvold et al. (2011) found that medical evidence contradicted suspects in 9 out of 27 cases in which interrogated suspects denied sexual contact. In addition, DNA evidence could influence perpetrators' legal defense against charges of sexual assault. Offenders who might have contemplated denying sexual contact with the victim without DNA evidence might instead claim consent as a defense because they know or have reason to believe that DNA evidence will provide evidence of sexual contact (Alderden et al., 2021). DNA evidence may not be probative if offenders claim consent as a defense (Alderden et al., 2021; Spohn & Tellis, 2012). Even then, there are circumstances in which it can be probative, if the specific details of the DNA evidence (e.g., where the DNA evidence is on the victim's body or found at the crime scene) corroborates the victim's account over the assailant's (Alderden et al., 2021; Menaker et al., 2017). Presentation of DNA evidence at trial may help ensure that the defendant does not deny sexual contact (Alderden et al., 2021; Spohn & Tellis, 2012). It may also help persuade juries of the defendants' guilt, even if the DNA evidence is not strictly probative because defendants claim consensual sexual contact. The "CSI Effect" may apply to sexual assault cases; that is, jurors may have expectations for forensic evidence because of

fictional television shows about crime scene investigators (Alderden et al., 2021; Henry & Jurek, 2020; Peterson et al., 2012), although researchers disagree whether a CSI effect on juror expectations exists (Shelton et al., 2011; Smith et al., 2011; Young et al., 2009).

DNA Evidence as a Correlate or Result of Criminal Justice Actions

The relationship between DNA evidence and criminal justice outcomes could also be correlational and not causal. DNA evidence may be more likely if other, more probative evidence is available (see Table 2 for other types of evidence). A vigorous investigative effort by police or prosecutors may produce a wide array of evidence, including DNA evidence. Kruse (2012, 2016) argues that medical and laboratory findings such as DNA evidence are useful when prosecutors make them meaningful by combining them with other evidence from the investigation to create a compelling narrative about the case.

Moreover, law enforcement and prosecutor actions, such as making an arrest and filing criminal charges, can make DNA match to the suspect more likely (Alderden et al., 2021). Developing DNA evidence requires several actions even after biological samples are collected in forensic medical examinations. The forensic evidence kit must be sent to a crime laboratory. The crime laboratory must conduct an analysis to attempt to develop a DNA profile. A separate DNA profile must be obtained from the suspect. Occasionally, a DNA profile is available in CODIS (the Combined DNA Index System, the national DNA database maintained by the FBI, see Federal Bureau of Investigation, n.d.), but more often it is obtained by collecting a comparison biological sample directly from the suspect, by court order if necessary (a common method is to do a buccal swab in the suspect's mouth). A DNA match is obtained when the crime laboratory compares DNA from the forensic examination with DNA from the comparison suspect sample. Only if there is a match does the DNA become evidence that could be probative.

Prosecutors influence several steps of this process (Kreeger & Weiss, 2004). They can ask crime laboratories to expedite DNA analysis in certain cases and not make such a request in other cases. The prosecutor also decides whether to collect a suspect sample and coordinates the effort to get the sample (i.e., asking law enforcement to get the sample and seeking a court order requiring the suspect to submit to sampling). Prosecutors use discretion in taking these actions, particularly because each requires time and money. They are likely to take action to obtain a DNA match in cases that they intend to prosecute and not do so in cases they decide not to prosecute. If no arrest is made and criminal charges are not filed, they are not likely to seek to obtain a DNA match, unless such a match would be necessary to advance the investigation toward possible charges. If criminal charges are filed but the case is later dismissed, the dismissal may lead the prosecutor not to seek a suspect sample, or not to ask the crime laboratory to analyze the comparison suspect sample if it was obtained already.

Thus, it is possible for DNA evidence to be a result of prosecutor actions as well as a contributing factor influencing prosecution actions and outcomes.

This raises questions about studies that have found a statistical relationship between DNA evidence and law enforcement and prosecution outcomes. DNA evidence could be statistically related to arrests because the DNA evidence helped law enforcement establish probable cause. However, DNA evidence could also be related to arrests because police and prosecutors sometimes seek DNA evidence when an arrest is made and typically do not when no arrest is made. DNA evidence could help prosecutors establish the basis for filing criminal charges, but filing criminal charges could also lead prosecutors to seek DNA evidence. DNA evidence could help lead prosecutors to decide to take a case to trial, but deciding to take a case to trial might also lead prosecutors to seek DNA evidence to strengthen their case in court. Thus, prosecutor actions that lead to criminal justice outcomes such as conviction could also influence whether DNA evidence is produced, and thus a relationship between DNA evidence and criminal justice outcomes could be a simple byproduct of the actions prosecutors take. At each of these steps, any correlation between DNA evidence and third variables (such as presence of other evidence) could also help explain a relationship between DNA evidence and criminal justice outcomes.

Studies Relating DNA to Criminal Justice Actions in Sexual Assault Cases

Johnson et al. (2012) studied a sample of sexual assault incidents reported to police across five U.S. jurisdictions. Forensic evidence was significantly related to making an arrest and filing criminal charges, but not to conviction. However, in 98.4% of cases that had both crime scene evidence (including evidence from the forensic evidence kit) and an arrest, the arrest was made *before* forensic evidence was analyzed. Thus, forensic evidence could not have influenced the decision to arrest; what seems likely is that arrest had an impact on forensic evidence by causing evidence kits to be analyzed. Cross and colleagues (2020) analyzed the relationship between DNA evidence and arrest in a statewide sample of sexual assault cases in which there were both a forensic medical examination and a report to police, but again, the vast majority of arrests (91.5%) occurred before crime laboratory results were available, so DNA evidence could not have influenced the decision to arrest in those cases. In 10 cases in which the crime laboratory report preceded arrest, Cross et al. (2020) found a higher rate of arrest when there was a DNA match to suspect, but these results must be interpreted cautiously because of the small size of this subsample. Briody (2002) found that DNA evidence was not significantly related to cases reaching court versus being dismissed or to obtaining guilty pleas, but did find that DNA evidence was significantly related to juries finding defendants guilty at trial in which defendants did not argue consent as a defense. Ingemann-Hansen and colleagues (2008) did not find a significant relationship between a positive DNA match and conviction in a Danish sample. Unlike the current study, these studies did not attempt to distinguish between DNA evidence

as a contributing factor influencing prosecution action and outcomes versus a result or correlate of prosecution action.

Campbell et al. (2009) studied adult sexual assault cases from a Sexual Assault Nurse Examiner (SANE) program. The availability of a DNA profile was significantly related to progress in the criminal justice system, as measured by the following ordinal variable: (a) not referred by the police for prosecution, (b) referred to the prosecutor but not warranted for prosecution, (c) warranted by the prosecutor but later dropped or acquitted, and (d) guilty plea or conviction. However, the timing of laboratory reports and criminal justice actions was not considered, so it is impossible to distinguish between the influence of DNA on case progression in their study versus the influence of case progression on obtaining a DNA profile. Moreover, unlike the current study, this study did not assess whether the DNA profile matched a suspect sample, which is the only way in which a DNA profile is probative.

The current article explores the relationship between DNA evidence and criminal justice outcomes in a district attorney's office in a metropolitan area in the northeastern United States, while controlling for other potentially confounding factors like the presence of other evidence. It also includes analyses designed to distinguish more effectively between the influence of DNA evidence on the outcome of prosecuting sexual assault and the possibility that moving forward with prosecution made it more likely for DNA evidence to be obtained.

Methods

Sample

Data for this study came from a sample of 257 cases of sexual assault involving victims age 12 or older that were referred to a metropolitan prosecutor's office by the police from 2005 to 2010 (Cross, et al., 2016). Quantitative data from the project are available at the National Archive of Criminal Justice Data (Cross & Alderden, 2018). In a qualitative component of the study, prosecutors in a unit that handled sexual assaults were interviewed about how they used forensic evidence in prosecuting sexual assault cases and their perceptions of its effects (Alderden et al., 2021; Schmitt et al., 2017). In this particular jurisdiction, prosecutors were sometimes involved in cases early on, including those in which the suspect had yet to be identified. The study was approved by the Institutional Review Board of the University of Illinois at Urbana-Champaign.

Data Collection

Officials from the prosecutor's office provided the research team with access to prosecution paper case files that contained a host of information from a variety of sources, including, but not limited to: police department initial crime reports taken by the patrol officer who responded to the call for service; detailed follow-up reports from the sexual assault unit detectives that had been assigned to the investigation; forensic medical examinations forms filled out by medical personnel; internal prosecutor's office

documentation; and court records. The case files contained extensive information about the assault, the victim(s), the witnesses (if any), and the suspect(s). Police also documented whether physical evidence was recovered from the crime scene, what evidence was taken into custody, whether the victim underwent a forensic medical examination, and what evidence was included as part of the rape kit. Prosecutors documented evidence pertinent to the case, including any issues that may influence the trajectory of the case (e.g., victim credibility), decisions about how to move forward, and reasons for cases to be closed.

The second and third authors regularly visited the prosecutor's office and coded data from these files. The research team used a codebook that was adapted from one developed by Spohn and Tellis (2012). Among the variables coded were victim demographic and background characteristics, suspect demographic and background characteristics, assault characteristics, injuries noted in prosecutor files, victim credibility issues noted in the file (e.g., victim used drugs or alcohol prior to or during the incident, victim story was inconsistent), types of evidence collected by law enforcement, types of evidence used by prosecutors, and criminal justice actions and outcomes (including dates of actions and outcomes when available).

Data on biological evidence were gathered from the primary crime laboratory serving the prosecutor's office. This crime laboratory served the major city in the county and dealt with a large majority of the sexual assault cases referred to the prosecutor; another crime laboratory that we did not have access to processed cases from three outlying towns in the county. The state in which the study occurred requires medical examiners to complete a standardized forensic evidence kit for any medical examination conducted within 120 hours of the assault. The kit involves a 20-step protocol of specimen collection that includes a standard blood sample from the victim, a saliva sample, vaginal swabs and smears, external genital swabs, anorectal swabs and smears, perianal swabs, and oral swabs and smears. Kits sent to the crime laboratory for screening undergo standardized analysis, which allows laboratory personnel to report on the presence of forensic evidence in the kit. A project research assistant working at the crime laboratory coded data from the standard documentation forms completed by medical examiners on the sample cases. Crime laboratory data were available for 65.1% of the cases in the analysis sample. In 18.9% of cases, no forensic evidence kit was collected; and in 16.0% of cases, a kit had been collected by forensic medical examiners but had not been analyzed at the crime laboratory. The data gathered from the crime laboratory were merged with the case data collected at the prosecutor's office.

Data Reliability

To assess interrater reliability of the coding of prosecutor files, the second and third authors each coded the first 50 cases independently, and Cohen's kappas were calculated for the vast majority of variables. Most kappas were in an acceptable range (>.60). Most of the independent and dependent variables used in our analyses for this article had moderate to high kappas: case not being accepted for prosecution or being

dismissed after charging (1.0), guilty plea (.89) going to trial (1.0), victim drug or alcohol use during the incident (.79), and suspect arrest record (.61). It was difficult to achieve interrater reliability on coding specific types of evidence, in part because some forms of evidence were very infrequent, and most kappas for these variables were below .60. Consequently, an intraclass coefficient calculated to measure interrater reliability on the number of types of evidence was .34, too low to claim interrater reliability. The research team implemented improvements on the coding of evidence (e.g., a simpler protocol for coding these variables, better operationalization of the variables), but time limitations made it impossible to measure interrater reliability again, so the reliability of the number of types of evidence variable remains in question. It was impossible to measure interrater reliability for the crime laboratory data, since we were only able to have one coder there, but the crime laboratory variables used here come from standardized crime laboratory report documents provided to prosecutors, which suggests they are reliable.

Analysis Sample

Given that a major purpose of this study was to examine the relationship between a DNA match to the suspect and conviction, the sample was narrowed to include only those cases in which prosecution and conviction were possibilities. Two contingencies effectively ruled out prosecuting a case in the sample: a) a suspect not being identified, and b) a victim not participating in the prosecution. Victim participation was coded as yes when information in the case record indicated that victims expressed an interest in prosecuting the case and/or acted in a way to support prosecution (e.g., meeting with prosecutors). Victim participation was coded as no when information in the case record indicated that victims opposed prosecution or when there was no response to prosecutor outreach. No case in which a victim declined to participate was accepted for prosecution. In the original sample of 257 cases, the suspect was not identified in 22.6% of cases ($n = 57$), the victim actively declined to participate in the prosecution of the alleged offender in 19.4% of cases ($n = 49$), and victims passively declined to participate in prosecution (e.g., stopped responding to the prosecutor's attempts to contact them) in 25.3% ($n = 65$). Excluding these cases resulted in a final sample of 106 cases.

Primary Analyses

We used the Statistical Package for the Social Sciences (SPSS) to conduct all analyses. We calculated descriptive statistics (means, standard deviations, percentages) on a number of variables to describe the sample. Other primary analyses assessed the relationship between a DNA match to the suspect and prosecution and conviction. The primary analyses did not enable us to distinguish between DNA influencing prosecutor decision-making versus the prosecutor decision to move forward with a case increasing the likelihood that a DNA match would be sought. We computed cross tabulations with a Pearson χ^2 test to see whether DNA match was related to progression in the

prosecution process. For this, we used a prosecution progression variable with four levels representing the furthest point a case progressed in the prosecution process: 1) not criminally charged or accepted for prosecution, 2) criminally charged/accepted for prosecution (some cases were prosecuted by seeking a grand jury indictment directly rather than filing criminal charges), 3) carried forward without prosecutor dismissal, and 4) trial. Out of 28 cases that were carried forward without prosecutor dismissal but did not go to trial, 20 resulted in guilty pleas, five were diverted to another court without the outcome being recorded in the prosecutor case file, and three did not secure an indictment from the grand jury. The prosecution progression variable represented a series of stages in which it may be more likely for prosecutors to use DNA. Next, we examined the relationship between DNA match to suspect and conviction using a cross tabulation with a Pearson χ^2 test. When more than 20% of cells in any cross tabulation had expected frequencies less than 5, we judged that the Pearson χ^2 test was not valid (see McHugh, 2013) and used exact significance tests developed for SPSS (Mehta & Patel, 2011).

We then took steps to develop a multivariable logistic regression model that controlled for third variables that could potentially explain the relationship between DNA match to suspect and conviction. Potential confounding variables included victim demographics, suspect demographics and criminal history, assault characteristics, and composite variables representing the number of victim credibility concerns noted in case files and the number of types of nonbiological evidence available in each case. We used cross tabulations with Pearson χ^2 tests and one-way analyses of variance to examine which variables were related significantly both to conviction and to DNA match to suspect. Variables significantly related to both conviction and DNA match to suspect could potentially create a spurious relationship between DNA match to suspect and conviction. Those variables that were significant were included in a multivariable logistic regression to examine whether DNA match predicted conviction, controlling for possible confounding variables. We examined the correlation of the predictor variables in the logistic regression to assess multicollinearity and used regression diagnostics to assess whether extreme or outlier cases had an undue influence on the results. Note that our limited sample size influenced our decision to take a more practical than theory-driven approach to developing the logistic regression model.

Supplementary Analyses

In addition, we conducted supplementary analyses to explore the possibility that DNA match to suspect influenced prosecutor decision-making and the possibility that moving forward with prosecution increased the likelihood that a DNA match would be sought and obtained. Date variables were used to examine the relative timing of the crime laboratory report vis-à-vis the filing of criminal charges and/or obtaining a grand jury indictment. If the crime laboratory report predated these prosecutor actions, then it is plausible that the DNA match influenced the prosecutor's action in those cases. If the crime laboratory report post-dated these prosecutor actions, this

provides support for the inference that the relationship between DNA match and prosecution outcomes is at least in part a result of prosecutor actions leading to a DNA match.

We also computed a cross tabulation with a Pearson χ^2 test and a multivariable logistic regression examining the relationship between DNA match to suspect and conviction in a subsample of cases in which a suspect buccal swab had been obtained. If a suspect buccal swab was obtained, it was very likely that the prosecutor was seeking a DNA match to the suspect. Using a subsample in which suspect buccal swab was a constant eliminated the effect of prosecutors' seeking a DNA match as a factor, to better assess the influence of DNA match on conviction. Finally, we conducted a qualitative assessment of the 16 cases in which there was a DNA match to suspect and a conviction to try to infer the role of DNA in each case.

Results

Case Characteristics

Table 1 presents information on case characteristics in the analysis sample. The vast majority of victims were female. Although the largest percentage of victims was White (non-Hispanic), a majority of victims were people of color. The median victim age was 23. All of the suspects in the sample were male. Just over half of the suspects were Black, and their median age was 29.5. Over half of suspects had a prior arrest record. More than half of the suspects were acquaintances of the victim, while smaller percentages were strangers or current or former intimate partners. The majority of cases involved vaginal penetration, and bodily force was used in almost two-thirds of incidents. In nearly half of the cases in the analysis sample, victims used recreational drugs and/or alcohol prior to or during the incident. We were not able to determine what the suspect's final defense was in almost half of the cases; however, in just over a quarter of cases, we determined that the suspect maintained that the victim fabricated the assault, and in just over one-fifth of cases, we were able to determine that the suspect maintained that the victim consented to sexual activity.

In a plurality of cases, there was a crime laboratory report but no DNA match to suspect; in over one-quarter of cases a DNA match to the suspect was noted in either the crime laboratory report or prosecution file; and in just under one-third of cases there was no laboratory report. Regarding case progression in the criminal justice system, just under one-half of cases were not accepted and had no criminal charges filed, less than one-fifth of cases were accepted for prosecution but were later dismissed, over one-quarter of cases were carried forward without prosecutor dismissal (most of these cases had guilty pleas), and less than one-tenth of cases went to trial. A conviction was obtained in less than a quarter of cases, including six of the ten cases that went to trial.

Table 2 shows the frequency of different types of evidence used by the prosecutor. Victim testimony was one source of evidence in almost all cases. Two-thirds of cases had witnesses who could corroborate some part of the victim's account, though they

Table 1. Characteristics of Cases in Which Suspects were Identified and Victims Participated in Prosecution ($N = 106$).

Variable	*n*	% or median
Victim gender		
Female	102	96.2%
Male	4	3.8%
Victim race-ethnicity		
White (non-Hispanic)	38	37.6%
Black (non-Hispanic)	36	35.6%
Hispanic	19	18.8%
Asian/Pacific Islander	7	6.6%
Other	1	0.9%
Victim age[a]		
12–15	8	7.5%
16–17	9	8.5%
18–24	37	34.9%
25–29	23	21.7%
30–39	13	12.3%
40 and older	16	15.1%
Suspect male gender	106	100%
Suspect race-ethnicity		
White (non-Hispanic)	21	21.4%
Black (non-Hispanic)	50	51.0%
Hispanic	24	24.5%
Asian/Pacific Islander	3	3.1%
Suspect age[b]		
14–17	6	5.8%
18–24	30	28.8%
25–29	16	15.4%
30–39	23	22.1%
40 and older	29	27.3%
Suspect has a record of prior arrests	60	56.6%
Victim-suspect relationship		
Stranger	24	22.9%
Acquaintance	62	59.0%
Intimate partner/former intimate partner	19	18.1%
Assault type		
Fondled	57	53.8%
Oral penetration	26	24.5%
Anal penetration	9	8.5%
Digital penetration	24	22.6%
Vaginal penetration	66	62.3%
Attempted assault	3	2.8%
Victim cannot recall	2	1.9%
Type of assault unknown	4	3.8%
Bodily force used	67	66.3%

(continued)

Table 1. (continued)

Variable	*n*	% or median
Victim use recreational drugs and/or alcohol prior to/during incident	49	46.2%
Suspect's final defense		
Assault fabricated	27	25.5%
Victim consented	24	22.6%
No defense—confession	8	7.5%
Unknown	47	44.3%
DNA match to suspect		
No laboratory report on evidence kit found	34	32.1%
Laboratory report on evidence kit but no DNA match to suspect	44	41.5%
DNA match to suspect in laboratory report and/or prosecution file	28	26.4%
Case progression		
Not accepted—no criminal charges	48	45.3%
Accepted for prosecution but dismissed later	20	18.9%
Carried forward without prosecutor dismissal	28	26.4%
Trial	10	9.4%
Conviction[c]	26	24.5%

Note. [a] median = 23, mean = 26.59, *SD* = 10.41, minimum = 12, maximum = 66.
[b]median = 29.5, mean = 32.37, *SD* = 11.17, minimum = 14, maximum = 63.
[c]Twenty guilty pleas without a trial, two guilty pleas after a trial began, and four convictions at trial.

Table 2. Frequency of Different Types of Evidence Used by the Prosecutor (*N* = 106).

Type of evidence	*n*	%
Victim testimony	101	95.3
Corroborating witness	71	67.0
Physical evidence at the crime scene	41	38.7
Non-genital injury	40	37.7
Semen	26	24.5
DNA match to suspect	23	21.7
Cellular phone communication	22	20.8
Genital injury	19	17.9
Surveillance video	14	13.2
CODIS hit to a convicted person	12	11.3
Social media communication	10	9.4
Physical evidence at the forensic medical examination	9	8.5
Amylase/Saliva	8	7.5
Hair	7	6.6
CODIS hit to another investigation	5	4.7
Fingerprints	4	3.8
Blood	2	1.9

were not eyewitnesses to the assault. Over one-third of cases had physical evidence from the crime scene and nongenital injury was evidence in over one-third of cases. Other forms of evidence were less common, including DNA match to suspect,

which was noted as a form of evidence used in just over one-fifth of cases. A CODIS hit to a convicted person occurred in just over one-tenth of cases and a CODIS hit to another investigation in 4.7% of cases.

The Relationship of DNA Evidence to Case Progression

Table 3 shows differences in case progression for different categories of the DNA match to suspect variable. Cases with a DNA match were significantly more likely to move forward in the criminal justice system. About three-quarters of cases with a DNA match resulted in a guilty plea or went to trial. On the other hand, 86.4% of cases at the crime laboratory that did not have a DNA match did not proceed to a guilty plea or trial, and over two-thirds of cases for which there was no crime laboratory report did not proceed to a guilty plea or trial. Nine out of ten cases that went to trial had a DNA match to suspect. The one case that went to trial without a DNA match had other evidence that was particularly damning—multiple voicemail messages in which the suspect admitted to committing rape.

Analyses Examining the Relationship of DNA Match to Suspect to Conviction

More than half of cases with a DNA match to the suspect led to a conviction, versus less than one-tenth of cases that were processed at the crime laboratory in which there was no DNA match to suspect, and less than one-fifth of cases in which there was no kit or the kit was not analyzed at the crime laboratory (see Table 3). The

Table 3. Case Progression and Conviction for Cases with and Without a DNA Match to Suspect (Excluding Cases Without an Identified Suspect and Without a Participating Victim) ($N = 106$).

	Case progression				
	Not criminally charged or accepted for prosecution	Criminally charged/ accepted and then dismissed	Carried forward without prosecutor dismissal	Trial	Conviction
No laboratory report ($n = 34$)	13 38.2%	10 29.4%	10 29.4%	1 2.9%	6[a] 17.6%
No DNA match to suspect ($n = 44$)	30 68.2%	8 18.2%	6 13.6%	0 0%	4 9.1%
DNA match to suspect ($n = 28$)	5 17.9%	2 7.1%	12 42.0%	9 32.1%	16[b] 57.1%

Note. Cells present counts and row percentages. Because of small cell sizes on case progression, an exact significance test was calculated via SPSS using computer resources, exact $p < .011$. For the 3×2 cross tab on conviction vs. no conviction, Pearson χ^2 $(2, N = 106) = 25.02$, $p < .001$.

[a]Five guilty pleas, one conviction at trial.

[b]Eleven guilty pleas, five convictions at trial.

result was statistically significant at $p < .001$. Similarly, a logistic regression found a statistically significant bivariate relationship between DNA match to suspect and conviction, Wald χ^2 $(2, N = 106) = 18.85$, $p < .001$. Tests of contrasts in the analysis found that the odds of conviction with a DNA match were 13.33 times greater than the odds if the kit was analyzed, but there was no DNA match (Wald χ^2 $[1, N = 106] = 15.94$, $p < .001$), and 6.22 times greater than if there was no kit or the kit was not analyzed (Wald χ^2 $[1, N = 106] = 9.60$, $p = .002$).

In our analysis of third variables that could possibly confound the relationship between DNA match to suspect and conviction (see Table 4), we found that the following variables were significantly related at $\alpha = .05$ to both DNA match to suspect and conviction: victim age, suspect having an arrest record, and victim using recreational drugs and/or alcohol prior to or during the offense. Victims in cases with a DNA match were significantly younger than victims in cases in which there was no kit, or the kit was not analyzed at the crime laboratory. But an analysis of variance showed that neither of these groups was significantly different in age from victims whose kits were analyzed but did not yield a DNA match to suspect [$F(2,103) = 3.23$, $p = .043$]. In a majority of cases with a DNA match or no analyzed kit, the suspect had an arrest record, but the suspect had an arrest record in just over one-third of cases in which the kit was analyzed but there was no DNA match to suspect, Pearson χ^2 $(2, N = 106) = 12.55$, $p = .002$. Only a minority of cases with a DNA match to suspect or without a DNA kit analyzed had a victim who used recreational drugs or alcohol prior to or during the assault. However, in cases with analyzed kits but no DNA match, a majority of victims had used recreational drugs or alcohol prior to or during the assault, Pearson χ^2 $(2, N = 106) = 9.24$, $p = .011$. The count of the number of types of nonexamination related evidence (see Table 2 for a list of such evidence types) was also significantly related to conviction but was related to DNA match to suspect at the level of a statistical trend, $F(2,103) = 2.85$, $p = .057$. Cases with a DNA match had more types of nonexamination evidence than cases that were analyzed but yielded no DNA match to suspect and cases that did not have an analyzed kit, but the pairwise comparisons were not statistically significant. Because this variable could still be a confounding variable in analyzing the relationship between DNA match to suspect and conviction, we included it in further analyses.

Table 4. Relationship of DNA Match to Suspect to Potentially Confounding Third Variables.

	Victim age	Suspect has an arrest record	Victim drug or alcohol use	Number of other types of evidence
No laboratory report ($n = 34$)	$M = 30.0$, $SD = 11.0$	24 70.6%	11 32.4%	$M = 2.9$ $SD = 1.6$
No DNA match to suspect ($n = 44$)	$M = 25.9$, $SD = 10.5$	16 36.4%	28 63.6%	$M = 3.0$ $SD = 1.5$
DNA match to suspect ($n = 28$)	$M = 23.6$, $SD = 8.5$	20 71.4%	10 35.7%	$M = 3.8$ $SD = 1.6$
p	.043	.002	.011	.057

Table 5. Bivariate and Multivariable Logistic Regressions Explaining Conviction (Excluding Cases Without an Identified Suspect and/or Without a Participating Victim) ($N = 106$).

Variable	Bivariate odds ratio	Adjusted odds ratio	Lower bound	Upper bound	*p*
Victim age	0.93	0.94	0.88	1.01	.104
Victim used drugs and/or alcohol[a]	0.26	0.30	0.09	1.05	.060
Suspect has an arrest record	4.42	2.33	0.63	8.71	.208
Number of types of nonbiological evidence used by prosecutor	1.75	1.71	1.14	2.54	.009
DNA match to suspect					.006
DNA match vs. no DNA match	13.33	9.31	2.09	41.42	.003
No laboratory report vs. kit processed but no DNA match	2.14	2.05	0.41	10.52	.388

Note. Model χ^2 (6) = 41.925, $p < .001$. Nagelkerke $R^2 = .49$. Hosmer–Lemeshow χ^2 (8) = 1.61, $p = .991$.
[a]Victim used drugs and/or alcohol prior to and/or during the offense.

Table 5 shows the results of the multivariable logistic regression analysis. The model χ^2 indicated a statistically significant relationship of the independent variable set to conviction, and the Nagelkerke R^2 indicated a strong relationship between the predictor variables and conviction. The Hosmer–Lemeshow χ^2 was highly nonsignificant, indicating a good fit of the data to the model. In a correlation matrix of the predictor variable, the highest correlation between variables was −.265, suggesting that the multicollinearity among the predictor variables was modest. Regression diagnostics revealed a modest number of cases (5) with studentized residuals greater than 2 and only one case with a Cook's d greater than 1. The DFBeta statistics revealed that removal of any of the outlier cases would have had a minimal effect on the results for individual variables. These diagnostics indicate that it is unlikely that a small number of outlier cases produced the results.

DNA match to suspect was significantly related to conviction in the logistic regression model. The odds of conviction were 9.31 greater when there was a DNA match to suspect than when the crime laboratory processed the kit but there was no DNA match, controlling for other variables. In a related version of the logistic regression with the same predictor variables but different contrasts for the DNA match variable, the odds of a conviction were 4.53 times greater when there was a DNA match to suspect than when no evidence was found at the crime laboratory, $p = .029$. The only other variable that was significantly related to conviction was the number of types of nonbiological evidence. The odds of conviction were 1.71 times greater with an increase of one type of evidence, other predictor variables controlled.

Supplementary Analyses

Analysis of timing of crime laboratory report. In 21 cases with a DNA match to suspect, criminal charges were filed and/or there was a grand jury indictment. In 15 of those

cases, we had enough data on dates of events to determine the relative timing of the crime laboratory report to police and prosecution actions. In five of those cases, the crime laboratory report preceded the filing of criminal charges. In 10 of those cases, the crime laboratory report to police post-dated the filing of criminal charges and/or a grand jury indictment.

Analysis of cases with a suspect buccal swab. To control for the effect of prosecutors seeking a DNA match by obtaining a suspect buccal swab, we conducted additional analyses with the 29 cases in which prosecutors obtained a suspect buccal swab. Since there were only two cases in which prosecutors obtained a suspect buccal swab but a kit was not processed at the crime laboratory, we used a dichotomous version of the DNA match to suspect variable: DNA match versus no DNA match. As Table 6 shows, this variable was significantly related to case progression in cases with a suspect buccal swab. All but two cases with a suspect buccal swab and DNA match to suspect resulted in a guilty plea or trial, while all but one of the cases with a suspect buccal swab but no DNA match were either declined or dismissed. Over two-thirds of cases with a suspect buccal swab and DNA match resulted in conviction, versus only 14.3% of the suspect buccal swab cases without a DNA match. We examined other potential predictors of conviction within the 29 cases with a suspect buccal swab and found that suspect arrest record was significantly related both to DNA match to suspect and conviction in this subsample. We conducted a logistic regression examining the relationship of DNA match to suspect (dichotomous version) and suspect arrest record with conviction. As Table 7 shows, the independent variable set was significantly and strongly related to conviction. The correlation between DNA match to suspect and suspect arrest record was −.64, indicating that multicollinearity was not a problem. There were no outliers among the studentized residuals. The odds of a conviction with a DNA match were 15.25 the odds without a DNA match, controlling for suspect arrest record.

Table 6. Case Progression and Conviction in Cases with a Suspect Buccal Swab ($n = 29$).

	Case progression				
	Not criminally charged or accepted for prosecution	Criminally charged/ accepted and then dismissed	Carried forward without prosecutor dismissal	Trial	Conviction
No DNA match to suspect ($n = 7$)	4 57.1%	2 28.6%	1 14.3%	0 0.0%	3 6.8%
DNA match to suspect ($n = 22$)	2 9.1%	0 0.0%	11 50.0%	9 40.9%	16 68.2%

Note. Because of small cell sizes, exact significance tests were calculated via SPSS using computer resources. For case progression, exact $p < .001$. For 3 × 2 cross tab on conviction vs. no conviction, exact $p < .001$.

Table 7. Multivariable Logistic Regression Explaining Conviction in Cases with a Suspect Buccal Swab (Excluding Cases Without an Identified Suspect and/or Without a Participating Victim) ($N = 29$).

Variable	Odds ratio	Lower bound	Upper bound	*p*
Suspect has an arrest record	9.62	1.25	74.35	.030
DNA match to suspect	15.25	1.28	182.28	.031

Note. $N = 29$. Model χ^2 (2) = 12.11, $p = .002$. Nagelkerke $R^2 = .457$. Hosmer–Lemeshow χ^2 (2) = .113 , $p = .945$.

Table 8. Qualitative Description of Cases with a DNA Match and Conviction ($n = 16$).

Description	*n*
Unknown whether DNA match was a factor	6
Defense claims assault was fabricated	5
Stranger assailant identified only by CODIS[a] hit	2
DNA match not a factor	2
Witness identification of suspect confirms CODIS[a] hit	1

Note. [a] The Combined DNA Index System national DNA database.

Analysis of cases with both a DNA match and a conviction. The qualitative assessment of the 16 cases with both a DNA match to suspect and a conviction suggested some ways in which the DNA match could have had an effect (see Table 8). The number of other types of evidence the prosecutor used in these cases in addition to biological evidence and victim testimony ranged from 2 to 6 and averaged 4.3 ($SD = 1.4$), so any decision was influenced by an array of evidence, including but not limited to DNA match to suspect. In six cases, we lack data on the suspect's response to the allegations, but the suspects pleaded guilty or were found guilty at trial; it is plausible that the DNA match was a factor in these decisions, but we have no way of knowing that. In five cases, the defendant's defense was coded as claiming that the assault was fabricated, so it seems likely that the DNA match was used to try to rebut that defense or used as leverage in a plea bargain. Two cases had stranger assailants who were identified solely because of CODIS hits. In another case, a CODIS hit confirmed the identification made through a photo spread or lineup. In two of the 16 cases, data from the prosecutor files suggest that the DNA match was not a factor in the final disposition.

Discussion

The purpose of this study was to examine the relationship between DNA evidence and criminal justice outcomes. Our hypothesis was that DNA match influenced prosecution actions and convictions and was also a result of prosecution action. Cases with a DNA

match to suspect were significantly more likely to advance in the criminal justice system and to end in conviction. Almost three-quarters of cases with a DNA match to suspect were carried forward to a guilty plea or trial compared to less than a third of cases without a laboratory report and just 13.6% of cases with a laboratory report but no DNA match to suspect. DNA match to suspect had a dramatic relationship with conviction: over half of the cases with a DNA match to suspect ended in conviction compared to less than one-tenth of cases that were analyzed at the crime laboratory and under one-fifth of cases not analyzed at the crime laboratory. The odds of conviction were much greater when there was a DNA match. The relationship between DNA match to suspect and conviction was unlikely to be a result of third variables because DNA match to suspect was still significantly related to conviction when we controlled for possible confounding variables, with an odds ratio indicating a large effect (see Olivier et al., 2017).

The supplementary analyses suggest that DNA match to suspect both influenced prosecutor actions and was, in part, a result of these actions. (DNA match was a result in the sense that in many cases it would not occur unless prosecutors sought a suspect sample.) The analysis of dates of events supports the inference that obtaining a DNA match was in part a *result* of deciding to prosecute a case. In a number of cases, crime laboratory results were reported only *after* criminal charges were filed and/or a grand jury indictment was obtained; presumably, the DNA match would never have been obtained in these cases if prosecutors had not decided to prosecute the case and seek a DNA match.

When we restricted the analysis to those cases in which prosecutors obtained a suspect buccal swab, we found a significant relationship between DNA match to suspect and case progression and conviction. This supported the inference that DNA match influenced prosecution outcomes. Prosecutors presumably sought DNA evidence in all the cases with a suspect buccal swab, so seeking a DNA match because prosecutors decided to move forward with the case did not have an effect on the results for this subsample. The DNA match could have influenced a) the prosecutor's decision to carry the case forward and not dismiss it, b) the suspect's decision to plead guilty versus seek an acquittal at trial, and/or c) the jury's verdict if the case went to trial.

The analysis of the 16 cases in which there was both a DNA match to suspect and a conviction also provides evidence of the influence of DNA match on outcomes in at least some of those cases. In the two cases in which the DNA evidence was the primary means by which the suspect was identified, prosecution may not have been possible without the DNA match, which suggests a clear impact of DNA evidence. In those cases in which the suspect claimed that the sexual assault allegation was fabricated, it seems likely that the DNA evidence was used to counter that assertion and could have had an impact on obtaining a conviction.

The near-ubiquity of DNA evidence in cases that went to trial suggests that DNA evidence may have been a factor in prosecutors deciding to take a case to trial, and that obtaining a DNA match is an important part of trial preparation. In the qualitative component of this study, prosecutors in this jurisdiction reported that it was important

to present biological evidence (including DNA evidence) because of a potential CSI effect—juries' expectation of seeing forensic evidence (Alderden et al., 2021). Prosecutors also felt that DNA evidence was important at trial to establish that suspects had sexual contact with the victim even if, during the investigation, suspects had claimed consensual sexual contact. Suspects at trial could make new claims that the allegation was fabricated, and the DNA evidence helped preempt the possibility of such a claim.

The Impact of DNA Evidence in Sexual Assault Cases

We think these results provide the clearest support to date of the impact of DNA evidence on outcomes of prosecuting sexual assault. Contrary to studies such as Johnson et al. (2012) and Ingemann-Hansen et al. (2008), we found a significant relationship between DNA evidence and conviction. Unlike Briody (2002), we found that DNA evidence was related to conviction overall and not just to juries finding defendants guilty. Like Campbell et al. (2009), we found that DNA evidence was related to case progression, but unlike Campbell we were able, at least to some degree, to distinguish between DNA as an influence on and a result of prosecutor actions.

The Implications of Failing to Obtain a DNA Match

One practical implication of this research is to underline how advisable it is for victims and professionals who want to support prosecution of sexual assault to do what they can to obtain DNA evidence. The study results also raise questions about the prospects for achieving a conviction if a DNA match is unavailable. A variety of circumstances can lead to a failure to obtain a DNA match. In some sexual assaults, actual intercourse or ejaculation does not occur, or the perpetrator uses a condom or takes other steps to avoid leaving evidence. Victims may react to the trauma of the event by washing, showering, or changing clothes quickly. Some victims do not want to have forensic medical examinations, which can be long, uncomfortable, and emotionally difficult. One can understand their reluctance, particularly if biological evidence does not seem to be needed to identify the perpetrator or establish that there was a sexual act. Some victims may only feel emotionally ready to deal with the assault after some time has elapsed, but getting an examination more than a few days after the assault substantially reduces the likelihood of obtaining biological evidence, and some programs do not conduct forensic medical examinations more than 72 hours after the assault (Ledray, 2010). Attrition affects the number of cases with DNA evidence just as attrition affects the prosecution of sexual assault. Even timely examinations do not always yield biological evidence, even when a sexual assault has been committed: not all samples are adequate for DNA testing, a DNA profile is not always obtained from a sample from the victim, and circumstances may hinder obtaining a suspect sample —all situations that are out of the control of the victim.

In this day of widespread awareness of DNA evidence and other forensic results, it may be difficult to proceed in a case without a DNA match. One issue to consider is

whether the growth in the use of DNA has the unintended consequence of making it more difficult to move forward with legitimate cases that do not have DNA evidence. The need for DNA evidence may place a burden on victims of sexual assault that victims of other crimes do not have. Professionals who work with victims may need to be prepared for possible limitations in the criminal justice system if DNA evidence is not available. Prosecutors should also reflect on the implications of the current results. To some extent, the results vindicate the use of DNA evidence in sexual assault cases and support investment by district attorneys in providing training on using DNA evidence. On the other hand, prosecutors should consider whether DNA evidence functions as a requirement that becomes an obstacle to achieving justice in certain cases.

Limitations

This study has several limitations that should influence interpretation of the results and spur additional research. The reliability of the number of types of evidence variable is in question. Sample sizes for several key categories of cases were small, limiting statistical power to find effects. Nevertheless, the effect sizes for results were often large enough to be statistically significant despite small sample sizes. The research was conducted in one jurisdiction and the results may not generalize to other jurisdictions. Analysis of case data does not reveal the process by which DNA evidence affects decision-making. We were not able to distinguish fully between DNA as an influence on prosecutor actions versus a result of prosecutor actions.

We could not disentangle the effects of DNA on prosecutors, suspects, and juries. The source of the apparent causal impact of DNA match on conviction is ambiguous because we cannot distinguish how much of this stems from its impact on prosecutors' decision to carry cases forward, versus suspects' decision to plead guilty, versus juries' decision to convict. Importantly, we cannot distinguish between DNA evidence having an impact because of its probative value in determining guilt versus having an impact because prosecutors see it as necessary to move forward with a case. Note that the near-ubiquity of DNA in trials in our sample as well as the small sample size of trials made it impossible to analyze the relationship between DNA match and jury verdicts. Despite these limitations, the study does advance knowledge about the effects of DNA evidence in sexual assault cases.

Future Research

Future studies could focus more on those cases that will be the most informative for testing the effects of DNA evidence. For example, case–control studies could select matched DNA match and non-DNA match cases with comparable biological samples and testing and compare the difference in outcomes between cases with and without DNA evidence. Case–control studies could also examine jury trials in sexual assault cases. One benefit of such studies would be to increase the sample size of cases with DNA evidence. Interrupted times series analysis studies could

examine prosecution outcomes in sexual assault cases historically, before and after the introduction of DNA methods.

Future research is needed to distinguish between DNA having an impact because of its probative value versus DNA having an impact because prosecutors see it as necessary for prosecution. Future studies could extend the case study method employed in McEwen's (2011) study of forensic evidence to explore further the effect of DNA evidence on decision-making. A sample of cases with DNA evidence could be selected and prosecutors could be interviewed or surveyed to study the case circumstances that made this evidence more or less probative, the specific methods they used with this evidence, how defense attorneys countered the introduction of this evidence, and how these factors related to outcomes.

Conclusion

The possibility of obtaining DNA evidence is a major reason why thousands of victims of sexual assault undergo forensic medical examinations every year. Their investment makes it even more important to understand the impact of DNA evidence in sexual assault cases. The findings from the present study strengthen the case for providing victims access to quality forensic medical examinations, for investing in crime laboratories' ability to conduct effective DNA analysis, and for training prosecutors to use DNA results effectively. Yet, communities differ in the availability of SANEs or other trained medical examiners (Frellick, 2018), skilled crime laboratories (National Research Council, 2009), and police and prosecutors knowledgeable about working with DNA evidence (Griswold & Murphy, 2010; Prottas & Noble, 2017). Advocates may want to consider the results of this study in developing their arguments for enhancing systems of response to sexual assault.

The present study suggests that DNA evidence makes a difference, but our research leaves many questions unanswered. We hope the current study is one stepping stone toward more research to develop a thorough understanding of the effects of DNA evidence on the prosecution of sexual assault.

Acknowledgments

The authors are deeply indebted to the staff of the Domestic Violence and Sexual Assault Unit of the prosecutor's office in which we conducted this research for their assistance and support, especially two chiefs of unit and a victim witness advocate, and to the Sexual Assault Unit of the primary police department affiliated with this prosecutor's office. The authors also thank Alex Wagner and Cassia Spohn for their assistance.

Declaration of Conflicting Interests

The authors have no conflicts of interest with respect to the research, authorship, and/or publication of this article: Laura Siller is now the Assistant Director of Research and Evaluation at Project Bread, Boston, MA.

Funding

The author(s) disclosed receipt of the following financial support for the research, authorship, and/or publication of this article: This study was funded through grant 2013-NE-BX-0005 from the National Institute of Justice to the University of Illinois at Urbana-Champaign and is based, in part, on the final summary overview for the grant. There are no conflicts of interest.

ORCID iD

Theodore P. Cross https://orcid.org/0000-0003-4097-1541

References

Alderden, M., Cross, T. P., Vlajnic, M., & Siller, L. (2021). Prosecutors' perspectives on biological evidence and injury evidence in sexual assault cases. *Journal of Interpersonal Violence*, *36*(7–8), 3880–3902. https://doi.org/10.1177%2F0886260518778259

Briody, M. (2002). The effects of DNA evidence on sexual offence cases in court. *Current Issues in Criminal Justice*, *14*(2), 159–181. https://doi.org/10.1375/acri.37.2.231

Campbell, R., Feeney, H., Goodman-Williams, R., Sharma, D. B., & Pierce, S. J. (2019). Connecting the dots: identifying suspected serial sexual offenders through forensic DNA evidence. *Psychology of Violence*, *10*(3), 255–267. https://doi.org/10.1037/vio0000243

Campbell, R., Patterson, D., Bybee, D., & Dworkin, E. (2009). Predicting sexual assault prosecution outcomes: The role of medical forensic evidence collected by sexual assault nurse examiners. *Criminal Justice and Behavior*, *36*(7), 712–727. https://doi.org/10.1177/0093854809335054

Cross, T., & Alderden, M. (2018). Injury evidence, forensic evidence and the prosecution of sexual assault, United States, 2005–2011. Inter-university Consortium for Political and Social Research [distributor], 2018–04–23. https://doi.org/10.3886/ICPSR36608.v1

Cross, T. P., Alderden, M., Wagner, A., Sampson, L., Peters, B., & Lounsbury, K. (2020). Biological evidence in adult and adolescent sexual assault cases: Timing and relationship to arrest. *Journal of Interpersonal Violence*, *35*(7/8), 1828–1939. https://doi.org/10.1177/Q886260517704229

Cross, T. P., Siller, L., Vlajnic, M, Alderden, M., & Wagner, A. (2016). *Injury evidence, biological evidence, and prosecution of sexual assault.* Final summary overview. NCJ Number: 251036. nij.ojp.gov/library/publications/injury-evidence-biological-evidence–and-prosecution-sexual-assault.

Davis, R. C., & Wells, W. (2019). DNA testing in sexual assault cases: when do the benefits outweigh the costs? *Forensic Science International*, *299*, 44–48. https://doi.org/10.1016/j.forsciint.2019.03.031

Federal Bureau of Investigation (n.d). *Frequently asked questions (FAQs) on the CODIS Program and the National DNA Index System*. Retrieved from https://www.fbi.gov/about-us/lab/biometric-analysis/codis/codis-and-ndis-fact-sheet

Frellick, L. (2018). *SANE Nurse shortfall is a national issue*. Nurse.com. Retrieved from https://resources.nurse.com/sane-nurse-shortfall-is-a-national-issue

Griswold, M. E., & Murphy, G. R. (2010). *It's more complex than you think: A chief's Guide to DNA*. Police Research Forum. Retrieved from https://www.policeforum.org/assets/docs/Free_Online_Documents/DNA_Forensics/its%20more%20complex%20than%20you%20think%20-%20a%20chiefs%20guide%20to%20dna%202010.pdf

Henry, T. K. S., & Jurek, A. L. (2020). Identification, corroboration, and charging: Examining the use of DNA evidence by prosecutors in sexual assault cases. *Feminist Criminology, 15*(5), 634–658. https://doi.org/10.1177/1557085120940795

Ingemann-Hansen, O., Brink, O., Sabroe, S., Sørensen, V., & Charles, A. V. (2008). Legal aspects of sexual violence—does forensic evidence make a difference? *Forensic Science International*, *180*(2–3), 98–104. https://doi.org/10.1016/j.forsciint.2008.07.009

Johnson, D., Peterson, J., Sommers, I., & Baskin, D. (2012). Use of forensic science in investigating crimes of sexual violence: contrasting its theoretical potential with empirical realities. *Violence Against Women*, *18*(2), 193–222. https://doi.org/10.1177/1077801212440157

Kreeger, L. R., & Weiss, D. M. (2004). *DNA evidence: Policy considerations for the prosecutor.* American Prosecutors Research Institute (NCJ Document No. 207520). https://www.crime-scene-investigator.net/APRI-DNApolicyprosecutor.pdf

Kruse, C. (2012). Legal storytelling in pre-trial investigations: arguing for a wider perspective on forensic evidence. *New Genetics and Society*, *31*(3), 299–309. https://doi.org/10.1080/14636778.2012.687084

Kruse, C. (2016). *The social life of forensic evidence*. University of California Press.

Ledray, L. (2010). Expanding evidence collection time: Is it time to move beyond the 72-hour rule? How do we decide? *Journal of Forensic Nursing*, *6*(1), 47–50. https://doi.org/10.1111/j.1939-3938.2009.01065.x

Lovell, R., Luminais, M., Flannery, D. J., Overman, L., Huang, D., Walker, T., & Clark, D. R. (2017). Offending patterns for serial sex offenders identified via the DNA testing of previously unsubmitted sexual assault kits. *Journal of Criminal Justice*, *52*, 68–78. https://doi.org/10.1016/j.jcrimjus.2017.08.002

McEwen, T. (2011). *The role and impact of forensic evidence in the criminal justice process: Revised final report*. (NIJ Document No. 236474). U.S. Department of Justice, National Institute of Justice. https://www.ncjrs.gov/pdffiles1/nij/grants/231977.pdf

McHugh, M. L. (2013). The chi-square test of independence. *Biochemia Medica*, *23*(2), 143–149. https://doi.org/10.11613/BM.2013.018

Mehta, C. R., & Patel, N. R. (2011). *IBM SPSS exact tests*. Cytel Software Corporation & Harvard School of Public Health.

Menaker, T. A., Campbell, B. A., & Wells, W. (2017). The use of forensic evidence in sexual assault investigations: Perceptions of sex crime investigators. *Violence Against Women*, *23*(4), 399–425. https://doi.org/10.1177/1077801216641519

National Research Council (2009). *Strengthening forensic science in the United States: A path forward*. National Academies Press.

Nesvold, H., Ormstad, K., & Friis, S. (2011). To be used or not to be used, that is the question: Legal use of forensic and clinical information collected in a self-referral sexual assault centre. *Journal of Forensic Sciences*, *56*(5), 1156–1162. https://doi.org/10.1111/j.1556-4029.2011.01879.x

Olivier, J., May, W. L., & Bell, M. L. (2017). Relative effect sizes for measures of risk. *Communications in Statistics—Theory and Methods*, *46*(14), 6774–6781. https://doi.org/10.1080/03610926.2015.1134575

Peterson, J., Johnson, D., Herz, D., Graziano, L., & Oehler, T. (2012). *Sexual assault kit backlog study* (NIJ Document No. 238500). National Institute of Justice. https://www.ncjrs.gov/pdffiles1/nij/grants/238500.pdf

Peterson, J., Sommers, I., Baskin, D., & Johnson, D. (2010). *The role and impact of forensic evidence in the criminal justice process* (NIJ Document No. 231977). National Institute of Justice. https://www.ncjrs.gov/pdffiles1/nij/grants/231977.pdf

Prottas, J. M., & Noble, A. A. (2017). Use of forensic DNA evidence in prosecutors' offices. *Journal of Law, Medicine & Ethics*, *35*(2), 310–315.

Schmitt, T., Cross, T. P., & Alderden, M. (2017). Qualitative analysis of prosecutors' perspectives on sexual assault nurse examiners and the criminal justice response to sexual assault. *Journal of Forensic Nursing*, *13*(2), 62–68. https://doi.org/10.1097/JFN.0000000000000015

Shelton, D. E., Barak, G., & Young, S. K. (2011). Studying juror expectations for scientific evidence: A new model for looking at the CSI myth. *Court Review*, *47*, 8–18. https://digitalcommons.unl.edu/cgi/viewcontent.cgi?article=1357&context=ajacourtreview

Smith, S. M., Stinson, V., & Patry, M. W. (2011). Fact or fiction? The myth and reality of the CSI effect. *Court Review*, *47*(1/2), 4–7. https://digitalcommons.unl.edu/cgi/viewcontent.cgi?article=1358&context=ajacourtreview

Spohn, C., & Tellis, K. (2012). *Policing and prosecuting sexual assault in Los Angeles City and County: A collaborative study in partnership with the Los Angeles Police Department, the Los Angeles County Sheriff's Department, and the Los Angeles County District Attorney's Office* (NCJ Document No.: 237582). NCJRS. https://www.ncjrs.gov/pdffiles1/nij/grants/237582.pdf

Young, S. K., Barak, G., & Shelton, D. E. (2009). Examining the CSI-effect in the cases of circumstantial evidence and eyewitness testimony: multivariate and path analyses. *Journal of Criminal Justice*, *37*(5), 452–460. https://doi.org/10.1016/j.jcrimjus.2009.07.005

Author Biographies

Theodore P. Cross is a senior research professor at the Children and Family Research Center in the School of Social Work at the University of Illinois at Urbana-Champaign. He served as a principal investigator on National Institute of Justice grants to study the relationship of biological evidence to police response and to prosecutor actions in sexual assault cass. For over 20 years, he has also studied the criminal justice response to child sexual abuse. In addition, he has published work comparing forensic evidence and police response in child, adolescent, and adult sexual assault cases.

Laura Siller is the assistant director of Research and Evaluation at Project Bread. Her work focuses on the prevention, intervention, and criminal justice system response to gender-based violence, with an emphasis on historically marginalized and underserved populations.

Maja Vlajnic is a Data and Policy Specialist at the Crime and Justice Institute and a doctoral candidate in the Department of Criminology and Criminal Justice at Northeastern University. Her research interests include violence against women and experiences of victimization and vulnerability among marginalized populations.

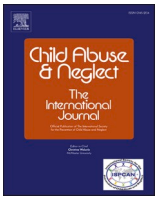
Megan Alderden is an associate professor at DePaul University. Her work includes examining issues within the field of victimology and policing. She worked on two National Institute of Justice-funded research studies examining the impact of forensic evidence on police and prosecutorial decisions in sexual assault cases, and was a researcher with the National Police Research Platform, where her work focused on police diversification, police culture, and the civilianization of police agencies. She is currently the evaluator of a federally funded reentry program that focuses on job training and reentry support for individuals post-incarceration.

Child Abuse & Neglect 145 (2023) 106283

Contents lists available at ScienceDirect

Child Abuse & Neglect

journal homepage: www.elsevier.com/locate/chiabuneg



Interpretation of medical findings in suspected child sexual abuse: An update for 2023

Nancy D. Kellogg [a,*], Karen J. Farst [b], Joyce A. Adams [c,1]

[a] Department of Pediatrics, Division of Child Abuse, University of Texas Health Science Center at San Antonio, 7703 Floyd Curl Drive, San Antonio, TX 78229, United States
[b] Department of Pediatrics-Children at Risk, University of Arkansas for Medical Sciences, Arkansas Children's Hospital, 4301 Markham Street, Little Rock, AR 72205, United States
[c] Department of Pediatrics, University of California San Diego, La Jolla, San Diego, CA 92093, United States

A B S T R A C T

Health care professionals who examine children who may have been sexually abused need to be able to recognize, and photo-document any physical signs, and to have access to expert reviewers, particularly when signs concerning for sexual abuse are found. Although the general consensus among practitioners is that children will show few signs of sexual abuse on examination, there is considerable variability and rates of positive exam findings among practitioners of different professions, practice settings, and countries. This review will summarize new data and recommendations regarding the interpretation of medical findings and sexually transmitted infections (STIs); assessment and management of pediatric patients presenting with suspected sexual abuse or assault; and testing and treating patients for STIs. Updates to a table listing an approach to the interpretation of medical findings are presented, and reasons for changes are discussed.

Introduction

The "Interpretation of Medical Findings" table has been updated and published 8 times since 1992 (Adams, 2001; Adams, 2004; Adams, 2008; Adams, 2011; Adams et al., 2007; Adams et al., 2016; Adams, Harper, & Knudson, 1992), most recently in 2018 (Adams, Farst, & Kellogg, 2018). Over these 30 years, the list of items in the sections of the table describing normal and non-traumatic findings has expanded significantly while the findings diagnostic of blunt force penetrating trauma has remained relatively short and unchanged. The "no expert consensus" category was added to include findings, when considered independently, that have possible but unclear significance with respect to sexual abuse. The infections section has been consistently expanded with changes to sexually transmitted infection (STI) testing, interpretation, mimics and pathogens. Several edits to improve clarity, thoroughness and precision have been made with each revision. Updates to the table have been based on research studies, recommendations from professional organizations regarding guidelines for providing medical care for children suspected of having been sexually abused, and expert consensus.

Recent studies provide additional guidance for the 2023 Interpretation of Medical Findings in Suspected Child Sexual Abuse Table (Interpretation Table). We present results from a recent survey of child abuse pediatricians regarding their clinical experience and their interpretation of findings in the "no expert consensus" section of the Interpretation Table. In addition, there are updates to clinical assessment, testing, and treatment of children and adolescents who are suspected victims of sexual abuse or assault. Finally, a scoping review of studies reporting rates of positive examination findings over the past 20 years is summarized, highlighting differences in

* Corresponding author at: Center for Miracles, 315 North San Saba, Suite 201, San Antonio, TX 78207, United States.
E-mail address: kelloggn@uthscsa.edu (N.D. Kellogg).
[1] Retired.

https://doi.org/10.1016/j.chiabu.2023.106283
Received 25 January 2023; Received in revised form 12 May 2023; Accepted 7 June 2023
Available online 19 September 2023

Table 1
2023 updated approach to interpretation of medical findings in suspected child sexual abuse.

SECTION 1: PHYSICAL FINDINGS:

A. Findings Documented in Newborns or Commonly Seen In Non-abused Children

[*] *These findings are normal and are unrelated to a child's disclosure of sexual abuse.*

Normal variants

1. Hymenal variations
   a) Annular: hymenal tissue present all around the vaginal opening including at the 12 o'clock location
   b) Crescentic hymen: hymenal tissue is absent at some point above the 3 to 9 o'clock locations
   c) Imperforate hymen: hymen with no opening
   d) Micro-perforate hymen: hymen with one or more small openings
   e) Septate hymen: hymen with one or more septae across the opening
   f) Redundant hymen: hymen with multiple flaps, folding over each other
   g) Hymen with tag of tissue on the rim
   h) Hymen with mounds or bumps on the rim at any location
   i) Any notch or cleft of the hymen (regardless of depth) above the 3 and 9 o'clock location
   j) A notch or cleft in the hymen, at or below the 3 o'clock or 9 o'clock location, that does not extend nearly to the base of the hymen
   k) Smooth posterior rim of hymen that appears to be relatively narrow along the entire rim; may give the appearance of an enlarged opening
   l) Asymmetry in width of posterior hymenal rim
2. Periurethral or vestibular band(s)
3. Intravaginal ridge(s) or column(s)
4. External ridge on the hymen
5. Diastasis ani (smooth area)
6. Perianal skin tag(s)
7. Hyperpigmentation of the hymen, labia minora or perianal tissues
8. Dilation of the urethral opening
9. Normal midline anatomic features
   a) Groove in the fossa, seen in early adolescence
   b) Failure of midline fusion (also called perineal groove; see Figure 2)
   c) Median raphe
   d) Linea vestibularis (midline avascular area)
10. Visualization of the pectinate/dentate line at the juncture of the anoderm and rectal mucosa, seen when the anus is fully dilated, as with passage or presence of flatus or stool in the anal canal
11. Reflex anal dilation that occurs during examination maneuvers, such as traction applied to perianal tissues or positioning the patient, particularly in prone or supine knee-chest positions
12. Anal dilation, causing visualization of the dentate/pectinate line, anal columns, and/or anal crypts, any of which may be mistaken for anal laceration or abrasion (Figures 1A and 1B)

B. Findings commonly caused by conditions other than trauma or sexual contact

These findings require that a differential diagnosis be considered, as each may have several different causes.

13. Erythema, inflammation, fissuring, and/or maceration of the perianal, perineal or vulvar tissues related to poor hygiene or other irritant dermatitis
14. Increased vascularity of vestibule and hymen
15. Labial adhesion
16. Friability of the posterior fourchette
17. Vaginal discharge that is not associated with a sexually transmitted infection
18. Anal fissures
19. Venous congestion or venous pooling in the perianal area
20. Complete/immediate anal dilatation in children with pre-disposing conditions, such as current symptoms or history of constipation and/or encopresis, or children who are sedated, under anesthesia or with impaired neuromuscular tone for other reasons

C. Findings Due to Other Conditions, Which Can Be Mistaken for Abuse

21. Irritative/non-infectious: erythema, inflammation, and fissuring of the perianal, perineal or vulvar tissues due to irritant dermatitis, including Jacquet's dermatitis
22. Inflammatory: aphthous ulcers, inflammatory bowel disease (anal fissures/prominent anal tags, rectal discharge), Behcets disease (painful ulcers)
23. Dermatologic conditions: lichen sclerosus et atrophicus, folliculitis, vitiligo, angiokeratomas,and hemangiomas
24. Immunologic causes: pyoderma gangrenosum (painful ulcers)
25. Multifactorial/idiopathic: urethral prolapse, rectal prolapse, anal funneling
26. Post-mortem changes: anal dilatation, red/purple discoloration of the genital structures (including the hymen) from lividity or other rare systemic conditions. Histologic analysis needed for confirmation.

D. No expert consensus regarding degree of significance

These physical findings have been associated with a history of sexual abuse in some studies, but at present, there is no expert consensus as to how much weight they should be given with respect to abuse. Findings 28 and 29 should be confirmed using additional examination positions and/or techniques, to ensure they are not normal variants (findings 1. i. 1.j) or a finding of residual traumatic injury (finding 38)

27. Complete and immediate anal dilation with relaxation of the internal as well as external anal sphincters, in the absence of other predisposing factors such as constipation, encopresis, sedation, anesthesia, and neuromuscular conditions
28. Notch or cleft in the hymen rim, at or below the 3 o'clock or 9 o'clock location, which extends nearly to the base of the hymen, but is not a complete transection. This is a very rare finding that should be interpreted with caution unless an acute injury was documented at the same location.
29. Complete cleft/suspected transection to the base of the hymen at the 3 or 9 o'clock location

E. Findings Caused by Trauma

These findings are highly suggestive of abuse, even in the absence of a disclosure from the child, unless the child and/or caretaker provides a timely and plausible description of accidental anogenital straddle, crush or impalement injury, or past surgical interventions that are confirmed from review of medical records. Findings that may represent residual/healing injuries should be confirmed using additional examination positions and/or techniques. Isolated/few/superficial injuries that appear to be bruises or petechiae should be confirmed as traumatic injury by showing resolution on follow up examination. Photographs or video recordings of these findings should be taken, then evaluated and confirmed by an expert in sexual abuse evaluation to ensure accurate diagnosis

(*continued on next page*)

Table 1 (*continued*)

1) Acute trauma to genital/anal tissues
30. Acute laceration(s) or bruising of labia, penis, scrotum, or perineum
31. Acute laceration of the posterior fourchette or vestibule, not involving the hymen
32. Bruising, petechiae, **or** abrasions on the hymen
33. Acute laceration of the hymen, of any depth; partial or complete
34. Vaginal laceration
35. Perianal bruising or perianal laceration with exposure of tissues below the dermis
2) Residual (healing) injuries to genital/anal tissues
36. Perianal scar (a very rare finding that is difficult to diagnose unless an acute injury was previously documented at the same location)
37. Scar of posterior fourchette or fossa (a very rare finding that is difficult to diagnose unless an acute injury was previously documented at the same location)
38. Healed hymenal transection/complete hymen cleft- a defect in the hymen below the 3 to 9 o'clock location that extends to or through the base of the hymen, with no hymenal tissue discernible at that location.
39. Signs of female genital mutilation (FGM) or cutting, such as loss of part or all of the prepuce (clitoral hood), clitoris, labia minora or labia majora, or vertical linear scar adjacent to the clitoris (Type 4 FGM)
3) Acute trauma to oral tissues
40. Acute oral trauma, such as unexplained injury or petechiae of the lips or palate, particularly near the junction of the hard and soft palate
SECTION 2: INFECTIONS
A. Infections not related to sexual contact
41. Erythema, inflammation, fissuring of perianal, perineal, or vulvar tissues due to bacteria, fungus, virus or parasites that are transmitted by non-sexual means, such as Streptococcus Type A or Type B, Staphylococcus sp., Escherichia coli, Shigella or other gram-negative organisms
42. Genital ulcers caused by viral infections such as Epstein Barr Virus
B. Infections that can be spread by (or are associated with) sexual transmission as well as non-sexual transmission
Interpretation of these infections may require additional information, such as mother's gynecologic history (HPV) or child's history of oral lesions (HSV), or presence of lesions elsewhere on the body (Molluscum) which might clarify likelihood of sexual transmission.
43. Molluscum contagiosum in the genital or anal area. In young children, transmission is most likely non-sexual. Transmission from intimate skin-to-skin contact in the adolescent population has been described.
44. Condyloma acuminatum (HPV) in the genital or anal area.
45. Herpes Simplex Type 1 or 2 infections in the oral, genital or anal area diagnosed by culture or nucleic acid amplification test
46. Urogenital Gardnerella vaginalis (associated with sexual contact but also found in prepubertal and adolescent vaginal flora)
47. Urogenital Mycoplasma genitalium or ureaplasma urealyticum; while sexually transmitted in adolescents, prevalence and transmission of these infections in children not well understood
C. Infections caused by sexual contact, if confirmed by appropriate testing, and perinatal transmission has been ruled out
48. Genital, rectal or pharyngeal *Neisseria gonorrhea* infection
49. Syphilis
50. Genital, rectal or pharyngeal *Chlamydia trachomatis* infection
52. *Trichomonas vaginalis* infection isolated from vaginal secretions or urine
53. HIV, if transmission by blood or contaminated needles has been ruled out
SECTION 3: FINDINGS DIAGNOSTIC OF SEXUAL CONTACT
54. Pregnancy
55. Semen identified in forensic specimens taken directly from a child's body

examination approaches and criteria used to interpret examinations.

Updates for clinical assessment, testing and treatment of children and adolescents

Testing for sexually transmitted infections

In children and adolescents evaluated for STIs during sexual abuse/assault assessments, the prevalence of STIs is low; 7.9 % for Chlamydia and 2.5 % for N. gonorrhea in one recent study (Kellogg, Melville, Lukefahr, Nienow, & Russell, 2018). The American Academy of Pediatrics' Committee on Child Abuse and Neglect (Jenny, Crawford-Jakubiak & Committee on Child Abuse and Neglect, 2013) and the Center for Disease Control and Prevention (Workowski et al., 2021) suggest that STI testing in pre-adolescent children be considered when:

1) Child has experienced penetration of the genitals, anus, or oropharynx
2) Child has been abused by a stranger
3) Child has been abused by a perpetrator known to be infected with an STI or is at high risk for being infected (intravenous drug users, men who have sex with men, or people with multiple sexual encounters)
4) Child has a sibling or other relative in the household with an STI
5) Child discloses sexual abuse and lives in an area with a high rate of STI in the community
6) Child has signs or symptoms of an STI
7) Child has already been diagnosed with one STI
8) The abused child or their parent requests STI testing

9) The child is unable to verbalize details of the assault

In addition, we recommend assessments when:

10) The sexual abuse has been witnessed or documented with photos or video, given that child subjects typically do not fully disclose details of their abuse (Gewirtz-Meydan, Walsh, Wolak, & Finkelhor, 2018)

While many centers routinely test all children who present for examination with sexual abuse allegations, the rate of positive STI results in patients who do not meet this criteria is unknown, Most of these recommendations also apply to testing for STIs in adolescents. Additional considerations for testing adolescents include history or exam findings that support concern for trafficking, sexting, or commercial sexual exploitation of children. Signs that suggest commercial sexual exploitation of children (CSEC) include previous drug and/or alcohol use, runaway behavior, involvement with law enforcement, significant wounds or fractures, STIs, and sexual activity with >5 partners (Greenbaum, Dodd, & McCracken, 2018). When CSEC or trafficking is suspected, the medical assessment should be comprehensive and include assessment for acute and chronic medical, mental health and dental needs, overall nutritional status, pregnancy testing, STI testing, and tests for alcohol and drug use as indicated. In addition to standard prophylaxis for STIs and pregnancy, the clinician should consider offering contraceptive options and referrals to community resources and national organizations that provide services to sex trafficking victims (Greenbaum and Crawford-Jakubiak, 2015).

Alarming trends in media-facilitated sexual assault and sexting have also been reported (MacPherson, Brown, Herold, & Narayan, 2018; Madigan, Ly, Rash, Van Ouytsel, & Temple, 2018; Titchen, Maslyanskaya, Silver, & Coupey, 2019). Stranger assaults, facilitated through social media and texts, involve significant medical and mental health risks. One study (Titchen et al., 2019) found that 24 % of girls and 20 % of boys had sent a sext; sexting by girls was associated with sexual activity, sexual abuse and violence by an intimate partner. Screening children and adolescents for unsafe media use may guide strategies for sexual assault prevention and STI testing.

Modes of STI transmission

The majority of STIs found during abuse evaluations are sexually transmitted, however, non-sexual transmission of Chlamydia, HPV, HSV and syphilis continue to be explored in recent publications. The 2021 CDC guidelines (Workowski et al., 2021) cite studies from 1994 (Bell et al., 1994) and 1986 (Schachter et al., 1986) as support for prolonged Chlamydia vaginitis following birth for "as long as 2–3 years." Recent guidelines from the American College of Gynecology (ACOG) (https://www.acog.org/womens-health/faqs/routine-tests-during-pregnancy?utm_source=redirect&utm_medium=web&utm_campaign=otn, accessed 1/17/2023) recommend routine/universal testing for STIs, including Chlamydia, early in pregnancy followed by treatment and test of cure during pregnancy for positive results. Routine screening and treatment during pregnancy has resulted in a dramatic decrease in perinatal chlamydial infections in the United States (Hammerschlag, 2022). In addition, current STI testing modalities are more sensitive than those used prior to 2000, so it is likely that more infections are detected and treated now than previously, further reducing the likelihood of STI perinatal transmission. Improved testing modalities and observed decreases in perinatal infections also contribute to this lower likelihood of perinatal transmission.

Perinatal transmission of STIs (Table 1, Section 2C) may still be possible, but should be considered less likely in regions where routine screening and treating STIs during pregnancy is the standard of care.

Syphilis beyond the postnatal period is generally considered to be sexually transmitted. A recent publication (Moscatelli et al., 2021) postulates post-natal non-sexual transmission of syphilis by oral secretions. In this study, 24 children (mean age 4.2 years) had serologic evidence of syphilis whereas all mothers had negative serology during pregnancy; 15 children presented with condylomata lata. Sexual transmission was excluded based on "psychosocial evaluation…[that] did not reveal signs of sexual abuse in any of the cases." The authors speculated that "overcrowded and poor household conditions" and transmission via oral secretions through "kisses, breastfeeding, sharing utensils" or "pre-mastication of food," were the primary causes although 70.5 % of the tested ($N = 78$) household contacts were negative for syphilis. This study did not provide clear or convincing evidence to exclude sexual abuse in this population of young children. In evaluating anogenital STI infections in pre-verbal children, the presence of a household member with the same infection does not exclude sexual transmission, and a psychosocial evaluation is inadequate to exclude sexual abuse.

While gonorrhea infections beyond the newborn period are generally considered to be sexually transmitted, past and recent case reports (Hasui, Kamiya, & Nakasuji, 2022; Rana & Gurung, 2021) postulate post-natal non-sexual transmission in young children. In one case report (Rana & Gurung, 2021) of a preverbal (2.5 years old) child with ocular gonorrhea, the mother was described as "irritable and uncooperative" and non-sexual transmission was concluded because there was no history from the child or mother. Other sites were not tested for gonorrhea, nor was the genital examination described. The other case report (Hasui et al., 2022) was a 2-year-old who presented with a bloody vaginal discharge and positive gonorrhea culture. Because the parents developed gonorrhea "simultaneously," the child was "constantly with [the mother]," and "the route of infection could not be identified," it was concluded that the child had contracted gonorrhea through non-sexual means. As these case reports provide a weak evidence base for non-sexual transmission of gonorrhea, the Interpretation Table has retained gonorrhea in the category of infections caused by sexual contact if perinatal transmission has been excluded. Therefore, children presenting in the post-natal period with gonorrhea (identified at any site) and no known history of sexual contact should still have a complete medical assessment for sexual abuse.

Herpes Simplex Virus (HSV) serology is of limited value in determining a primary type-specific herpes infection (Page et al., 2003); serology is also of limited value in confirming that the first known appearance of the lesions is related to the timing of the sexual assault. HSV culture or NAA testing is recommended for diagnosis in patients with suspicious lesions (Workowski et al., 2021). The Interpretation Table has been updated to reflect that HSV infection should be diagnosed with culture or NAA testing only.

A recent metanalysis study examined characteristics of anogenital Human papillomavirus (HPV) lesions in children in an attempt to

differentiate sexual from non-sexual modes of transmission. (Awasthi, Ornelas, Armstrong, Johnson, & Eisen, 2021;). While the presence of warts in any anogenital location and in children older than 3 years predicted a diagnosis of sexual abuse, several of the included studies were >20 years old and utilized non-specific examination findings (such as enlarged vaginal or anal opening) as diagnostic criteria for abuse. Other publications have examined the role of HPV subtyping of anogenital warts in determining mode of transmission. As both cutaneous HPV subtypes (such as those commonly found on the hands) and mucosal HPV subtypes (such as those commonly found within the genitals and anus) have been identified in anogenital warts subtyping is not helpful in differentiating sexual and non-sexual transmission (Costa-Silva, Azevedo, & Lisboa, 2018; Giannaki et al., 2013). While cutaneous HPV lesions and subtypes are typically considered ubiquitous and transmissible through non-sexual contact, cutaneous HPV can also be sexually transmitted through hand-to-genital contact. Regardless of HPV subtype, condylomata acuminata has been considered suspicious for sexual abuse, especially if the lesions initially appear in a child older than 5 years (Workowski et al., 2021). However, it is not clear whether the age at clinical diagnosis approximates the age at which the infection was transmitted since lesions can be obscure or latent for months or years. Because mucosal HPV subtypes have been identified in vaginal samples of prepubertal and postpubertal children without a history of sexual contact (Bacopoulou et al., 2016), and because the mode of transmission or transference of the virus is unknown in these situations, we have eliminated the statement about sexual transmission of HPV in children older than 5 years from the Interpretation Table. The evaluation of children with anogenital warts should include a detailed medical history (i.e., history of HPV cutaneous and mucocal infections in mother, caregivers and child), interview of verbal children, and examination, including testing for other STIs; reporting to child protection agencies should be considered when abuse remains a possibility. In considering the medical history, it should be noted that a negative history of known HPV infection in a household contact does not imply sexual abuse by a non-family member. Likewise, a history of HPV in a household contact does not exclude the possibility of sexual abuse of the child.

Because HPV infections can occur as a result of sexual assault, the Center for Disease Control and prevention has recommended the HPV vaccine for sexually abused children who are age 9 years and older (Workowski et al., 2015) due to an increased risk for unhealthy or premature sexual behavior. An HPV vaccine can also be provided for unvaccinated or partially vaccinated adolescents presenting acutely following a sexual assault; some evidence suggests a preventative or prophylactic role for the vaccine in this clinical setting (McCormack, 2014).

Screening and treatment for STIs

The most recent CDC guidelines recommend FDA-cleared NAA testing for *N. gonorrhea*, *Chlamydia trachomatis,* and *Trichomonas vaginalis* in children, adults and adolescents. Based on history and clinical assessment, "urogenital, pharyngeal and rectal testing should be considered for preverbal children and children who cannot verbalize details of the assault" (Workowski et al., 2021). In addition, we would recommend that testing not be limited to sites in which penetration is described, given the potential for incomplete disclosures by the child and contiguous spread from genitals to anus (primarily in females). Confirmatory testing of positive results is recommended in situations where the results may be forensically significant (children and adolescents who are not sexually active). In contrast to earlier versions, the 2021 CDC guidelines no longer provide direct references that details alternate target testing as the preferred method of confirmation testing. When considering prepubertal children, there is ongoing potential risk for false positive results when utilizing non-couture testing methodologies to identify an STI in a low prevalence population. Therefore, providers should employ a testing strategy that maximizes specificity (Hammerschlag, 2011; Hammerschlag & Guillén, 2010; Qin & Melvin, 2020). Pharyngeal gonorrhea and chlamydia have been added to the Interpretation Table.

Because rectal Chlamydia has been identified in females denying anal-penile contact, clinicians should consider obtaining rectal swabs for patients with a history of only vaginal-penile contact (Chan et al., 2016). Due to emerging antibiotic resistance, the recommended prophylaxis and treatment for gonorrhea and chlamydia has changed, increasing Ceftriaxone to 500 mg IM and replacing the one-time Azithromycin dose with 7 days of Doxycycline (Workowski et al., 2021). These changes have generated concerns for non-compliance and inadequately treated infections. When non-compliance is a concern, a one-time Azithromycin dose can be provided although follow up evaluation and re-testing may be needed, particularly for patients with positive Chlamydia results from their initial examination. To allow clearance of Chlamydia, a test of cure should be delayed for 4 weeks following treatment (Geisler, Hocking, Darville, Batteiger, & Brunham, 2022).

Follow up care

Follow-up examinations have been recommended in previous publications (Gavril, Kellogg, & Nair, 2012; Workowski et al., 2021) to complete STI testing, complete HPV vaccines, monitor treatment and side effects to post-exposure prophylaxis, and to further clarify examination findings. A statement regarding the importance of confirming some exam findings as trauma through a follow up examination has been added to the Interpretation Table. Additionally, gonorrhea and chlamydia sensitivity to antimicrobial treatment has continued to evolve, presenting challenges to ensuring efficacious treatment and increasing the need to test for cure in some circumstances. Additional reasons to provide follow up include re-assessment of recovery from physical and psychological injury a few days and a few weeks following the assault (Kaplan, Moore, Hirway, Barron, & Goldberg, 2021), particularly in patients at risk for self-injurious thoughts or behaviors.

Interpretation of Physical and Laboratory Findings (Table 1)

Findings that have been edited or added to the 2018 version of the Interpretation Table include:

1. Section 1B Findings commonly caused by medical conditions other than trauma or sexual contact

   Anal funneling and folliculitis have been added to this section. Anal funneling has been described as an anorectal malformation (Suomalainen, Wester, Koivusalo, Rintala, & Pakarinen, 2007) and as a traumatic finding (Hobbs & Wright, 2014), but further evidence is needed to support a traumatic etiology. Folliculitis is common among adolescents who shave their pubic hair and sometimes progresses to ulcerative lesions and cellulitis. Anal dilatation is further clarified as a normal finding in some children after 1–2 min when they are placed in the prone knee chest position or have stool in the anal vault (McCann, Miyamoto, Boyle, & Rogers, 2007; Myhre et al., 2013).

   New section added: E3. Oral findings reported in individuals who present acutely with oral-penile penetration. Few studies have examined intra-oral injuries that result from oral-penile penetration. "Unexplained injury or petechial hemorrhage of the palate, particularly at the junction of the hard and soft palate" has been attributed to forced oral penetration (Fisher-Owens et al., 2017; Schlesinger, Borbotsina, & O'Neill, 1975). In another study, the most common oral injuries associated with sexual assault in patients 16 and older were abrasions and bruises or petechiae to the lips (Brew-Graves & Morgan, 2015). Facial injuries also occur during physical assault so interpretation of these injuries relies primarily on patient history. While additional research is needed to establish the type and frequency of oral injuries sustained during oral-penile contact, examiners may wish to consider photo-documentation of any oral injuries identified during sexual assault examinations.
2. Section 2B. Infections that can be spread by (or are associated with) sexual transmission as well as non-sexual transmission

   Although there have not been any recent studies regarding anogenital infections with Gardnerella or Mycoplasma in children or adolescents, these are added to the table for completeness.

   Gardnerella vaginalis is uncommonly diagnosed in prepubertal females, but is commonly found in sexually active adolescents and adults. In one study, *Gardnerella* was found in children who were sexually abused and children who were thought not to be sexually abused (Ingram et al., 1992). Gardnerella is considered normal vaginal flora, occurring in up to 13.5 % of prepubertal children (Neyazi, 2019). Rather than sexual transmission, it is likely that sexual contact alters vaginal flora and overgrowth of Gardnerella results in vaginosis. Bacterial vaginosis may increase risk of infection with STIs, including HIV, gonorrhea, Chlamydia, trichomonas, HPV and HSV (Abbai, Nyirenda, & Naidoo S., Ramjee, G., 2018; Abbai, Reddy, & Ramjee, 2016; Brusselaers, Shrestha, van de Wijgert, & Verstraelen, 2019). If *Gardnerella* is identified, the child should be screened for sexual abuse and tested for other STIs.

   Similarly, anogenital infections with *Mycoplasma hominis* and *Ureaplasma urealyticum* are associated with sexual activity in adolescents and adults, but are considered uncommon in prepubertal children and can occur in children who are not sexually abused (Jain, 2004). Identification of these infections should prompt testing for other STIs, but as an isolated finding may be transmitted through non-sexual sources.
3. 2C. Infections caused by sexual contact, if confirmed by appropriate testing, and perinatal transmission has been ruled out

   Pharyngeal *Chlamydia trachomatis* infection has been added, based on studies of STIs identified at extra-genital sites (Kellogg et al., 2018).

2022 interpretation of medical findings survey

In order to determine the level of agreement among providers of sexual abuse evaluations regarding their interpretation of anogenital HSV or HPV infections and findings in the "No expert consensus regarding degree of significance" category of the Interpretation Table, a survey was conducted in November 2022. An invitation to participate was sent via the organization's listserv to the 642 members of the Ray E. Helfer Society, an honorary society for physicians involved in the assessment of child abuse.

Based on responses to the 2022 survey, three physical exam findings remained in the "no expert consensus" section and the two infections remained in the "Infections that can be spread by non-sexual as well as sexual transmission" section. A previous publication (Adams et al., 2018) summarizes the studies and rationale for the exam findings listed in the "no expert consensus" category. Results of the survey are presented in Table 2. Regardless of examiner experience or regularity of practice (Questions 7 and 8), more than half of the respondents indicated that marked, immediate anal dilation to 2 cm or more, a deep posterior notch nearly to the base of the hymen, and anogenital HSV type 1 or 2, and an anogenital HPV infection in a child older than 5 years had "possible but unclear significance with respect to abuse." With one exception, there were no significant differences in responses to questions 1, 3, 4, 5, and 6 when those who practiced regularly (question 7, answer b) were compared to those who practiced less regularly; those who practiced regularly were more likely to indicate that a "very narrow posterior rim of hymen' was not significant finding of abuse when compared with those who conducted exams less regularly (Fisher's exact test, p=.006; implemented in the R package "gtsummary" version 1.6.3; https://cran.r-project.org). Responses to questions 1, 3, 4, 5 and 6 did not significantly differ among those who had performed fewer than 1000 exams when compared to those who had conducted >1000 exams. Whereas about one-third of respondents indicated that anogenital HSV 1 or 2 infections were concerning or highly suggestive of abuse, fewer than 20 % thought condylomata acuminata was concerning or highly suggestive of abuse. This may be due to differences in latency periods, delay of clinical diagnosis, and likelihood of non-sexual transmission via hygiene assistance. No recent studies have further elucidated the probability of non-sexual transmission of anogenital HSV type 2 in children. Assessing the likelihood of sexual transmission in children with anogenital HPV or HSV infections is case-specific and dependent on numerous factors, including the age of the child, presence of other STIs, timing of symptoms, and presence of other evidence to support sexual contact. In addition, the epidemiology of HPV infections in children is likely changing due to HPV vaccines in adolescents and adults.

Rates of positive examination findings among children and adolescents evaluated for sexual abuse

Why "normal" does not mean "nothing happened"

There have been challenges in the last 10 years as to whether a normal examination is possible in children who experience vaginal-penile penetration. One viewpoint publication (Hariton, 2012) has questioned whether it is "normal to be normal" (Adams, Harper, Knudson, & Revilla, 1994), based on the supposition that "penetration" that is "partially or completely through the hymen ring" (Hariton, 2012) in a prepubertal female will always result in injury. However, there is a lack of certainty that a prepubertal child's statement that "he put it inside" actually represents penetration beyond the hymenal rim or contact to the hymenal rim, both of which can cause pain and/or bleeding. A child or adolescent may have a normal examination following sexual abuse for several reasons, including:

1. No sexual contact occurred
2. Sexual contact occurred but did not result in visible injury
3. Sexual contact occurred and resulted in injury that healed.

Table 2
Responses to 2022 survey ($N = 113$ responders).

1. What is the significance, with respect to possible sexual abuse, of the finding of marked, immediate anal dilation to an AP diameter of 2 cm or more, in the absence of predisposing factors such as chronic constipation, encopresis, sedation, anesthesia, neuromuscular conditions or the postmortem state? (N = 113)
   a. Not a significant finding for abuse 24/113 (24 %)
   b. Possible but unclear significance with respect to abuse 75/113 (66 %)
   c. Concerning for abuse 8/113 (7 %)
   d. Highly suggestive of abuse 1/113 (1 %)
   e. Other: 2/113 (2 %)
2. Do you think the examination position of the child (supine knee-chest, prone knee-chest, left lateral knee-chest) can change the likelihood of observing reflex anal dilation? ($N = 112$)
   a. Yes 72/112 (64 %)
   b. No 7/112 (6 %)
   c. Unsure 32/112 (29 %)
3. What is the significance of a very narrow posterior rim of hymen, located between 9 and 3 o'clock with patient in the supine position, which is confirmed in the prone knee-chest position? (N = 112)
   a. Not a significant finding for abuse 67/112 (60 %)
   b. Possible but unclear significance with respect to abuse 39/112 (35 %)
   c. Concerning for abuse 3/112 (3 %)
   d. Highly suggestive of abuse 0/112 (0 %)
   e. Other: 3/112 (3 %)
4. What is the significance of finding a deep notch, nearly to the base of the posterior rim of hymen, between 3 and 9 o'clock in the absence of a history of injury from an accident or fall? (N = 112)
   a. Not a significant finding for abuse 9/112 (8 %)
   b. Possible but unclear significance with respect to abuse 61/112 (54 %)
   c. Concerning for abuse 33/112 (29 %)
   d. Highly suggestive of abuse 7/112 (6 %)
   e. Other: 2/112 (2 %)
5. What is the significance of diagnosing Herpes Simplex Type 1 or 2 from lesions in the genital or anal area in a child *over 5 years of age, who* no longer requires assistance with bathing or toileting hygiene, has no history of sexual contact or previous oral or anogenital lesions, has no other STDs and an otherwise normal examination? (N = 113)
   a. Not a significant finding for abuse 6/113 (5 %)
   b. Possible but unclear significance with respect to abuse 70/113 (62 %)
   c. Concerning for abuse 31/113 (27 %)
   d. Highly suggestive of abuse 4/113 (4 %)
   e. Other:2/113 (2 %)
6. What is the significance of finding lesions due to condyloma acuminata in the anal or genital area of a child over the age of 5 years who no longer requires assistance with bathing or toileting hygiene, has no history of sexual contact or other verruceous growths, has no other STDs and an otherwise normal examination? (N = 113)
   a. Not a significant finding for abuse 7/113 (6 %)
   b. Possible but unclear significance with respect to abuse 84/113 (74 %)
   c. Concerning for abuse 16/113 (14 %)
   d. Highly suggestive of abuse 5/113 (4 %)
   e. Other: 1/113 (1 %)
7. Are you currently performing child sexual abuse medical evaluations? (N = 113)
   a. Yes, occasionally 21/113 (19 %)
   b. Yes, regularly 83/113 (73 %)
   c. No 9/113 (8 %)
8. Approximately how many child sexual abuse medical examinations have you performed during your career? (N = 113)
   a. <500 29/113 (26 %)
   b. 500 to 1000 27 (24 %)
   c. 1000 to 2000 26/113 (23 %)
   d. d. Over 2000 31/113 (27 %)

Table 3
Studies reporting acute injuries from sexual abuse and assault (≥80 % of exams done within 5 days).

Publication year, first author[1]	Patients with ano-genital injury (N;%)	Population descriptors	Clinician specialty	Includes findings not listed in Section 1E in 2018 Interpretation Table?	Additional comments
Adams, Girardin and Faugno, 2001 US	137/214;64 %	-All females, -All adolescents -87% seen within 72 h	Nurse-S	Yes; erythema, swelling of hymen, lacerations with toluidine blue dye	-Used toluidine blue dye -No photos -Physician reviewer indicated "findings less than stated" on 26% of cases
Jones, Rossman, Hartman and Alexander, 2003 US	173/204;85 %	-All females, ages 13–17 -89 % seen within 72 h	Nurse-S	Yes, erythema, edema, lacerations with toluidine blue dye	-Used toluidine blue dye -One photo of hymenal bruise -Compared sexually assaulted adolescents (85 %with injury) to adolescents reporting consensual sex (73 % with injury)
Rossman, Jones, Dunnuck, Wynn and Bermingham, 2004 US	43/53;81 %	-All females, ages 13–78 (mean age 20.4 yrs) -94 % seen within 72 h	Nurse-S	Yes, erythema and abrasions and injuries to cervix	- Used toluidine blue dye -Photos provided of vaginal and cervical lacerations but difficult to interpret -Erythema was most common finding -All had history of (only) digital-vaginal penetration
Sugar, Fine and Eckert, 2004 US	52/180;29 %	-All females, ages 15–19 -76.5 % seen within 24 h	Ob-gyn residents	No details of anogenital trauma other than bruise, abrasion, or laceration of unspecified location	-No photos -Genital-anal injury was more common in 15–19 year-olds than older groups -Genital injury more common in those without prior intercourse
White and McLean, 2006 US	90/208;43 %	-All females, Ages 12–17 -Average time to exam 65 h	MD-S	No details of anogenital trauma other than "full thickness/less than full thickness" hymen lacerations, bruises, abrasions	-No photos -Injuries more common in "virgin" vs "non-virgin" group
Hornor, Thackeray, Scribano, Curran and Benzinger, 2012 US	97/336;29 %	-88 % females, ages 1–20 -65 % seen within 24 h and all had forensic kits	Nurse-S	Not specified; looked at "anogenital injury" vs no anogenital injury	-No photos -Goal of study was to compare exam and legal outcomes pre-PSANE to PSANE intervals; positive exam findings increased from 20 % to 34 %
Baker and Sommers, 2008 US	92/140;66 %	-All females ages 14–21 -All seen within 72 h	Nurse-S	Yes, cervical injuries, redness, and edema	-No photos -Used TEARS[2] criteria -Found younger age not associated with presence/absence of injury but was associated with increased number of genital injuries
Gallion, Milam and Littrell, 2016 US	73/340;21 %	-All females, up to age 17 -All seen within 72 h	Nurse-S, PA, MD-S	Indicates uses Adams criteria (see comment)	-No photos -33 of 99 children with anogenital findings had "acute trauma to labia, perineum or fourchette/fossa"
Zilkens et al., 2017	50/189;26 %	-All females, ages 13–17 -80 % seen within 72 h	24 MD-S; affiliated with legal medicine facilities	Yes, abrasions and injury to cervix, mons pubis, perineum	-No photos -All had history of vaginal penetration
Smith, Raman, Madigan, Waldman and Shouldice, 2018 US	91/643;14.2 %	-82 % female, ages 0–18 -All seen within 72 h	Pedi-S	No	-No photos -Adolescents (vs <12 yr) and females (vs males) were more likely to have diagnostic findings
Ohayi and Ezugwu, 2019	22/32;69 %	-All females, ages 10–19 -All seen within 72 h -	MD-S?; unclear	Yes, includes abrasions of labia and clitoris	-No photos -Genital injuries more likely in "virgins" vs "non-virgins"
Rossman, Jones, Dunnuck, Wynn and Bermingham, 2004 US	309/410;75 %	-All females, ages 12–51 -All had forensic evidence collection	Nurse-S EM-MD	Yes, abrasions, erythema, and edema	-No photos -Sexually assaulted females without prior sexual intercourse had greater number of injuries than those with prior sexual intercourse

(*continued on next page*)

Table 3 (*continued*)

Publication year, first author[1]	Patients with ano-genital injury (N;%)	Population descriptors	Clinician specialty	Includes findings not listed in Section 1E in 2018 Interpretation Table?	Additional comments
Kaplan, Moore, Hirway, Barron and Goldberg, 2021 US	29/182;16 %	62.5 % female, all under age 18 -All seen within 96 h	EM-MD EM-NP	Not specified	-All had history of penile penetration -Used TEARS criteria -Toluidine blue dye used -No photos -Examined compliance with follow-up exams which was higher for younger patients, and those with injuries or CPS/law enforcement involvement
Suttipasit, Sinlapamongkolkul, Wongwittayapanich, 2022	275/446;62 %	-All females, ages 10–18 -All seen within 120 h	"Forensic staff" MDs and residents	Yes, included "abrasions" of labia, cervix, and "external" anogenital sites, and edema	-No photos -Anogenital injury was more common in non-consenting females (70 %) than consenting females (56 %)
Ouellette et al., 2022[3] US	687/977;70 %	All females, ages 13 and older; mean age 23.9 yrs. -All seen within 96 h	Nurse-S	Yes, included erythema and edema and nuclear staining with toluidine blue dye	-No photos -Found no difference in frequency, type or location of anogenital injury among rape victims with and without recent consensual sexual contact -Used toluidine blue dye

See Table 5 for footnotes and sbbreviations

Children and adolescents can have normal anogenital examinations even when there is evidence that sexual abuse occurred:

1. Acute definitive evidence that heals completely (McCann et al., 2007)
2. Pregnancy (Kellogg, Menard, & Santos, 2004)
3. Confirmed presence of an STI (Girardet et al., 2009; Kellogg et al., 2018)
4. Confirmed presence of foreign DNA (Girardet et al., 2011; Thackeray, Hornor, Benzinger, & Scribano, 2011)
5. Photographic evidence of sexual abuse (Vrolijk-Bosschaart et al., 2017)

Studies reporting rates of positive examination findings

A scoping review of all papers reviewed from 2000 to 2022 by The Quarterly, a publication of the Helfer Society plus additional references cited in these papers yielded 32 studies that reported positive examination rates in children and adolescents evaluated for sexual assault or abuse. Tables 3, 4 and 5 summarize these studies grouped by acute exams (at least 80 % of examinations conducted within 5 days), non-acute exams (all exams conducted >5 days from the last abusive event) and studies combining rates for both acute and non-acute examinations. A meta-regression analysis (performed on proportions by random intercept logistic regression, implemented in the metaprop function of the R package "meta" version 6.1–0; https://cran.r-project.org/) of these three study groupings examined the relationship between positive exam rate and exam acuity (acute, non-acute, combination of acute and non-acute), use of Adams classification to assess examination findings (yes or no), publication (prior to 2011 and subsequent to 2010), use of toluidine blue dye (yes or no), where study was conducted (U.S. vs non-U.S.), patient population younger than 13 years (yes or no), and exam assessment conducted by pediatric subspecialist or child abuse pediatrician (yes or no).

As expected, positive exam rates were significantly higher among studies of acute exams when compared with studies of non-acute exam findings ($p = 0.0001$) and studies that combined acute and non-acute exam findings ($p = 0.0097$). For acute exams (Table 3), rates of positive exam findings ranged from 14.2 % to 85 %; there was a tendency for lower rates to be reported in studies that included prepubertal children and studies that were conducted in the U.S. However, when U.S. studies were compared to non-U.S. studies, there was no statistical difference in positive exam rates. This is likely due to 5 U.S. studies of adolescents and adults that utilized toluidine blue dye and reported 64 %–85 % positive exam rates. Positive exam rates were significantly higher among studies that utilized toluidine blue dye ($p = 0.0028$). Although the presumption in these studies has been that toluidine blue uptake is specific for sexual assault injury, there are other non-traumatic causes of skin breakdown that can expose nucleated cells and result in toluidine blue uptake. Positive examination rates were lower among studies that involved examinations conducted by pediatric specialists or child abuse pediatricians ($p = 0.0425$). None of the studies conducted by pediatric specialists utilized toluidine blue dye or the TEARS (tears, ecchymoses, abrasions, redness, or swelling) criteria to identify trauma. There were no statistical differences between studies of acute exams that were published prior to 2011 compared with studies published after 2010 or studies that utilized the concurrent version of the Adams criteria versus those that did not.

Positive exam rates for non-acute examinations were all <12 % with one exception (Bruni study, 88 %). This is expected, given that

all of these studies included prepubertal children. Rates of positive examination findings were lower in studies published subsequent to 2011 ($p = 0.0212$), consistent with the progressively longer list of anatomical variants and mimics of trauma.

Studies reporting findings from combined acute and non-acute clinical assessments ranged in positive exam rates from 4.5 %–74 %, although all but 2 studies reported rates <30 %. Studies with subject populations of only children younger than 12 years ($p = 0.0395$) and those that involved pediatric subspecialists or child abuse pediatricians ($p = 0.0257$) had significantly lower rates of positive exam findings than studies that included adolescents or other clinician disciplines.

This variability in positive exam rates is not unique to pediatric sexual assault examinations; a review of adolescent/adult sexual assault literature reports anogenital findings in 16 % to 77 % of patients and attributes the disparity to variable examination protocols, injury classification and examiner qualifications (Laitinen, Grundmann, & Ernst, 2013). Among pediatric cases, variations in rates of positive examination findings are generally expected based on patient age (adolescents generally higher than pre-adolescents), patient sex (females higher than males), and examination acuity (patients examined acutely have higher rates of positive examination findings than those examined nonacutely), but significant variations are observed beyond these expected differences.

There are several possible explanations for the variance in positive examination rates. First, there appears to be lack of agreement regarding the specificity of some examination findings for trauma. Since anogenital erythema can also be associated with irritation, inflammation, infection, and non-estrogenized state in females, it is listed in the Interpretation Table as a "Finding commonly caused by medical conditions other than trauma or sexual contact." However, the TEARs criteria, utilized in some studies, does include "redness" as a traumatic finding. We have not found any recent studies that support a change in how redness or erythema should be interpreted. Other findings of questionable or unknown specificity to trauma include hymenal perforation, lateral hymenal clefts, anal funneling, reflex anal dilatation, anal tags, anal laxity, abrasions to the cervix, positive staining with toluidine blue dye, and labial fissures. In addition, since many studies did not include photographs of reported examination findings, it is not possible to determine what was observed and how it was interpreted. For example, it was not possible to discern how lacerations were differentiated from fissures, how scars were differentiated from anatomical variants, or whether healed hymenal transections were confirmed with different techniques or independent expert review. Based on review of studies that did provide photo-documentation, interpretation of observed or reported findings likely varies among clinicians.

While it is possible that disparities in reported injury rates are due in part to patient- and geographic-specific variations in sexual assault injuries, this cannot be evaluated without consensus regarding observed findings and interpretation of these findings. High quality video of examination finding may improve reviewer agreement (Killough et al., 2016) regarding observed examination findings, a pre-requisite for agreement on interpretation of such findings. Quality improvement of photo- and video-documentation is

Table 4
Studies reporting non-acute injuries from sexual abuse or assault (exams done >5 days after last contact).

Publication year, first author[1]	Total patient population[2]	Population descriptors	Clinician specialty	Includes findings not listed in Section 1E in 2018 Interpretation Table?	Additional comments
Berenson et al., 2000 US	4/192;2 %	-All females, ages 3–8 yrs with history of penetration	Pedi-S and Gynecologist	Yes, hymenal perforation, deep notch	-Includes photos
Heger, Ticson, Velasquez and Bernier, 2002 US	66/1652;4 %	82 % females, all age 14 years and younger	Pedi-S	No	-No photos -6 % of girls reporting penetration had abnormal exams
Bruni, 2003	44/50;88 %	-74 % females, ages 2–14 -All with abuser guilty plea to "anal abuse"	MD-S and gynecologist	Yes, anal funneling, tags, RAD, venous congestion	-No photos -42 children had anal scars
Anderst, Kellogg and Jung, 2009 US	56/506;11 %	-All females, ages 5–17 with history of genital penetration	Pedi-S	No	-Photos provided -Positive exam findings were associated with a history of bleeding, but not associated with reported number of penetrative events
Gallion, Milam and Littrell, 2016 US	26/1160;2 %	-All females, up to age 17	Nurse-S, PA and MD	No	-No photos -Positive exam findings were associated with patient's history of vaginal (vs genital) penetration
Al-Jilaihawi, Borg, Maguire and Hodes, 2017	16/233;7 %	80 % females, up to age 17	Pedi-S	Yes, hymenal transection at 3 or 9(61 %), partial transection, deep notch, RAD	-No photos -Used 2008 Royal College evidence-based guidance
Vrolijk-Bosschaart et al., 2017	0/54;0 %	-20 % females, up to age 6, all from daycare case with abuse confirmed by conviction and/or pornography	EM-MD	Yes, perianal scars and tags and reflex anal dilatation	-No photos -Used 2015 Royal College evidence-based guidance

See Table 5 for footnotes and sbbreviations

Table 5
Studies reporting combined acute and non-acute injuries from sexual abuse or assault.

Publication year, first author[1]	Total patient population	Population descriptors	Clinician specialty	Includes findings not listed in Section 1E in 2018 Interpretation Table?	Additional comments
Kelly, Koh and Thompson, 2006	130/1346;10 %	-86 % females, ages 1 mo–17 yrs	Pedi-S	No	-No photos - 26 % had forensic evidence kits -1346 of 2310 disclosed sexual abuse; others referred for behavioral changes and physical symptoms
Watkeys, Price, Upton and Maddocks, 2008	77/193;40 %	-All females, ages 3 mo–17 yrs	Pedi-S	No	-No photos -All had history of penile or digital penetration -Reported abnormal exam findings by acute exam vs exam done >7 days after assault and anal vs vaginal
Modelli, Galvão and Pratesi, 2012	80/1762;4.5 %	-87 % females, all under 12	Not specified; all referred to forensic medicine institute	Yes, anal, and labial fissures, anal dilatation	-No photos -Abnormal findings include bruises in neck, breast, and thigh area, described as "rare" -Did not indicate proportion of acute exams
Myhre et al., 2013 US	11/198;5.5 %	-84 % females, ages .2–19 years	Pedi-S	No	-Photos provided -9/197 had anal laceration(s) and 4/198 had anal bruising; at least 1 child had both and one had laceration and GC -Children with high probability of anal penetration more likely to have anal soiling, fissure, laceration, and total anal dilatation -About half acute, half non-acute exams
Hobbs and Wright, 2014	136/184;74 %	-45 % female, ages 2–16 years -All with "alleged anal abuse"	Pedi-S	Yes, reflex anal dilatation, anal laxity, anal gaping, fissure/laceration, tag, scar	-No photos Physical signs of anal penetration were based on 2008 Royal College evidence-based review and 1989 Hobbs article -Compared sexual abuse (N = 184) to control group(N = 179) with respect to anal findings -16 % (29) children in control group had "classic signs associated with anal abuse"
Morgan, Khadr and Bewley, 2017	30/176;17 %	-80 % females, up to age 12 -All examined within 7 days	Pedi-S, and "Sexual offences examiner"	Yes, abrasions, erythema, swelling, tenderness	-No photos -Specific injuries by location not described; fourchette and labia were most common sites and abrasions most common type -Acute vs non-acute not described, but list of injuries implies mostly acute exams
Smith, Raman, Madigan, Waldman and Shouldice, 2018 US	45/997;4.5 %	-80 % females, up to age 18 -All seen more than 72 h after abuse	Nurse-S Pedi-S	No	-No photos -Overall results: 3118 (87.4 %) normal exams 247 (6.9 %) indeterminate 33 (0.9 %) accidental
Hauet-Wiedemann et al., 2018	75/285;26.3 %	-80 % female, all under 18	Pedi-S	Yes, abrasions, erythema, fissures	-No photos
Zilkens et al., 2018	11/77;14.3 %	All males, all 13 and older -All seen within 10 days	MD-S	Yes, anal abrasion and "injury of anal canal"	-No photos
Garfield, Schou, Lassen and Leth, 2021	20/80;25 %	All females under 15 years old	Pedi-S, "Forensic medical expert"	No	-No photos -All 20 had healed transections (16) or fresh hymenal lacerations (4) -Used foley catheter in pubertal girls

(*continued on next page*)

Table 5 (*continued*)

Publication year, first author[1]	Total patient population	Population descriptors	Clinician specialty	Includes findings not listed in Section 1E in 2018 Interpretation Table?	Additional comments
Hösükler, Yilmaz and Erkol, 2022	29/113;26 %	84 % female, 18 and younger	MD-S	Yes, describes "elastic hymen," "notch of hymen," "chronic anal fissures" and "acute fissure"	-No photos -Unclear if elastic hymen and notch of hymen were considered abnormal
Bravo-Queipo-de-Llano et al., 2022	26/213;12 %	83 % females, all under 17 -50 % seen within 72 h	EM	Indeterminate; indicate they base findings on Adams criteria but list "damaged hymen," "bleeding of vaginal introitus" and other findings	-No photos

1. Studies done in the US indicated.
2. TEARS classification system: codes injuries as tears, ecchymoses, abrasions, redness, or swelling (Slaughter, Brown, Crowley &Peck, 1997).
3. Same US program/authors as Rossman 2021, Rossman 2004 and Jones 2003.
MD-S is a physician who is a faculty member of a "forensic department" but is not a member of a child protection team or board certified in child abuse.
Nurse-S is a SANE nurse or nurse who has received other training.
Pedi-S is a pediatrician who is part of a child protection team (prior to child abuse board certification) or a child abuse pediatrician.
RAD: reflex anal dilatation.
EM: Emergency Medicine clinician.

the first step towards achieving consistency in examination technique and recognition of normal variants, particularly those that mimic trauma or are misattributed to trauma.

Some studies have reported different positive exam rates and types of genital injuries among females based on their prior sexual experience and whether the experience was consensual. These studies have focused primarily on adult women who were examined within 72–120 h of sexual contact/assault (Lincoln, Perera, Jacobs, & Ward, 2013; Rossman, Solis, Ouellette, Kolacki, & Jones, 2021; Suttipasit, Sinlapamongkolkul, & Wongwittayapanich, 2022). None of the studies provide photographs demonstrating the injuries reported. High rates of genital injury were reported for all non-consensual sexual encounters, ranging from 53.7 % to 81.7 %. Of interest, women without prior sexual intercourse experience had very high (81.7 %) rates of acute genital injury whereas other studies of adolescents presenting after an acute assault report much lower rates of injury (14.2 %; Smith, Raman, Madigan, Waldman, & Shouldice, 2018). While there may be differences between adults and adolescents in their sexual assault experiences, the significant disparity in rates suggests other factors, including interpretation of toluidine blue staining and differentiation between superficial and deep abrasions and tears may contribute to these differences.

Working towards consensus among practitioners may require:

1) collaborative expert review of high-quality photo- or video-documentation; 2) agreement on what is viewed in the photo/video-documentation and 3) agreement on interpretation of what is viewed. Initially, this review process could be conducted independent of the patient's history or symptoms which could introduce bias and may result in misinterpretation. For example, some clinicians will interpret a finding as trauma if the patient complains of pain when the area is touched; however, individuals who have experienced traumatic events or who are anxious about the anogenital examination may have emotional reactions that are interpreted by the patient or the practitioner as physical pain.

Conclusion

The main updates to the 2018 guidelines for the medical assessment and care of children who may have been sexually abused relate to testing for sexually transmitted infections, treating sexually transmitted infections, follow up care and the interpretation of physical examination findings. A recent survey of child abuse pediatricians supports no changes to the physical examination items in the "no expert consensus" or "infections that can be spread by non-sexual as well as sexual transmission" categories of the Interpretation table. The finding of a deep notch in the posterior hymen is still an inconclusive finding, with no expert consensus as to the degree of significance with respect to abuse.

A summary of studies reporting positive examination rates indicates suggests considerable variability based not only on acuity of the examination but also on examination techniques, examiner discipline, and differing criteria for what is interpreted as "trauma." Recommendations to approach consensus in recognition and interpretation of anogenital findings include: 1) advocate for high-quality photo- or video-documentation and 2) commit to peer review discussion across disciplines regarding what is seen on examination and how it is interpreted. Indications for STI testing in children and adolescents has expanded, and recommendations for identifying and treating adolescents with high-risk behaviors is discussed. Careful examination and documentation of oral injuries in patients presenting with acute forced oral-penile contact is encouraged. New CDC recommendations regarding prophylactic treatment for gonorrhea and Chlamydia involve challenges in patient compliance, particularly among adolescents with medical or mental health challenges that may compromise follow up care. STI testing with NAATs is the preferred testing modality for children, adolescents and adults, with attention to confirmatory testing when indicated.

The Interpretation Table from 2018 has been revised by adding new items and clarifying the content. The revised table will continue to be useful in assisting medical providers to interpret physical findings in children examined for signs of sexual abuse.

Declarations of competing interest

None.

This research did not receive any specific grant from funding agencies in the public, commercial, or non-for-profit sectors.

Data availability

Data will be made available on request.

Acknowledgement

The authors would like to acknowledge Dr. Wouter Koek, who performed statistical analysis for the survey and the positive examination rate data.

References

Abbai, N. S., Nyirenda, M., & Naidoo S., Ramjee, G.. (2018). Prevalent herpes simplex virus-2 increases the risk of incident bacterial vaginosis in women from South Africa. *AIDS Behavior, 22*, 2172–2180. https://doi.org/10.1007/s10461-017-1924-1 (PMID:28956191).

Abbai, N. S., Reddy, T., & Ramjee, G. (2016). Prevalent bacterial vaginosis infection—A risk factor for incident sexually transmitted infections in women in Durban, South Africa. *International Journal of STDs and AIDS, 27*, 1283–1288. https://doi.org/10.1177/0956462415616038 (PMID:26538552).

Adams, J. A. (2001). Evolution of a classification scale: Medical evaluation of suspected child sexual abuse. *Child Maltreatment, 6*(1), 31–36. https://doi.org/10.1177/1077559501006001003

Adams, J. A. (2004). Medical evaluation of suspected child sexual abuse. *Journal of Pediatric and Adolescent Gynecology, 17*, 191–197.

Adams, J. A. (2008). Guidelines for medical care of children evaluated for suspected sexual abuse: An update for 2008. *Current Opinion in Obstetrics & Gynecology, 20*(5), 435–441. https://doi.org/10.1097/GCO.0b013e32830866f4

Adams, J. A. (2011). Medical evaluation of suspected child sexual abuse: 2011 update. *Journal of Child Sexual Abuse, 20*(5), 588–605. https://doi.org/10.1080/10538712.2011.606107

Adams, J. A., Farst, K. J., & Kellogg, N. D. (2018). Interpretation of medical findings in suspected child sexual abuse: An update for 2018. *Journal of Pediatric and Adolescent Gynecology, 31*(3), 225–231. https://doi.org/10.1016/j.jpag.2017.12.011

Adams, J. A., Girardin, B., & Faugno, D. (2001). Adolescent sexual assault: Documentation of acute injuries using photo-colposcopy. *Journal of Pediatric and Adolescent Gynecology, 14*(4), 175–180. https://doi.org/10.1016/s1083-3188(01)00126-7

Adams, J. A., Harper, K., & Knudson, S. (1992). A proposed system for the classification of anogenital findings in children with suspected sexual abuse. *Adolescent and Pediatric Gynecology, 5*(2), 73–75. ISSN 0932-8610. https://doi.org/10.1016/S0932-8610(19)80070-1

Adams, J. A., Harper, K., Knudson, S., & Revilla, J. (1994). Examination findings in legally confirmed child sexual abuse: it's normal to be normal. *Pediatrics, 94*(3), 310–317.

Adams, J. A., Kaplan, R. A., Starling, S. P., Mehta, N. H., Finkel, M. A., Botash, A. S., … Shapiro, R. A. (2007). Guidelines for medical care of children who may have been sexually abused. *Journal of Pediatric and Adolescent Gynecology, 20*(3), 163–172. https://doi.org/10.1016/j.jpag.2006.10.001

Adams, J. A., Kellogg, N. D., Farst, K. J., Harper, N. S., Palusci, V. J., Frasier, L. D., … Starling, S. P. (2016). Updated guidelines for the medical assessment and Care of Children who may Have Been Sexually Abused. *Journal of Pediatric and Adolescent Gynecology, 29*(2), 81–87. https://doi.org/10.1016/j.jpag.2015.01.007

Al-Jilaihawi, S., Borg, K., Maguire, S., & Hodes, D. (2017). The value of paediatric assessment in historic child sexual abuse. *Archives of Disease in Childhood, 102*(6), 550–555. https://doi.org/10.1136/archdischild-2016-311989

Anderst, J., Kellogg, N., & Jung, I. (2009). Reports of repetitive penile-genital penetration often have no definitive evidence of penetration. *Pediatrics, 124*(3), e403–e409. https://doi.org/10.1542/peds.2008-3053

Awasthi, S., Ornelas, J., Armstrong, A., Johnson, J. A., & Eisen, D. B. (2021). Anogenital warts and relationship to child sexual abuse: Systematic review and meta-analysis. *Pediatric Dermatology, 38*(4), 842–850. https://doi.org/10.1111/pde.14650

Bacopoulou, F., Karakitsos, P., Kottaridi, C., Stefanaki, C., Deligeoroglou, E., Theodoridou, K., … Michos, A. (2016). Genital HPV in children and adolescents: Does sexual activity make a difference? *Journal of Pediatric and Adolescent Gynecology, 29*(3), 228–233. https://doi.org/10.1016/j.jpag.2015.08.010

Baker, R. B., & Sommers, M. S. (2008). Relationship of genital injuries and age in adolescent and young adult rape survivors. *Journal of Obstetric, Gynecologic, and Neonatal Nursing: JOGNN, 37*(3), 282–289. https://doi.org/10.1111/j.1552-6909.2008.00239.x

Bell, T. A., Stamm, W. E., Kuo, C. C., Wang, S. P., Holmes, K. K., & Grayston, J. T. (1994). Risk of perinatal transmission of Chlamydia trachomatis by mode of delivery. *The Journal of Infection, 29*(2), 165–169. https://doi.org/10.1016/s0163-4453(94)90674-2

Berenson, A. B., Chacko, M. R., Wiemann, C. M., Mishaw, C. O., Friedrich, W. N., & Grady, J. J. (2000). A case-control study of anatomic changes resulting from sexual abuse. *American Journal of Obstetrics and Gynecology, 182*(4), 820–834. https://doi.org/10.1016/s0002-9378(00)70331-0

Bravo-Queipo-de-Llano, B., Alonso-Sepúlveda, M., Ruiz-Domínguez, J. A., Molina-Gutiérrez, M.Á., de Ceano-Vivas La Calle, M., & Bueno-Barriocanal, M. (2022). Child sexual abuse detection in the pediatric emergency room. *Child Abuse & Neglect, 129*, Article 105676. https://doi.org/10.1016/j.chiabu.2022.105676

Brew-Graves, E., & Morgan, L. (2015). Injuries and allegations of oral rape: A retrospective review of patients presenting to a London sexual assault referral Centre. *Journal of Forensic and Legal Medicine, 34*, 155–158. https://doi.org/10.1016/j.jflm.2015.06.004

Bruni, M. (2003). Anal findings in sexual abuse of children (a descriptive study). *Journal of Forensic Sciences, 48*(6), 1343–1346.

Brusselaers, N., Shrestha, S., van de Wijgert, J., & Verstraelen, H. (2019). Vaginal dysbiosis and the risk of human papillomavirus and cervical cancer: Systematic review and meta-analysis. *American Journal of Obstetrics Gynecology, 221*, 9–18.e8. https://doi.org/10.1016/j.ajog.2018.12.011 (PMID:30550767).

Chan, P. A., Robinette, A., Montgomery, M., Almonte, A., Cu-Uvin, S., Lonks, J. R., … Hardy, E. J. (2016). Extragenital infections caused by Chlamydia trachomatis and Neisseria gonorrhoeae: A review of the literature. *Infectious Diseases in Obstetrics and Gynecology, 2016*, 5758387. https://doi.org/10.1155/2016/5758387

Costa-Silva, M., Azevedo, F., & Lisboa, C. (2018). Anogenital warts in children: Analysis of a cohort of 34 prepubertal children. *Pediatric Dermatology, 35*(5), e325–e327. https://doi.org/10.1111/pde.13543

Fisher-Owens, S. A., Lukefahr, J. L., Tate, A. R., & AMERICAN ACADEMY OF PEDIATRICS, SECTION ON ORAL HEALTH, COMMITTEE ON CHILD ABUSE AND NEGLECT, AMERICAN ACADEMY OF PEDIATRIC DENTISTRY, COUNCIL ON CLINICAL AFFAIRS, COUNCIL ON SCIENTIFIC AFFAIRS, & AD HOC WORK GROUP ON CHILD ABUSE AND NEGLECT. (2017). Oral and dental aspects of child abuse and neglect. *Pediatrics, 140*(2), Article e20171487. https://doi.org/10.1542/peds.2017-1487

Gallion, H. R., Milam, L. J., & Littrell, L. L. (2016). Genital findings in cases of child sexual abuse: Genital vs vaginal penetration. *Journal of Pediatric and Adolescent Gynecology, 29*(6), 604–611. https://doi.org/10.1016/j.jpag.2016.05.001

Garfield, G. B., Schou, M. P., Lassen, K., & Leth, P. M. (2021). Hymenal transections in children found by photocolposcopy in suspected sexual abuse cases is associated with a history of bleeding. *Journal of Forensic and Legal Medicine, 80*, Article 102176. ISSN 1752-928X, https://doi.org/10.1016/j.jflm.2021.102176. ISSN 1752-928X,.

Gavril, A. R., Kellogg, N. D., & Nair, P. (2012). Value of follow-up examinations of children and adolescents evaluated for sexual abuse and assault. *Pediatrics, 129*(2), 282–289. https://doi.org/10.1542/peds.2011-0804

Geisler, W. M., Hocking, J. S., Darville, T., Batteiger, B. E., & Brunham, R. C. (2022). Diagnosis and Management of Uncomplicated Chlamydia trachomatis infections in adolescents and adults: Summary of evidence reviewed for the 2021 Centers for Disease Control and Prevention sexually transmitted infections treatment guidelines. *Clinical infectious diseases: An official publication of the infectious diseases society of. America, 74*(Suppl_2), S112–S126. https://doi.org/10.1093/cid/ciac126

Gewirtz-Meydan, A., Walsh, W., Wolak, J., & Finkelhor, D. (2018). The complex experience of child pornography survivors. *Child Abuse & Neglect, 80*, 238–248. ISSN 0145-2134; https://doi.org/10.1016/j.chiabu.2018.03.031. ISSN 0145-2134;.

Giannaki, M., Kakourou, T., Theodoridou, M., Syriopoulou, V., Kabouris, M., Louizou, E., & Chrousos, G. (2013). Human papillomavirus (HPV) genotyping of cutaneous warts in Greek children. *Pediatric Dermatology, 30*(6), 730–735. https://doi.org/10.1111/pde.12113

Girardet, R., Bolton, K., Lahoti, S., Mowbray, H., Giardino, A., Isaac, R., Arnold, W., Mead, B., & Paes, N. (2011). Collection of forensic evidence from pediatric victims of sexual assault. *Pediatrics, 128*(2), 233–238. https://doi.org/10.1542/peds.2010-3037

Girardet, R. G., Lahoti, S., Howard, L. A., Fajman, N. N., Sawyer, M. K., Driebe, E. M., … Black, C. M. (2009). Epidemiology of sexually transmitted infections in suspected child victims of sexual assault. *Pediatrics, 124*(1), 79–86. https://doi.org/10.1542/peds.2008-2947

Greenbaum, J., Crawford-Jakubiak, J. E., & Committee on Child Abuse and Neglect. (2015). Child sex trafficking and commercial sexual exploitation: Health care needs of victims. *Pediatrics, 135*(3), 566–574. https://doi.org/10.1542/peds.2014-4138

Greenbaum, V. J., Dodd, M., & McCracken, C. (2018). A short screening tool to identify victims of child sex trafficking in the health care setting. *Pediatric Emergency Care, 34*(1), 33–37. https://doi.org/10.1097/PEC.0000000000000602

Hammerschlag, M. (2022). Chlamydia trachomatis infections in the newborn. In T. W. Post (Ed.), *UpToDate*. UpToDate: Waltham, MA.

Hammerschlag, M. R. (2011). Sexual assault and abuse of children. *Clinical Infectious Diseases: An Official Publication of the Infectious Diseases Society of America, 53* (Suppl. 3), S103–S109. https://doi.org/10.1093/cid/cir700

Hammerschlag, M. R., & Guillén, C. D. (2010). Medical and legal implications of testing for sexually transmitted infections in children. *Clinical Microbiology Reviews, 23*(3), 493–506. https://doi.org/10.1128/CMR.00024-09

Hariton, T. N. (2012). Sexual assault in prepubertal girls: "It is normal to be normal" - or is it? Evidence of vaginal penetration in prepubertal girls. *Medicine, Science, and the Law, 52*(4), 193–197. https://doi.org/10.1258/msl.2012.012015

Hasui, M., Kamiya, T., & Nakasuji, K. (2022). Non-sexual transmission of concurrent genital gonorrhea. *Pediatrics International: Official Journal of the Japan Pediatric Society, 64*(1), Article e15051. https://doi.org/10.1111/ped.15051

Hauet-Wiedemann, M., Wiedemann, A., Gatin, A., Renaud, E., Lapp, L., Franchi, A., … Borsa-Dorion, A. (2018). Agressions sexuelles sur mineurs: étude d'une population d'enfants ayant consulté dans une unité médico-judiciaire hospitalière entre 2011 et 2015 [Child sexual abuse: Description of a French population having consulted in a forensic medical service between 2011 and 2015]. *Archives de pediatrie: organe officiel de la Societe francaise de pediatrie, 25*(4), 247–250. https://doi.org/10.1016/j.arcped.2018.03.004

Heger, A., Ticson, L., Velasquez, O., & Bernier, R. (2002). Children referred for possible sexual abuse: Medical findings in 2384 children. *Child Abuse & Neglect, 26* (6–7), 645–659. https://doi.org/10.1016/s0145-2134(02)00339-3

Hobbs, C. J., & Wright, C. M. (2014). Anal signs of child sexual abuse: A case–control study. *BMC Pediatrics, 14*, 128. https://doi.org/10.1186/1471-2431-14-128

Hornor, G., Thackeray, J., Scribano, P., Curran, S., & Benzinger, E. (2012). Pediatric sexual assault nurse examiner care: Trace forensic evidence, ano-genital injury, and judicial outcomes. *Journal of Forensic Nursing, 8*(3), 105–111. https://doi.org/10.1111/j.1939-3938.2011.01131.x

Hösükler, E., Yılmaz, A., & Erkol, Z. Z. (2022). Evaluation of juvenile and adolescent sexual abuse victims: A retrospective study. *Turkish Archives of Pediatrics, 57*(1), 68–74. https://doi.org/10.5152/TurkArchPediatr.2022.21186

Ingram, D. L., White, S. T., Lyna, P. R., Crews, K. F., Schmid, J. E., Everett, V. D., & Koch, G. G. (1992). Gardnerella vaginalis infection and sexual contact in female children. *Child Abuse & Neglect, 16*(6), 847–853. https://doi.org/10.1016/0145-2134(92)90086-7

Jain, N. (2004). Sexually transmitted diseases in the pediatric patient. *British Columbia Medical Journal, 46*(3), 133–138.

Jenny, C., Crawford-Jakubiak, J. E., Committee on Child Abuse, Neglect, & American Academy of Pediatrics. (2013). The evaluation of children in the primary care setting when sexual abuse is suspected. *Pediatrics, 132*(2), e558–e567. https://doi.org/10.1542/peds.2013-1741.

Jones, J. S., Rossman, L., Hartman, M., & Alexander, C. C. (2003). Anogenital injuries in adolescents after consensual sexual intercourse. *Academic Emergency Medicine: Official Journal of the Society for Academic Emergency Medicine, 10*(12), 1378–1383. https://doi.org/10.1111/j.1553-2712.2003.tb00013.x

Kaplan, D. M., Moore, J. L., Hirway, P., Barron, C. E., & Goldberg, A. P. (2021). A comprehensive pediatric acute sexual assault protocol: From emergency department to outpatient follow-up. *Pediatric Emergency Care, 37*(2), 62–69. https://doi.org/10.1097/PEC.0000000000001652

Kellogg, N. D., Melville, J. D., Lukefahr, J. L., Nienow, S. M., & Russell, E. L. (2018). Genital and Extragenital gonorrhea and Chlamydia in children and adolescents evaluated for sexual abuse. *Pediatric Emergency Care, 34*(11), 761–766. https://doi.org/10.1097/PEC.0000000000000101411

Kellogg, N. D., Menard, S. W., & Santos, A. (2004). Genital anatomy in pregnant adolescents: "normal" does not mean "nothing happened". *Pediatrics, 113*(1 Pt 1), e67–e69. https://doi.org/10.1542/peds.113.1.e67

Kelly, P., Koh, J., & Thompson, J. M. (2006). Diagnostic findings in alleged sexual abuse: Symptoms have no predictive value. *Journal of Paediatrics and Child Health, 42*(3), 112–117. https://doi.org/10.1111/j.1440-1754.2006.00808.x

Killough, E., Spector, L., Moffatt, M., Wiebe, J., Nielsen-Parker, M., & Anderst, J. (2016). Diagnostic agreement when comparing still and video imaging for the medical evaluation of child sexual abuse. *Child Abuse & Neglect, 52*, 102–109. https://doi.org/10.1016/j.chiabu.2015.12.007

Laitinen, F. A., Grundmann, O., & Ernst, E. J. (2013). Factors that influence the variability in findings of anogenital injury in adolescent/adult sexual assault victims: A review of the forensic literature. *The American Journal of Forensic Medicine and Pathology, 34*(3), 286–294. https://doi.org/10.1097/PAF.0b013e31829a0f46

Lincoln, C., Perera, R., Jacobs, I., & Ward, A. (2013). Macroscopically detected female genital injury after consensual and non-consensual vaginal penetration: A prospective comparison study. *Journal of Forensic and Legal Medicine, 20*(7), 884–901. https://doi.org/10.1016/j.jflm.2013.06.025

MacPherson, S., Brown, E. C., Herold, B., & Narayan, A. (2018). Media-facilitated sexual assault in children and teens. *Clinical Pediatrics, 57*(11), 1349–1353. https://doi.org/10.1177/0009922818775744

Madigan, S., Ly, A., Rash, C. L., Van Ouytsel, J., & Temple, J. R. (2018). Prevalence of multiple forms of sexting behavior among youth: A systematic review and Meta-analysis. *JAMA Pediatrics, 172*(4), 327–335. https://doi.org/10.1001/jamapediatrics.2017.5314

McCann, J., Miyamoto, S., Boyle, C., & Rogers, K. (2007). Healing of hymenal injuries in prepubertal and adolescent girls: A descriptive study. *Pediatrics, 119*(5), e1094–e1106. https://doi.org/10.1542/peds.2006-0964

McCormack, P. L. (2014). Quadrivalent human papillomavirus (types 6, 11, 16, 18) recombinant vaccine (gardasil®): A review of its use in the prevention of premalignant anogenital lesions, cervical and anal cancers, and genital warts. *Drugs, 74*(11), 1253–1283. https://doi.org/10.1007/s40265-014-0255-z

Modelli, M. E., Galvão, M. F., & Pratesi, R. (2012). Child sexual abuse. *Forensic Science International, 217*(1–3), 1–4. https://doi.org/10.1016/j.forsciint.2011.08.006

Morgan, L., Khadr, S., & Bewley, S. (2017). Child sexual assault reported to an acute sexual assault referral Centre in London. *Archives of Disease in Childhood, 102*(2), 165–169. https://doi.org/10.1136/archdischild-2016-311121

Moscatelli, G., Moroni, S., García Bournissen, F., Falk, N., Destito, A., González, N., … Altcheh, J. (2021). Acquired syphilis by nonsexual contact in childhood. *The Pediatric Infectious Disease Journal, 40*(10), 892–898. https://doi.org/10.1097/INF.0000000000003215

Myhre, A. K., Adams, J. A., Kaufhold, M., Davis, J. L., Suresh, P., & Kuelbs, C. L. (2013). Anal findings in children with and without probable anal penetration: A retrospective study of 1115 children referred for suspected sexual abuse. *Child Abuse & Neglect, 37*(7), 465–474. https://doi.org/10.1016/j.chiabu.2013.03.011

Neyazi, S. M. (2019). Prepubertal vulvovaginitis. *Journal of Nature and Science of Medicine, 2*, 14–22.

Ohayi, S. R., & Ezugwu, E. C. (2019). Prevalence and pattern of genital injuries among adolescent rape victims attending Enugu state university teaching hospital, south East Nigeria. *Journal of Obstetrics and Gynaecology: The Journal of the Institute of Obstetrics and Gynaecology, 39*(2), 190–194. https://doi.org/10.1080/01443615.2018.1474189

Ouellette, L., McCoy, J., Bush, C., Rossman, L., Kolacki, C., Rossman, P., & Jones, J. S. (2022). Comparative prevalence of anogenital injury following sexual assault in women who have had recent consensual sexual contact. *The American Journal of Emergency Medicine, 51*, 124–126. https://doi.org/10.1016/j.ajem.2021.10.036

Page, J., Taylor, J., Tideman, R. L., Seifert, C., Marks, C., Cunningham, A., & Mindel, A. (2003). Is HSV serology useful for the management of first episode genital herpes? *Sexually Transmitted Infections, 79*(4), 276–279. https://doi.org/10.1136/sti.79.4.276

Qin, X., & Melvin, A. J. (2020). Laboratory diagnosis of sexually transmitted infections in cases of suspected child sexual abuse. *Journal of Clinical Microbiology, 58*(2), Article e01433-19. https://doi.org/10.1128/JCM.01433-19

Rana, R. S., & Gurung, R. (2021). A case of acute gonococcal conjunctivitis in an unusual age group. *Nepalese Journal of Ophthalmology: A Biannual Peer-reviewed Academic Journal of the Nepal Ophthalmic Society: NEPJOPH, 13*(25), 137–140. https://doi.org/10.3126/nepjoph.v13i1.29021

Rossman, L., Jones, J. S., Dunnuck, C., Wynn, B. N., & Bermingham, M. (2004). Genital trauma associated with forced digital penetration. *The American Journal of Emergency Medicine, 22*(2), 101–104. https://doi.org/10.1016/j.ajem.2003.12.012

Rossman, L., Solis, S., Ouellette, L., Kolacki, C., & Jones, J. S. (2021). Colposcopic genital findings in female sexual assault victims: Relationship to prior sexual intercourse experience. *The American Journal of Emergency Medicine, 45*, 664–665. https://doi.org/10.1016/j.ajem.2020.10.059

Schachter, J., Grossman, M., Sweet, R. L., Holt, J., Jordan, C., & Bishop, E. (1986). Prospective study of perinatal transmission of Chlamydia trachomatis. *JAMA, 255*(24), 3374–3377.

Schlesinger, S. L., Borbotsina, J., & O'Neill, L. (1975). Petechial hemorrhages of the soft palate secondary to fellatio. *Oral Surgery, Oral Medicine, and Oral Pathology, 40*(3), 376–378. https://doi.org/10.1016/0030-4220(75)90422-3

Smith, T. D., Raman, S. R., Madigan, S., Waldman, J., & Shouldice, M. (2018). Anogenital findings in 3569 pediatric examinations for sexual abuse/assault. *Journal of Pediatric and Adolescent Gynecology, 31*(2), 79–83. https://doi.org/10.1016/j.jpag.2017.10.006

Sugar, N. F., Fine, D. N., & Eckert, L. O. (2004). Physical injury after sexual assault: Findings of a large case series. *American Journal of Obstetrics and Gynecology, 190*(1), 71–76. https://doi.org/10.1016/s0002-9378(03)00912-8

Suomalainen, A., Wester, T., Koivusalo, A., Rintala, R. J., & Pakarinen, M. P. (2007). Congenital funnel anus in children: Associated anomalies, surgical management and outcome. *Pediatric Surgery International, 23*(12), 1167–1170. https://doi.org/10.1007/s00383-007-2024-5

Suttipasit, P., Sinlapamongkolkul, P., & Wongwittayapanich, S. (2022). Comparative study of acute anogenital injury between consensual and nonconsensual Postmenarche adolescents. *The American Journal of Forensic Medicine and Pathology, 43*(2), 126–141. https://doi.org/10.1097/PAF.0000000000000738

Thackeray, J. D., Hornor, G., Benzinger, E. A., & Scribano, P. V. (2011). Forensic evidence collection and DNA identification in acute child sexual assault. *Pediatrics, 128*(2), 227–232. https://doi.org/10.1542/peds.2010-3498

Titchen, K. E., Maslyanskaya, S., Silver, E. J., & Coupey, S. N. (2019). Sexting and young adolescents: Associations with sexual abuse and intimate partner violence. *Journal of Pediatric and Adolescent Gynecology, 32*(5), 481–486. ISSN 1083-3188, https://doi.org/10.1016/j.jpag.2019.07.004. ISSN 1083-3188,.

Vrolijk-Bosschaart, T. F., Brilleslijper-Kater, S. N., Widdershoven, G. A., Teeuw, A. R. H., Verlinden, E., Voskes, Y., … Lindauer, R. J. L. (2017). Physical symptoms in very young children assessed for sexual abuse: A mixed method analysis from the ASAC study. *European Journal of Pediatrics, 176*(10), 1365–1374. https://doi.org/10.1007/s00431-017-2996-7

Watkeys, J. M., Price, L. D., Upton, P. M., & Maddocks, A. (2008). The timing of medical examination following an allegation of sexual abuse: Is this an emergency? *Archives of Disease in Childhood, 93*(10), 851–856. https://doi.org/10.1136/adc.2007.123604

White, C., & McLean, I. (2006). Adolescent complainants of sexual assault; injury patterns in virgin and non-virgin groups. *Journal of Clinical Forensic Medicine, 13*(4), 172–180. https://doi.org/10.1016/j.jcfm.2006.02.006

Workowski, K. A., Bachmann, L. H., Chan, P. A., Johnston, C. M., Muzny, C. A., Park, I., … Bolan, G. A. (2021). Sexually transmitted infections treatment guidelines, 2021. *MMWR. Recommendations and Reports: Morbidity and Mortality Weekly Report. Recommendations and Reports, 70*(4), 1–187. https://doi.org/10.15585/mmwr.rr7004a1

Workowski, K. A., Bolan, G. A., & Centers for Disease Control and Prevention. (2015). Sexually transmitted diseases treatment guidelines, 2015. *MMWR. Recommendations and Reports: Morbidity and Mortality Weekly Report. Recommendations and Reports, 64*(RR-03), 1–137.

Zilkens, R. R., Smith, D. A., Mukhtar, S. A., Semmens, J. B., Phillips, M. A., & Kelly, M. C. (2018). Male sexual assault: Physical injury and vulnerability in 103 presentations. *Journal of Forensic and Legal Medicine, 58*, 145–151. https://doi.org/10.1016/j.jflm.2018.05.009

Zilkens, R. R., Smith, D. A., Phillips, M. A., Mukhtar, S. A., Semmens, J. B., & Kelly, M. C. (2017). Genital and anal injuries: A cross-sectional Australian study of 1266 women alleging recent sexual assault. *Forensic Science International, 275*, 195–202. https://doi.org/10.1016/j.forsciint.2017.03.013

Further Reading

Nita Jain, M. D., & FRCPC.. (2004). Sexually transmitted diseases in the pediatric patient. *British Columbia Medical Journal, 46*(3), 133–138.

Ryder, N., Jin, F., McNulty, A. M., Grulich, A. E., & Donovan, B. (2009). Increasing role of herpes simplex virus type 1 in first-episode anogenital herpes in heterosexual women and younger men who have sex with men, 1992–2006. *Sexually Transmitted Infections, 85*, 416–419.

Collection of Forensic Evidence From Pediatric Victims of Sexual Assault

AUTHORS: Rebecca Girardet, MD,[a] Kelly Bolton, RN,[a] Sheela Lahoti, MD,[a] Hillary Mowbray, MD,[a] Angelo Giardino, MD,[b,c] Reena Isaac, MD,[b] William Arnold, MBA,[d] Breanna Mead, MS,[e] and Nicole Paes, MS[f]

[a]Department of Pediatrics, University of Texas Medical School, Houston, Texas; [b]Department of Pediatrics, Baylor College of Medicine, Houston, Texas; [c]Texas Children's Health Plan, Houston, Texas; [d]Crime Laboratory, Houston Police Department, Houston, Texas; [e]Institute for Serology and Forensic Genetics, University of Denver, Denver, Colorado; and [f]University of Texas Health Science Center, San Antonio, Texas

KEY WORDS
sexual abuse, diagnostic procedures

ABBREVIATION
HPD—Houston Police Department

www.pediatrics.org/cgi/doi/10.1542/peds.2010-3037

doi:10.1542/peds.2010-3037

Accepted for publication Apr 7, 2011

Address correspondence to Rebecca Girardet, MD, University of Texas Medical School at Houston, 6410 Fannin St, Suite 1425A, Houston, TX 77030. E-mail: rebecca.g.girardet@uth.tmc.edu

PEDIATRICS (ISSN Numbers: Print, 0031-4005; Online, 1098-4275).

FINANCIAL DISCLOSURE: *The authors have indicated they have no financial relationships relevant to this article to disclose.*

COMPANION PAPERS: Companions to this article can be found on pages 221, 227, and 374 and online at www.pediatrics.org/cgi/doi/10.1542/peds.2010-3288, www.pediatrics.org/cgi/doi/10.1542/peds.2010-3498, and www.pediatrics.org/cgi/doi/10.1542/peds.2011-1455.

WHAT'S KNOWN ON THIS SUBJECT: The American Academy of Pediatrics recommends that forensic evidence collection be considered for up to 72 hours after sexual assault. Data on child victims reveal that the yield is low beyond 24 hours, particularly for specimens collected from children's bodies.

WHAT THIS STUDY ADDS: Review of forensic laboratory results including DNA amplification indicates that collection of body swabs from children beyond 24 hours after assault may yield evidence. Most children with positive laboratory evidence have normal or nonspecific physical findings.

abstract

OBJECTIVE: To determine the time period after sexual assault of a child that specimens may yield evidence using DNA amplification. Secondary questions included the comparative laboratory yields of body swabs versus other specimens, and the correlation between physical findings and laboratory results.

PATIENTS AND METHODS: Data from evidence-collection kits from children 13 years and younger were reviewed. Kits were screened for evidence using traditional methods, and DNA testing was performed for positive specimens. Laboratory data were compared with historical information.

RESULTS: There were 277 evidence-collection kits analyzed; 151 were collected from children younger than 10; 222 kits (80%) had 1 or more positive laboratory screening test, of which 56 (20%) tested positive by DNA. The time interval to collection was <24 hours for 30 of the 56 positive kits (68% positives with a documented time interval), and 24 (43% of all positive kits) were positive only by nonbody specimens. The majority of children with DNA were aged 10 or older, but kits from 14 children younger than 10 also had a positive DNA result, of which 5 were positive by a body swab collected between 7 and 95 hours after assault. Although body swabs were important sources of evidence for older children, they were significantly less likely than nonbody specimens to yield DNA among children younger than 10 ($P = .002$). There was no correlation between physical findings and laboratory evidence.

CONCLUSIONS: Body samples should be considered for children beyond 24 hours after assault, although the yield is limited. Physical examination findings do not predict yield of forensic laboratory tests. *Pediatrics* 2011;128:233–238

National data for 2008 reveal that among ~758 000 reported child maltreatment victims, 9.1% were sexually abused. Just over half of sexually abused children were younger than 12.[1] For children who present to a medical facility after a recent episode of sexual assault, standard care includes collection of body swabs and other specimens (such as clothing) in the hope of identifying an assailant. Forensic evidence-collection kits ("rape kits") contain receptacles and instructions for collection of cotton swab specimens from the mouth, vagina/penis, and anus; scrapings or swabs from under the victim's nails; combed and pulled hair specimens; as well as miscellaneous items such as stained clothing and debris. The American Academy of Pediatrics recommends that forensic evidence collection be considered for up to 72 hours after sexual assault and in cases of acute injury.[2] The 72-hour timeframe is supported by studies of adult women after consensual intercourse and studies of adult rape victims.[3–5] The increased availability of sensitive DNA amplification methods in recent years has enabled detection of foreign DNA in adult women victims even when cytological tests were negative for spermatozoa, which has prompted some jurisdictions to request evidence collection beyond 72 hours after sexual assault.[6]

Data on the yield of evidence collection in child sexual assault victims is limited. Christian et al[7] reported that among 273 children younger than 10 who underwent forensic evidence collection after sexual assault, no swabs were positive for blood, semen, or sperm after 13 hours after assault, and 64% of the evidence recovered was found on clothing or linens. In their study of 39 adolescent and 41 prepubertal sexual assault victims, Young et al[8] found evidence of semen on swabs collected from 13 adolescents but none of the prepubertal children. Additional evidence was recovered from clothing and linens for 3 prepubertal children. None of the 39 kits collected beyond 24 hours yielded any evidence. Both investigations concerned the use of pre-DNA amplification laboratory methods, however, and their applicability to modern child sexual assault cases is unclear. In a more recent analysis of forensic findings that included some DNA methods it was concluded that positive examination findings, age older than 10, and pubertal Tanner stage were predictive of positive forensic evidence.[9] Clothing in the latter study was very likely to be positive but was collected in only a minority of cases.

The primary purpose of our investigation was to determine the time period after sexual assault of a child that specimens may yield positive laboratory evidence using DNA amplification techniques. Our secondary questions were to examine the correlations of specimen source and physical examination findings to the likelihood of finding positive laboratory results. A better understanding of these questions will enable practitioners to limit collection of specimens that are found to have low forensic yields and can help reassure victims and their caregivers about the importance of other specimens that prove to have greater evidentiary potential.

METHODS

This investigation was a collaborative effort between child abuse pediatricians from 2 Houston medical schools (University of Texas Houston Medical School and Baylor College of Medicine) and the Houston Police Department (HPD) Crime Laboratory. The laboratory is the largest crime laboratory in Houston, and processes ~70% of evidence-collection kits in the community. Permission to conduct the study was obtained from the human subjects panels for both medical schools and from HPD officials.

Data were derived from a retrospective review of case information and laboratory results from forensic evidence-collection kits collected from children 13 or younger. All kits from children 13 or younger that were processed by the laboratory between January 1, 2007, and December 31, 2008, were analyzed. The laboratory did not process all kits, but only those in which evidence was sought for investigative or legal purposes. Laboratory methods for processing of kits remained constant during the study period. Separate police reports also were consulted when data points were missing from the kits (such as time of assault or victim age).

Kits were processed according to standard laboratory protocol. Body swabs were tested for semen by acid phosphatase assay, and the presence of sperm/semen was confirmed with microscopy and/or prostate-specific (p30) antigen assay. Specimens suspected of containing blood were screened by using standard color tests (phenolphthalein and hematrace). Nonbody specimens were inspected visually and with the aid of an alternate light source (Omnichrome Omniprint 1000, 450 nm [Omnichrome, Carlsbad, CA] or Mini Crime Scope MCS-400, 455 nm [Horiba Scientific, Edison, NJ]) for stains. Identified stains were tested for evidence of sperm/semen and blood using the tests used for body swabs. Confirmative DNA testing was performed for specimens with positive microscopy, p30, or color test result. Specimens thought to contain other biological evidence (eg, saliva) were tested directly by DNA analysis. For kits with multiple positive results on screening tests, only the strongest or most probative specimens were tested further for

DNA. In cases involving multiple assailants, all specimens with positive screens were tested for DNA.

Data collected from forensic evidence kits is stored in a secure database at the crime laboratory according to routine laboratory practice. For the purposes of this investigation, laboratory data were recorded as positive or not positive (ie, negative or indeterminate). The source of each sample was recorded. Laboratory data were compared with historical and physical examination information recorded on standard evidence-collection documents; specifically, the type of sexual contact, the time since most recent sexual assault, the presence of acute anogenital trauma, and the facility where evidence collection was performed were abstracted. The retrospective nature of this investigation precluded an accurate assessment of additional data points such as whether the child had bathed or changed clothes before evidence collection. Because information regarding subjects' pubertal stage was inconsistently recorded on kit documents, this information was not abstracted. Multiple evidence-collection kits collected from the same child during the study period were counted as separate cases.

Anogenital examination findings recorded on kit documents were classified using a standard table.[10] Forensic photographs are not maintained by the HPD crime laboratory and, therefore, were not available for analysis. For the purposes of this investigation, only acute anogenital injuries were considered. Anogenital findings were analyzed separately by 2 investigators for evidence of recent penetrating trauma, and a consensus opinion was sought from all investigators for discrepant cases.

TABLE 1 Laboratory Test Yields

Test	No. of Kits With Positive Result of Total Kits Tested, *n*/*N* (%)	No. Positive From Nonbody Specimens Only	No. With Positive DNA
Alternate light source	162/178 (91)	NA	35
Phenothalein	39/77 (51)	19	15
Hematrace	10/12 (83)	10	6
Acid phosphatase	151/173 (87)	16	33
Microscopy	41/256 (16)	12	32
Prostate-specific antigen (p30)	38/242 (16)	13	23

NA indicates not applicable.

RESULTS

There were 290 total kits abstracted, of which 277 met study criteria. Of the 13 excluded cases, 7 contained insufficient data for study analysis, and the remainder were collected from subjects older than 13. One child had 2 kits during the study period. Among the included cases, 228 (82%) were female, and 153 (55%) were younger than 10. The majority of cases were from 1 of 2 children's hospitals serving the Houston area and the child advocacy center located in Houston. There were 244 kits (88%) collected in the year 2000 or later; the oldest kit was collected in 1988. Data on the numbers of kits that were stored but not processed during the study period were not available.

The time from assault to evidence collection was within 24 hours for 111 (40%) kits, between 25 and 48 hours for 24 (9%) kits, between 49 and 72 hours for 9 (3%) kits, and beyond 72 hours for 8 (3%) kits. The time interval for 125 (45%) kits was unknown; of these, 85 involved subjects younger than 10. Invasive body sampling (defined as oral, vaginal, and anal swabs) was performed for 253 kits. For 8 kits, the only invasive or intimate body specimens were oral swabs (7 kits) or pubic hair combings (1 child). Only objects from the crime scene (clothing and/or bedding, and a Ziploc bag in 1 case) were submitted for laboratory analysis for 24 cases.

There were 222 kits (80%) that had 1 or more positive laboratory nonDNA test that included alternate light source fluorescence. Yields of all nonDNA laboratory tests and their comparisons to DNA results are listed in Table 1. Specimens from 56 kits (20%) tested positive by DNA (53 girls). Two of the 56 kits with a positive DNA result did not have a nonDNA laboratory test; swabs from around the mouth and from the hands were the only specimens available for 1 child, and only objects from the crime scene were available for another. Positive DNA was found for 35 of 162 kits with a positive alternate light source test (22%), for 9 of 39 kits with a positive test for blood (phenolphthalein and/or hematrace; 23%), and for 39 of 130 kits with a positive test for semen/sperm (acid phosphatase, microscopy and/or p30; 30%). For 1 12-year-old girl with positive screens for blood and semen/sperm by all testing methods from body and nonbody specimens, DNA was recovered only from debris and clothing specimens. Another 3 kits with positive screens for semen/sperm by all modalities had no positive DNA test.

Among the kits with positive tests for DNA, 28 (50%) concerned a disclosure of penile-vaginal contact, 4 (7%) a disclosure of penile-anal contact, 3 (5%) a disclosure of both penile-vaginal and penile-anal contact, 5 (9%) a disclosure of other forms of sexual contact (cunnilingus, fondling, and/or fellatio), and no sexual contact was specified for another 16 (29%) kits. Among children with positive DNA from a body swab, 30 (91% of children in this group) were female.

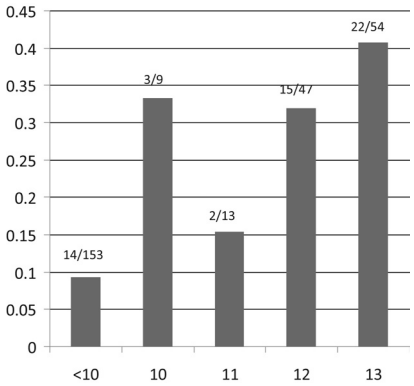


FIGURE 1
Proportion with positive DNA within age groupings.

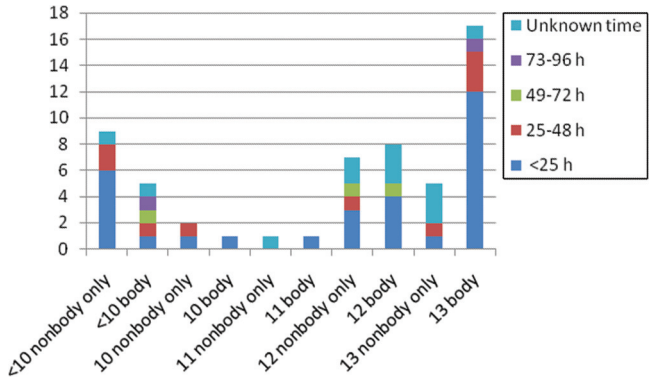


FIGURE 2
Kits with positive DNA according to age, source, and time after assault. Some kits that contained "body" specimens also contained nonbody specimens that were positive.

The majority of children with a positive DNA result were 10 or older, but 14 kits taken from children younger than 10 (9% of children in this age group) also had a positive DNA result (Fig 1). Of the 56 kits with a positive DNA result, 24 (43%) were positive only by specimens taken from sources other than the child's body (Fig 2). Of the 14 kits from children younger than 10 that had a positive DNA result, 13 included invasive body specimens, and 5 were positive by a swab taken from the child's body. Among these 5 kits, 2 also had positive DNA evidence from nonbody specimens, and nonbody specimens were not collected for the remaining 3 kits. Overall, among children younger than 10 with positive DNA evidence, the source of the positive evidence was more likely to have been a nonbody specimen than a body swab ($P = .002$). When body swabs were analyzed separately, positive results for DNA were uncommon except among children age 12 and 13, for whom the vagina was the most common source of evidence (Fig 3). Overall, vaginal specimens had the highest yield of positive DNA (21 of 200 kits), followed by penile (2 of 33), and anal (3 of 173). Fingernail swabs and scrapings yielded only 1 positive DNA result among 60 kits that contained these specimens. Hair combings (from the head in 114 kits and pubis in 69 kits) and oral specimens (145 kits) yielded no positive foreign DNA.

The time to evidence collection for kits testing positive for DNA was within 24 hours for 30 (54%) kits, between 25 and 48 hours for 9 (16%) kits, between 49 and 72 hours for 3 (5%) kits, and between 73 and 96 hours for 2 (4%) kits. The time to evidence collection was unknown for 12 (21%) kits that had a positive DNA result. When only kits with known time intervals were considered, 68% (30 of 44) were collected within 24 hours. Among the 7 kits containing specimens collected >96 hours after assault, none had a positive sample for DNA.

For the 5 kits taken from children younger than 10 who had a body swab specimen that tested positive for DNA, the time intervals to evidence collection were as follows: 7 hours (perioral and hands); 35 hours (vaginal and anal swabs); 66 hours (pubic hair from anus); 95 hours (fingernail swab); and an unknown time interval (penile swab).

Acute anogenital findings were classified differently by first and second reviewers for 87 cases, but agreement was achieved for all cases after group discussion among study authors that focused on consistent application of the standard criteria proposed by Adams.[10] The majority of children with a positive DNA result had normal, nonspecific, or indeterminate acute anogenital findings according to written kit documentation. Kits from 23% of cases with documented normal or nonspecific anogenital findings tested positive for DNA versus only 13% of kits from cases with diagnostic physical findings, but this difference was not statistically significant ($P = .187$). When clinical findings were compared with the source of positive DNA specimens, 23 of 28 (82%) kits in the normal/nonspecific group with a body swab tested yielded a positive result, versus all 6 kits from children with indeterminate or diagnostic findings ($P = .627$). Of the cases that did not include sufficient information to make a determination regarding the presence

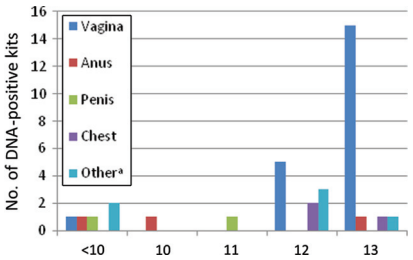


FIGURE 3
Number of kits with positive DNA from a body source according to site and age. [a] Other indicates pubic hair swab, neck, debris, pubic hair in child's anus.

TABLE 2 Acute Physical Findings and DNA Test Results

Classification of Acute Anogenital Findings	No. of Children ($N = 277$)	Positive DNA Total ($N = 56$)	No. of Body Swabs With Positive DNA From Total Swabs Tested, *n*/*N*
Normal or nonspecific	169	39	23/28
Indeterminate	11	3	2/2
Diagnostic	46	6	4/4
Insufficient information	51	8	3/4

of acute anogenital trauma, 16% yielded a positive DNA result (Table 2).

DISCUSSION

Our results support the findings of previous investigators who found that the majority of children with positive biological evidence undergo examination within 24 hours of assault, and that a significant proportion of evidence is collected from objects such as linens and clothing rather than from the children themselves.[7–9] Recovery of laboratory evidence is particularly rare in children younger than 10, for whom the majority of evidence was recovered from nonbody specimens. However, kits from 5 children younger than 10 years had a positive DNA test from a body swab collected between 7 and 95 hours, 1 of which included positive DNA from invasive body swabs collected 35 hours after the child's molestation. Two of the 5 kits also had positive DNA tests from nonbody sources, and nonbody specimens were not available for testing for the remaining 3 kits. It is conceivable that positive specimens taken from inside the child's body may be regarded as stronger proof of sexual contact than positive biological evidence recovered from nonbody objects, although this subject has not been investigated to our knowledge. Given the potentially higher probative value of a positive laboratory result from an invasive body swab than from a nonbody specimen, our data suggest that invasive body samples should be considered for prepubertal children beyond the 24-hour limit proposed by previous investigators, although the yield will be limited.

Despite the high number of kits with a positive screening laboratory test (80%), only 20% of the study population was confirmed positive by DNA testing. The alternate light source proved to be a particularly nonspecific screen, consistent with previous reports regarding its low specificity[11,12]; tests for blood and semen/sperm seem to be moderately specific, with 9 of 39 and 39 of 130 confirmed in our series, respectively.

Another important result of our investigation was the high proportion of cases of children with normal or nonspecific anogenital findings who had DNA evidence from a body swab (23 of 28 tested). Previous research has indicated a positive correlation between diagnostic physical findings and laboratory evidence[9]; although we found a trend toward positive DNA evidence among children with diagnostic findings, it was not significant. Our results are consistent with the reported yield of laboratory tests for sexually transmitted diseases among children with disclosures of genital contact but normal or nonspecific physical findings.[13] The preponderance of normal anogenital findings among children presenting for sexual assault has been convincingly established.[14–16] Reasons put forth to explain this phenomenon include the capacity for rapid healing of mucosal tissues and the inability of young children to accurately describe the details of their assault. Our results indicate that collection of forensic specimens after a disclosure of recent assault is appropriate even when physical findings are normal or nonspecific.

There are several limitations to this study. Like the other investigations of this subject, our ability to draw conclusions is limited by our retrospective design. A potential confounder in our study was the fact that the time interval from assault to evidence collection was unknown for 45% of cases; our data on the yield of laboratory testing within the various time intervals must therefore be interpreted with caution. However, the proportion of kits testing positive for DNA within 24 hours remained significantly greater even if it is theoretically assumed that the 12 positive kits with undocumented time intervals were collected after 24 hours ($P = .031$). Because data regarding bathing and changing clothes before examination was inconsistently recorded, we chose to forego analysis of these data points, and therefore we cannot comment on the possible effect on specimen yield that these actions might have had. The retrospective design is also problematic when comparing laboratory results to examination findings. The fact that the majority of kits included in our study were completed at 1 of 2 children's hospitals or a child advocacy center potentially mitigates the problem, although 18% of the kits (51 of 277) did not include sufficient documentation to determine whether there was visible trauma. We also cannot know whether all available specimens were collected in every case, and therefore the true contribution of clothing and linens cannot be known. Controlling for these factors in a prospective design would be a challenging but worthwhile endeavor given the implications of the results to protecting children.

CONCLUSIONS

The majority of children with DNA-confirmed biological evidence present to a medical facility within 24 hours of assault. DNA recovery from body swabs

among children younger than 10 is possible after 24 hours, although it occurs infrequently. The presence of visible acute anogenital trauma on examination does not predict recovery of DNA evidence. Nonbody specimens are more likely to yield positive DNA evidence than body swabs.

ACKNOWLEDGMENTS

We thank Drs Irma Rios and Laura Ghan of the HPD Crime Laboratory for assistance with this investigation.

REFERENCES

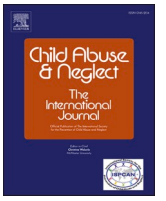
1. US Department of Health and Human Services. Administration for Children and Families. Administration on Children, Youth and Families, Children's Bureau. Child maltreatment 2008. Available at: www.acf.hhs.gov/programs/cb/stats_research/index.htm#can. Accessed June 19, 2010
2. Kellogg N; American Academy of Pediatrics Committee on Child Abuse and Neglect. The evaluation of sexual abuse in children. *Pediatrics*. 2005;116(2):506–512
3. American College of Obstetricians and Gynecologists. Sexual assault. *Int J Gynecol Obstet*. 1993;42:67–72; technical bulletin 172
4. Willott GM, Allard JE. Spermatozoa: their persistence after sexual intercourse. *Forensic Sci Int*. 1982;19(2):135–154
5. Dahlke MB, Cooke C, Cunnane M, Chawla J, Lau P. Identification of semen in 500 patients seen because of rape. *Am J Clin Pathol*. 1977;68(6):740–746
6. US Department of Justice. Office on Violence Against Women. President's DNA initiative; sexual assault medical forensic examinations. Available at: http://samfe.dna.gov/operational_issues/considerations_collecting_evidence/prompt. Accessed May 5, 2009
7. Christian CW, Lavelle JM, De Jong AR, Loiselle J, Brenner L, and Joffe M. Forensic evidence findings in prepubertal victims of sexual assault. *Pediatrics*. 2000;106(1 pt 1):100–104
8. Young KL, Jones JG, Worthington T, Simpson P, Casey PH. Forensic laboratory evidence in sexually abused children and adolescents. *Arch Pediatr Adolesc Med*. 2006;160(6):585–588
9. Palusci VJ, Cox EO, Shatz EM, Schultze JM. Urgent medical assessment after child sexual abuse. *Child Abuse Negl*. 2006;30(4):367–380
10. Adams JA. Guidelines for medical care of children evaluated for suspected sexual abuse: an update for 2008. *Curr Opin Obstet Gynecol*. 2008;20(5):435–441
11. Nelson DG, Santucci KA. An alternate light source to detect semen. *Acad Emerg Med*. 2002;9(10):1045–1048
12. Gabby T, Winkleby MA, Boyce WT, et al. Sexual abuse of children: the detection of semen on skin. *Am J Dis Child*. 1992;146(6):700–703
13. Girardet RG, Lahoti S, Howard LA, et al. The epidemiology of sexually transmitted infections in suspected child victims of sexual assault. *Pediatrics*. 2009;124(1):79–86
14. Adams JA, Harper K, Knudson S, Revilla J. Examination findings in legally confirmed child sexual abuse: it's normal to be normal. *Pediatrics*. 1994;94(3):310–317
15. Heger A, Ticson L, Velasquez O, et al. Children referred for possible sexual abuse: medical findings in 2384 children. *Child Abuse Negl*. 2002;26(6–7):645–659
16. Anderst J, Kellogg N, Jung I. Reports of repetitive penile-genital penetration often have no definitive evidence of penetration. *Pediatrics*. 2009;124(3). Available at: www.pediatrics.org/cgi/content/full/124/3/e403

Child Abuse & Neglect 136 (2023) 105998

Contents lists available at ScienceDirect

Child Abuse & Neglect

journal homepage: www.elsevier.com/locate/chiabuneg



Identification of red flag child sexual grooming behaviors☆

Elizabeth L. Jeglic [a,*], Georgia M. Winters [b], Benjamin N. Johnson [b]

[a] John Jay College of Criminal Justice, United States of America
[b] Fairleigh Dickinson University, United States of America

ARTICLE INFO

Keywords:
Sexual grooming
Sexual Grooming Model
Child sexual abuse
Prevention

ABSTRACT

Background: Sexual Grooming is the deceptive process wherein a would-be perpetrator prepares a child for sexual abuse (CSA) and prevents disclosure and detection. It is often difficult to detect sexual grooming because some grooming behaviors resemble normal adult-child interactions. To prevent CSA, it is vital to identify sexual grooming behaviors that can be considered "red flag" behaviors.

Objective: This study compared reported sexual grooming behaviors between adults who experienced CSA and those with no CSA history to identify which behaviors differed between the two groups. Further we explored whether the relationship to the adult male in the Non-CSA group impacted reported behaviors.

Participants and setting: Participants were recruited online through Prolific and included adults who experienced CSA ($n = 411$) and those with no CSA history ($n = 502$).

Methods: Participants who reported CSA completed the *Sexual Grooming Scale – Victim Version (SGS-V)* about their CSA experience. Those with no CSA history were randomly assigned to one of three conditions (family member/non-family member/community member) and completed a modified version of the *SGS-V* about an adult male with whom they had the most interpersonal contact before age 18.

Results: Numerous sexual grooming behaviors that differentiated the behaviors of adults who engaged in CSA and those who did not were identified. The relationship to the adult was an important consideration.

Conclusions: Red flag sexual grooming behaviors, specifically those related to desensitizing the child to physical contact and sexual content, can be identified in cases of CSA and have an important role in prevention.

Child sexual abuse (CSA) is a serious global problem, and it is estimated that one in four girls and one in 13 boys will experience CSA by the time they reach adulthood (Centers for Disease Control [CDC], n.d.). Children frequently do not report CSA, and if they do, it may be many years after it happened (Hébert et al., 2009). It has been hypothesized that CSA is often undetected as the perpetrator may use sexual grooming behaviors as a means of reducing the likelihood the victim will disclose, and avoiding recognition by others (Craven et al., 2006; McAlinden, 2012; van Dam, 2001). Importantly, research has shown it is hard to identify sexual grooming behaviors before the abuse occurs (Spenard & Cash, 2022; Winters & Jeglic, 2016, 2017). It has been suggested this difficulty is since

☆ This work was supported by a John Jay College Faculty COVID recoveries Award.

* Corresponding author at: Department of Psychology, John Jay College of Criminal Justice, 529 West 59th St, New York, NY 10019, United States of America.
E-mail address: ejeglic@jjay.cuny.edu (E.L. Jeglic).

https://doi.org/10.1016/j.chiabu.2022.105998
Received 27 October 2022; Received in revised form 10 December 2022; Accepted 14 December 2022
Available online 26 December 2022

many sexual grooming behaviors are analogous to normal adult/child interactions, however the underlying intention behind them is deviant in nature (Bennett & O'Donohue, 2014; Craven et al., 2006; Lanning, 2010). Despite this, it remains unclear as to how sexual grooming behaviors may be similar, or dissimilar to healthy and normative interactions between an adult and child. It is crucial to draw this distinction to better identify sexual grooming behaviors before the abuse occurs (Bennett & O'Donohue, 2014). To this end, this study aims to examine whether there are "red-flag" sexual grooming behaviors employed in cases of CSA that differentiate them from non-abusive adult/child interactions.

1. Child sexual grooming

While there have been varied definitions of sexual grooming proposed over the past several decades (see Bennett & O'Donohue, 2014 and Winters et al., 2021 for a discussion), the term generally refers to the process by which a person seeking to commit a sexual offense creates a situation in which the CSA can be more easily enacted and remain undetected. To bring consensus to the field and enable empirical analysis of the construct, Winters and colleagues (2021) proposed to define sexual grooming as:

> "the deceptive process used by sexual abusers to facilitate sexual contact with a minor while simultaneously avoiding detection. Prior to the commission of the sexual abuse, the would-be sexual abuser may select a victim, gain access to and isolate the minor, develop trust with the minor and often their guardians, community, and youth-serving institutions, and desensitize the minor to sexual content and physical contact. Post-abuse, the offender may use maintenance strategies on the victim to facilitate future sexual abuse and/or to prevent disclosure" (p.933).

Based on a content-validated model of sexual grooming (Sexual Grooming Model [SGM]; Winters et al., 2020), this process involves five stages: 1) selecting a vulnerable child to target for the abuse; 2) gaining access and isolating the child from others; 3) deceptively developing trust with the child and those around the child; 4) gradually desensitizing the child to sexual content and physical touch; and 5) after the abuse occurs, using post-abuse maintenance behaviors to facilitate the likelihood of continued abuse and/or reduce the likelihood of detection and disclosure. As identified by experts in the field, the SGM further includes 42 specific behaviors that may be observable within each of these five stages (see Winters et al., 2020 for a full review of the model development and validation).

The process of sexual grooming is believed to be a very complex and nuanced process, that may differ on a case-by-case basis (Bennett & O'Donohue, 2014; Craven et al., 2006; Winters et al., 2020). Generally speaking, research has shown sexual grooming behaviors are relatively common in cases of CSA (Canter et al., 1998; Groth & Birnbaum, 1978). More recent data using the *Sexual Grooming Scale -Victim Version* (SGS-V; a self-report scale based upon the 42 behaviors identified in the SGM; Winters & Jeglic, 2021) showed that 99 % of adults who reported experiencing CSA endorsed that they experienced at least one sexual grooming behavior, with an average of 15 out of 42 possible sexual grooming behaviors reported per participant (Winters & Jeglic, 2021).

2. Identifying sexual grooming behaviors

Importantly, it has been hypothesized that sexual grooming behaviors, although commonly employed in cases of CSA, are not easily recognized and are more easily identified retrospectively once the abuse has already been detected (Bennett & O'Donohue, 2014; Craven et al., 2006; Lanning, 2010). One experimental study examined whether there is a hindsight bias (i.e., the tendency to overestimate one's ability to have foreseen an outcome) in cases of CSA involving sexual grooming (Winters & Jeglic, 2016). Using a sample of 525 undergraduate students who were randomly assigned to read a vignette containing sexual grooming behaviors, with or without the outcome knowledge that the person committed CSA, Winters and Jeglic (2016) found that participants who did not receive outcome information (i.e., that sexual abuse occurred) overestimated the likelihood they would have predicted that the individual would have sexual abused the child. Additionally, they found that those who read vignettes that contained sexual grooming behaviors were significantly more likely to indicate that the person would go on to perpetrate CSA (~30 % compared to ~20 %, out of a possible 100 % [definitely true]), showing there was some ability to detect potentially predatory behaviors, although the percentages were toward the "definitely not true" anchor of the scale. Lastly, the authors explored what types of sexual grooming behaviors were most easily recognized as worrisome and found that participants were most concerned about behaviors involving the isolation and physical touch of the child. Recently, Spenard and Cash (2022) replicated Winters and Jeglic (2016) findings using a sample of 156 undergraduate students. They found evidence of a hindsight bias for both same and opposite-sex cases of CSA, and participants had some ability to recognize sexual grooming.

In a follow-up study to Winters and Jeglic (2016), Winters and Jeglic (2017) randomly assigned 393 undergraduate participants to read one vignette (one vignette contained no sexual grooming behaviors, while the remaining five vignettes contained behaviors from one or all of the first four stages of the SGM stages) and respond to outcome questions about the likelihood that the individual in the vignette committed CSA. The responses to outcome questions did not differ between those who read a vignette without sexual grooming behaviors compared to those that contained sexual grooming tactics. Contrary to the findings of Winters and Jeglic (2016) and Spenard and Cash (2022), the authors concluded that this showed that individuals have a hard time recognizing sexual grooming behaviors across the stages of the SGM process (Winters & Jeglic, 2017). Overall, these studies showed that sexual grooming is more easily identified retrospectively, and people may have a difficult time recognizing certain potentially predatory behaviors. Of note, these studies (Spenard & Cash, 2022; Winters & Jeglic, 2016, 2017) only examined recognition of the broad stages of the SGM, as opposed to individual behaviors.

3. Why is it difficult to recognize sexual grooming?

It has been suggested that many sexual grooming behaviors, especially the ones not related to sexual content or touch, are difficult to recognize beforehand in large part due to the seemingly innocuous nature of some of these tactics. Many of the actions considered to be sexual grooming can also be indicative of a normal, healthy adult relationship with a child. As Craven et al. (2006) state, sexual grooming is "not dissimilar to innocent behavior intended to broaden a young person's experiences. The only difference may be the motivation underlying the behaviour." (p. 292). In fact, it is likely a person seeking to commit a sexual offense will want to appear to engage in normative behavior so as not to be detected (Bennett & O'Donohue, 2014). For example, it is not necessarily worrisome for an adult to give a child a gift or play childlike games with them – yet these are behaviors that are also considered to be sexual grooming strategies (see Winters et al., 2020 for a list of sexual grooming behaviors and tactics).

It is crucial for the detection and prevention of CSA to be able to distinguish between innocuous caring behaviors and behaviors and tactics indicative of sexual abuse. Winters et al. (2020) hypothesized that there may be several ways to identify which sexual grooming behaviors may differ from appropriate interactions between a child/adult. First, there may be certain behaviors that are more concerning and are thus more indicative of sexual grooming (i.e., more *severe* or "*red flag*" behaviors). This would likely include behaviors found in the desensitization to sexual content and physical contact stage such as showing a child pornography, undressing around a child, or using inappropriate sexual language with a child (Winters & Jeglic, 2016). Second, the behaviors may be used in *high frequency* with the child. High frequency behaviors can further be broken down to include employing many different sexual grooming behaviors *(high number of behaviors)* or using select behaviors often, such as frequently doing activities with a child away from other adults, giving a child many compliments or gifts, or texting or communicating with a minor often *(high occurrence)*. Third, there may be certain combinations of behaviors (*clusters*) that are ultimately more concerning, such as using various behaviors across each of the five SGM stages (e.g., spending a lot of time with a vulnerable child without other adults around).

Importantly, these above-noted hypotheses have yet to be empirically examined. Thus, in order to develop prevention methods to identify sexual grooming before the abuse occurs, it is necessary to better understand how these sexual grooming behaviors may differ from ordinary adult interactions with children. To this end, the present study aims to explore differences in sexual grooming behaviors endorsed by those who experienced CSA compared to individuals who were never abused, using the *SGS-V*. More specifically, we aimed to explore a) whether there are certain red flag behaviors that are more common in cases of CSA compared to Non-CSA (*severe or red flag behaviors*), and whether these vary depending on relationship to the child (family, non-family, community member), and b) whether there are more sexual grooming behaviors used in cases of CSA compared to Non-CSA (*high number of behaviors*).

4. Method

4.1. Participants and procedure

Participants were individuals who were recruited through the online survey-taking website, Prolific. Prolific allows adult volunteers to complete research studies in exchange for monetary compensation and has a more diverse population to sample from than other similar platforms (e.g., MTurk, university participant pools; Palan & Schitter, 2018). Prolific users were able to sign up for the study ("An Analysis of Behaviors") through postings on the website. To be eligible for participation, individuals had to be aged 18 or older, reside in the United States (U.S.) and speak/write English. Out of 978 individuals who completed the informed consent, 913 (93.4 %) participants completed the full survey and passed validity and attention checks; 411 (45.02 %) endorsed experiencing CSA

Table 1
Demographics of participants.

Variable	Response options	Total sample	CSA	Non-CSA	χ^2	*p*
Sex at Birth	Male	285 (31.22)	79 (19.22)	206 (41.04)	50.18	<0.001
	Female	600 (65.72)	318 (77.37)	282 (56.18)		
	Other	24 (2.63)	12 (2.92)	12 (2.39)		
	Prefer not to Answer	4 (0.44)	2 (0.49)	2 (0.40)		
Self-identified Gender	Man	275 (30.12)	73 (17.76)	202 (40.24)	58.18	<0.001
	Woman	581 (63.64)	305 (74.21)	276 (54.98)		
	Transgender (male-to-female)	3 (0.33)	1 (0.24)	2 (0.40)		
	Transgender (female-to-male)	9 (0.99)	5 (1.22)	4 (0.80)		
	Non-binary	37 (4.05)	23 (5.60)	14 (2.79)		
	Questioning	0 (0.00)	0 (0.00)	0 (0.00)		
	Other	4 (0.44)	3 (0.73)	1 (0.20)		
	Prefer not to answer	4 (0.44)	1 (0.24)	3 (0.60)		
Race/Ethnicity	White/Of European Descent	646 (70.76)	292 (71.05)	354 (70.52)	12.04	0.10
	Black/African American	64 (7.00)	30 (7.30)	34 (6.77)		
	Hispanic or Latino	70 (7.67)	28 (6.81)	42 (8.37)		
	Asian/Pacific Islander	66 (7.23)	22 (5.35)	44 (8.76)		
	Multiracial	28 (3.07)	18 (4.38)	10 (1.99)		
	Biracial	24 (2.63)	11 (2.68)	13 (2.59)		
	Other	5 (0.55)	4 (0.97)	1 (0.20)		
	Prefer not to answer	10 (1.10)	6 (1.46)	4 (0.80)		

(sexual abuse before age 18), while 502 (54.98 %) did not report a history of CSA. Table 1 includes the demographic information for all participants. The mean age of participants was 33.52 years (range = 18–79; CSA $M = 34.01$, Non-CSA $M = 33.12$). Chi-square analyses showed there were significant differences between the CSA and Non-CSA groups in terms of sex at birth and self-identified gender, while there were no differences for race/ethnicity. All methods were approved by the first author's institutional review board.

Those who met eligibility criteria first completed an informed consent form, and if they agreed to participate, they proceeded to the full survey. Participants who reported CSA responded to demographic questions (i.e., age, race/ethnicity, sex, gender identity), items related to their CSA experience, and completed the *SGS-V* (described below). Those who did not report a history of CSA completed demographic questions and were randomly assigned to one of three conditions: Non-CSA Family (e.g., parent or step-parent, sibling or step-sibling, grandparent, uncle, cousin; $n = 169$; 33.67 %), Non-CSA Non-Family (e.g., current or former romantic partner, friends, friend of a family member or friend, acquaintance; $n = 168$; 33.47 %), and Non-CSA Community (e.g., coach, teacher, religious leader; $n = 165$; 32.87 %). The participants were asked to "select an adult male [family member/non-family member/community member, depending upon the condition] with whom you had the most interpersonal contact with before the age of 18 and respond to the sets of questions regarding that individual." They then completed a modified version of *SGS-V* (*SGS -Non-CSA [SGS-NC]*; see description below) in response to the individual they selected. Given that the majority of CSA is perpetrated by adult males (Basile et al., 2011; World Health Organization, 2012), we requested individuals respond regarding an adult male in their life. To maintain data quality, there were three attention check questions interspersed in the survey for all participants; all participants accurately responded to the attention check questions. Participants were provided a debriefing form following completion of the survey, including contact information for the researchers and emergency contact information should they have experienced distress because of participating in the study. Participants were compensated $4.00 for the 20-minute survey through Prolific where they were identified only by an ID number. No personally identifying information was gathered.

4.2. Materials

4.2.1. Sexual Grooming Scale – Victim Version (SGS-V)

The *SGS-V* is a self-report survey for adult victims of CSA to identify the sexual grooming behaviors they experienced during their abuse process. The *SGS-V* is based on the content-validated SGM that describes five stages of the sexual grooming process (i.e., Victim Selection, Gaining Access and Isolation, Trust Development, Desensitization to Sexual Content and Physical Contact, Post-Abuse Maintenance) and 42 specific behaviors that fall under these stages. The *SGS-V* asks individuals who experienced CSA to indicate whether they experienced each of the 42 behaviors (Yes, No, Prefer not to say) and if they endorse the behavior, they are asked to describe it qualitatively. The measure also includes five "other" behavior items after each stage for respondents to identify any additional sexual grooming behaviors they may have experienced. The *SGS-V* was pilot tested on 115 adults who experienced CSA, demonstrating support for the feasibility of the measure (Winters & Jeglic, 2021).

4.2.2. Sexual Grooming Scale – Non-CSA (SGS-NC)

The *SGS-V* was modified so that it could be completed by individuals who did not experience CSA – the *SGS-NC*. All of the individual items on the scale remained the same except that the instructions changed. Participants in the Non-CSA groups were asked: "Please select the adult male with whom you had the most interpersonal contact with before the age of 18 (family member/non-family

Table 2
SGS-V and SGS-NC stage prompts.

SGM stage	*SGS-V*	*SGS-NC*
Victim selection	"There are many reasons that an individual may select a victim for their sexually abusive behavior. Please select *all* the reasons you believe the individual who abused you may have selected you."	There are many reasons that an adult may choose to spend time with a child. Please select *all* the reasons you believe the adult spent time with you."
Gaining access and isolation	"There are many ways that an individual may gain access to and isolate a victim. Please select *all* the behaviors the individual who abused you may have done to gain access or isolate you."	"There are many ways that an adult can meet and spend time with a child. Please select *all* the behaviors that apply to the way that adult met and spent time with you."
Trust development	"There are many ways that an individual may develop trust with the victim or other people around the victim. Please select *all* the behaviors the individual who abused you may have done to develop trust with you or those around you."	"There are many ways that an adult may develop trust with a child or other people around the child. Please select *all* the behaviors the adult engaged in to develop trust with you or those around you."
Desensitization to sexual content and physical contact	"There are many ways that an individual may try to get the victim used to physical touch or sexual content before the abuse. Please select *all* the behaviors the individual who abused you may have done to get you used to physical touch or sexual content."	"There are many ways that an adult may talk with the child or physically touch them. Please select *all* the behaviors the adult talked with you or physically touched you."
Post-abuse maintenance	'There are many ways that an individual may try to prevent the victim from disclosing the abuse or to continue the abuse over time. Please select *all* the behaviors you believe the individual who abused you may used to try to prevent disclosure or continue the abuse."	"There are many behaviors that an adult may use after spending time with a child. Please select *all* the behaviors you believe the adult used to after spending time with you."

member/community member) and respond to the sets of questions regarding that individual." They were then given a list of possible examples from the condition for which they were assigned and asked to describe their relationship with the individual:

1. Non-CSA Family: Immediate family or extended family member (parent, sibling, step-parent, step-sibling, grandparent, uncle, aunt, cousin, other [specify])
2. Non-CSA Non-Family: Non-family member (romantic partner, ex-partner, friend, friend of family, friend of friend, acquaintance, other [specify])
3. Non-CSA Community: Community Member (coach, teacher, religious leader, other [specify])

The instructions for the five stages were also modified. See Table 2 for a description of the instructions prompts for the *SGS-V*

Table 3
Endorsement of SGS-V/SGS-NC items by the CSA and non-CSA groups.

	CSA	Non-CSA		
	N (%)	*N* (%)	X^2	*OR*
Victim Selection				
Compliant/trusting	258 (65.48)	372 (77.02)	13.71***	0.57†
Low self-esteem	251 (62.75)	169 (34.99)	66.50***	**3.13**
Lonely/isolated	157 (39.75)	108 (22.13)	31.42***	**2.32**
Troubled	114 (29.01)	66 (13.64)	30.48***	**2.58**
Needy	63 (15.91)	42 (8.68)	10.16**	**1.99**
Unwanted/unloved	167 (42.49)	86 (17.66)	64.28***	**3.44**
Parents not resources	154 (39.09)	70 (14.55)	67.16***	**3.76**
Single mother/need "father figure"	73 (18.16)	70 (14.34)	2.10	1.32
Lack of supervision	135 (33.83)	42 (8.55)	86.72***	**5.46**
Gaining Access and Isolation				
Involvement in youth-serving organizations	35 (8.62)	203 (41.51)	121.27***	0.13†
Manipulate family	99 (24.75)	39 (8.01)	45.59***	**3.77**
Activities alone with children	228 (58.61)	141 (29.31)	74.39***	**3.41**
Overnight stays/outings	60 (15.19)	50 (10.33)	4.26*	1.55
Separate child from peers and family	114 (29.38)	10 (2.08)	128.64***	**19.54**
Trust Development				
Charming/nice/likable	285 (72.15)	355 (74.74)	0.61	0.88
Insider status/good reputation	82 (20.87)	143 (30.3)	9.43**	0.61†
Affectionate/loving	213 (55.04)	180 (38.71)	22.01***	**1.94**
Giving the child attention	226 (57.65)	138 (29.61)	67.38***	**3.23**
Favoritism	125 (33.42)	76 (16.17)	33.22***	**2.6**
Compliments	193 (51.19)	186 (39.91)	10.26**	1.58
Spending time with child	185 (47.8)	159 (33.97)	16.28***	**1.78**
Engage in childlike activities	140 (35.9)	144 (30.44)	2.64	1.28
Rewards/privileges	96 (24.43)	91 (19.16)	3.23	1.36
Provided drugs and/or alcohol	64 (16)	19 (3.96)	35.64***	**4.61**
Desensitization to Sexual Content and Physical Touch				
Ask about sexual experience/relationships	115 (29.11)	29 (6.05)	81.98***	**6.36**
Talk about sexual things they did	108 (27.69)	19 (3.97)	95.08***	**9.25**
Inappropriate sexual language	138 (35.94)	43 (9)	91.56***	**5.66**
Sexual education	90 (23.2)	34 (7.14)	43.52***	**3.92**
Accidental touching	143 (37.63)	13 (2.71)	171.86***	**21.6**
Watch the child undressing	78 (20.74)	11 (2.3)	74.91***	**11.11**
Exposing naked body	169 (44.71)	14 (2.94)	216.28***	**26.64**
Show child pornography	46 (11.7)	8 (1.66)	35.91***	**7.82**
Seemingly innocent contact	182 (48.79)	49 (10.34)	153.7***	**8.24**
Increasing sexual touching	156 (42.39)	10 (2.09)	211.99***	**34.37**
Post-Abuse Maintenance				
Told not to tell anyone	168 (44.21)	8 (1.67)	232.78***	**46.46**
Encouraging secrets	118 (31.98)	15 (3.14)	128.68***	**14.47**
I love you/you're special	140 (36.55)	77 (16.28)	44.9***	**2.96**
Rewards/bribes	44 (11.43)	8 (1.67)	34.23***	**7.58**
Persuaded it was acceptable behavior	134 (35.45)	53 (11.35)	69.02***	**4.28**
Misstated moral standards	98 (26.56)	3 (0.63)	130.06***	**56.7**
Victim made to feel responsible	52 (13.83)	7 (1.47)	47.88***	**10.73**
Threats of abandonment/rejection	57 (14.47)	9 (1.89)	46.85***	**8.76**

† = a significant item comparison in which the Non-CSA group had higher endorsement than the CSA group.
*$p < .05$.
**$p < .01$.
***$p < .001$.

Table 4
Comparison SGS-V/SGS-NC item endorsement by CSA and non-CSA groups/subgroups (N = 913).

	CSA (n = 411)	Non-CSA (n = 502)			Non-CSA (Family) (n = 169)			Non-CSA (Non-Family) (n = 168)			Non-CSA (Community Member) (n = 165)		
	M/Med	*M*/Med	U	*r*	*M*/Med	U	*r*	*M*/Med	U	*r*	*M*/Med	U	*r*
TOTAL	13.68/14	6.78/6	20,264***	0.42	7.15/6	6887***	0.36	7.08/6	7355.5***	0.37	6.16/5	6022***	0.44
Victim Selection	3.34/3	2.05/1	48,853***	0.30	2.09/1	16,581***	0.26	2.09/1	16,903***	0.26	1.96/1	15,370***	0.29
Gaining Access and Isolation	1.35/1	0.91/1	68,084***	0.18	0.87/1	22,211***	0.19	0.83/1	21,763***	0.20	1.02/1	24,111**	0.12
Trust Development	4.06/4	3.07/3	54,374***	0.18	3.25/3	18,282***	0.13	3.26/3	19,238**	0.13	2.73/2	16,855***	0.23
Desensitization to Sexual Content and Physical Touch	3.16/3	0.44/0	19,031***	0.63	0.41/0	6112***	0.56	0.63/0	7664***	0.52	0.27/0	5256***	0.60
Post-Abuse Maintenance	2.02/2	0.35/0	31,432***	0.48	0.53/0	11,788***	0.35	0.38/0	10,774***	0.42	0.15/0	8869***	0.50

Note. Mann-Whitney *U* tests performed. Statistics reflect non-CSA group/subgroup compared against CSA group. Effect size (*r*) considered small = 0.10, medium = 0.30, large = 0.50.
*$p < .05$.
**$p < .01$.
***$p < .001$.

Table 5
Endorsement of SGS-V/SGS-NC items by the CSA and Non-CSA subgroups.

	CSA	Non-CSA Family			Non-CSA Non-Family			Non-CSA Community		
	N (%)	*N* (%)	*X2*	OR	*N* (%)	*X2*	OR	*N* (%)	*X2*	OR
Victim Selection										
Compliant/trusting	258 (65.48)	128 (77.11)	6.84**	0.56†	117 (72.67)	2.38	0.71	127 (81.41)	12.75***	0.43†
Low self-esteem	251 (62.75)	58 (35.15)	34.8***	**3.1**	58 (36.25)	31.39***	**2.96**	53 (33.54)	37.79***	**3.33**
Lonely/isolated	157 (39.75)	38 (22.89)	13.91***	**2.22**	37 (22.7)	14.04***	**2.24**	33 (20.75)	17.31***	**2.51**
Troubled	114 (29.01)	27 (16.36)	9.18**	**2.09**	24 (14.81)	11.62***	**2.35**	15 (9.55)	22.58***	**3.86**
Needy	63 (15.91)	14 (8.64)	4.51*	**2**	12 (7.41)	6.43**	**2.36**	16 (10)	2.80	**1.7**
Unwanted/unloved	167 (42.49)	31 (19.02)	26.68***	**3.14**	32 (19.63)	25.22***	**3.02**	23 (14.29)	39.09***	**4.42**
Parents not resources	154 (39.09)	24 (14.81)	29.97***	**3.68**	25 (15.43)	28.35***	**3.51**	21 (13.38)	33.06***	**4.15**
Single mother/need "father figure"	73 (18.16)	20 (12.27)	2.51	1.59	30 (18.29)	0	0.99	20 (12.42)	2.34	1.56
Lack of supervision	135 (33.83)	13 (7.83)	39.67***	**6**	14 (8.59)	36.57***	**5.43**	15 (9.26)	34.28***	**5**
Gaining Access and Isolation										
Involvement in youth-serving organizations	35 (8.62)	38 (23.03)	20.57***	0.32†	58 (35.15)	58.64***	0.17†	107 (67.3)	205.94***	0.05†
Manipulate family	99 (24.75)	14 (8.48)	18.31***	**3.54**	18 (11.04)	12.4***	**2.65**	7 (4.4)	29.34***	**7.12**
Activities alone with children	228 (58.61)	57 (34.97)	24.77***	**2.63**	48 (29.81)	36.63***	**3.33**	36 (22.93)	55.61***	**4.75**
Overnight stays/outings	60 (15.19)	30 (18.29)	0.61	**0.8**	10 (6.21)	7.58**	**2.7**	10 (6.29)	7.35**	**2.66**
Separate child from peers and family	114 (29.38)	5 (3.07)	45.4***	**13.11**	3 (1.89)	49.08***	**21.57**	2 (1.26)	51.72***	**32.55**
Trust Development										
Charming/nice/likable	285 (72.15)	92 (58.97)	8.39**	**1.8**	141 (87.04)	13.34***	0.39†	122 (77.71)	1.51	0.74
Insider status/good reputation	82 (20.87)	28 (17.39)	0.66	1.25	49 (30.43)	5.28*	0.6†	66 (44)	28.15***	0.34†
Affectionate/loving	213 (55.04)	94 (60.65)	1.20	0.79	55 (35.26)	16.62***	**2.24**	31 (20.13)	52.82***	**4.84**
Giving the child attention	226 (57.65)	57 (37.5)	17.02***	**2.27**	44 (28.21)	37.55***	**3.46**	37 (23.42)	51.53***	**4.44**
Favoritism	125 (33.42)	16 (10.26)	29.08***	**4.38**	27 (17.09)	13.73***	**2.43**	33 (21.15)	7.34**	**1.87**
Compliments	193 (51.19)	54 (34.84)	11.16***	**1.96**	64 (41.03)	4.17*	1.51	68 (43.87)	2.07	1.34
Spending time with child	185 (47.8)	61 (39.35)	2.86	1.41	59 (37.34)	4.55*	1.54	39 (25.16)	22.48***	**2.72**
Engage in childlike activities	140 (35.9)	57 (35.85)	0.00	1	60 (37.97)	0.13	0.91	27 (17.31)	17.27***	**2.67**
Rewards/privileges	96 (24.43)	57 (36.31)	7.3**	0.57†	24 (15)	5.41*	**1.83**	10 (6.33)	22.61***	**4.77**
Provided drugs and/or alcohol	64 (16)	4 (2.47)	18.6***	**7.51**	13 (8.12)	5.33*	**2.15**	2 (1.27)	22.19***	**14.82**
Desensitization to Sexual Content and Physical Touch										
Ask about sexual experience/relationships	115 (29.11)	5 (3.12)	43.86***	**12.7**	18 (11.18)	19.24***	**3.26**	6 (3.8)	40.85***	**10.37**
Talk about sexual things they did	108 (27.69)	4 (2.48)	43.17***	**14.99**	12 (7.55)	25.67***	**4.68**	3 (1.89)	45.04***	**19.85**
Inappropriate sexual language	138 (35.94)	14 (8.75)	40.12***	**5.83**	22 (13.84)	25.37***	**3.49**	7 (4.4)	55.53***	**12.14**
Sexual education	90 (23.2)	16 (10.06)	11.62***	**2.69**	12 (7.5)	17.4***	**3.72**	6 (3.82)	27.59***	**7.58**
Accidental touching	143 (37.63)	3 (1.88)	71.17***	**31.45**	4 (2.5)	68.38***	**23.44**	6 (3.75)	63.01***	**15.43**
Watch the child undressing	78 (20.74)	4 (2.52)	27.22***	**10.12**	5 (3.12)	25.3***	**8.09**	2 (1.25)	32.08***	**20.62**
Exposing naked body	169 (44.71)	3 (1.9)	91.75***	**41.59**	9 (5.66)	75.26***	**13.42**	2 (1.25)	95.93***	**63.49**
Show child pornography	46 (11.7)	1 (0.62)	16.79***	**21.29**	7 (4.38)	6.23**	**2.89**	0 (0)	18.8***	**Inf**
Seemingly innocent contact	182 (48.79)	18 (11.25)	65.73***	**7.49**	16 (10.19)	68.72***	**8.37**	15 (9.55)	71.18***	**8.99**
Increasing sexual touching	156 (42.39)	1 (0.62)	92.16***	**117.88**	9 (5.66)	67.95***	**12.22**	0 (0)	93.2***	**Inf**
Post-Abuse Maintenance										
Told not to tell anyone	168 (44.21)	1 (0.62)	97.46***	**125.37**	6 (3.75)	82.56***	**20.26**	1 (0.63)	96.91***	**124.58**
Encouraging secrets	118 (31.98)	4 (2.52)	52.64***	**18.16**	11 (6.92)	36.45***	**6.31**	0 (0)	64.02***	**Inf**
I love you/you're special	140 (36.55)	45 (29.41)	2.16	1.38	22 (13.75)	26.96***	**3.61**	10 (6.25)	50.33***	**8.62**
Rewards/bribes	44 (11.43)	2 (1.25)	13.86***	**10.17**	1 (0.62)	16.13***	**20.59**	5 (3.16)	8.34**	**3.94**
Persuaded it was acceptable behavior	134 (35.45)	22 (14.38)	22.3***	**3.26**	23 (14.65)	22.15***	**3.19**	8 (5.1)	50.88***	**10.2**
Misstated moral standards	98 (26.56)	1 (0.63)	47.35***	**56.93**	2 (1.27)	44.4***	**28.11**	0 (0)	49.81***	**Inf**
Victim made to feel responsible	52 (13.83)	4 (2.5)	14.21***	**6.24**	3 (1.89)	16.01***	**8.33**	0 (0)	22.51***	**Inf**
Threats of abandonment/rejection	57 (14.47)	5 (3.18)	13.2***	**5.13**	3 (1.88)	17.4***	**8.83**	1 (0.63)	21.66***	**26.65**

ORs of infinity ("Inf") reflect odds ratios in which there are no individuals endorsing sexual grooming behavior in the Non-CSA group (i.e., the denominator of the OR equation is zero).
† = a significant item comparison in which the Non-CSA group had higher endorsement than the CSA group.
*$p < .05$.

$^{**}p < .01$.
$^{***}p < .001$.

compared to *SGS-NC*.

4.2.3. Analytic plan

First, the frequency and percentage of participants in the CSA group and Non-CSA subgroups (Family, Non-Family, Community) who endorsed each *SGS-V/SGS-NC* items were examined; the difference in percentage between the CSA and Non-CSA group was also calculated. Then, chi-squares were used to examine the difference between the endorsement of *SGS-V/SGS-NC* items for the CSA and the combined Non-CSA groups, as well as the CSA compared to each of the three Non-CSA subgroups. Moreover, odds ratios (ORs) were used to reflect the increasing odds of endorsing an item for participants in the CSA group compared to the Non-CSA groups.

5. Results

5.1. CSA versus non-CSA

5.1.1. Red flag behaviors

The frequency and percentages for the endorsement *SGS-V/SGS-NC* items by the CSA and Non-CSA groups are presented in Table 3, along with the chi-square comparisons and ORs. For the CSA group, the endorsement of each behavior ranged between 8.62 % (involvement in youth-serving organization) to 72.12 % (charming/likable/nice). The Non-CSA groups ranged between 0.63 % (misstated moral standards) to 77.0 % (compliant/trusting child).

All but four (i.e., single mother/need "father figure"; charming/nice/likable; engaged in childlike activities; rewards/privileges) of the 42 chi-square analyses were significantly different when comparing endorsement of the sexual grooming behavior between the those who experienced CSA and those did not. An examination of the significant findings showed that in all but three of the comparisons, the CSA group endorsed the sexual grooming behavior more than the Non-CSA group. The three comparisons where the Non-CSA group endorsed the behavior more often was: compliant/trusting (77.02 % v. 65.48 %), involvement in youth serving organizations (41.51 % v. 8.62 %), and insider status/good reputation (30.3 % v. 20.87 %). When examining the ORs for the significant findings, 14 were indicated of large effects, 8 moderate effects, and 11 small effects; only five fell in the negligible effect. The largest ORs were for the behaviors of misstating moral standard about touch (56.7 %), telling the child not to tell anyone (46.46 %), increasing sexual touching (34.37 %), exposing naked body to a child (26.64 %), and use of accidental touching (21.6 %).

5.1.2. Number of behaviors

A series of Mann-Whitney *U* tests were performed to examine whether the total number of sexual grooming behaviors experienced by the CSA group differed from the Non-CSA group (see Table 3). Results showed the total sexual grooming score was significantly different between CSA ($M = 13.68$) and Non-CSA ($M = 6.78$) groups, which reflected a moderate effect size. Moreover, when examining each SGM stage, the CSA group had significantly more behaviors in each stage compared to the Non-CSA groups. These reflected small (gaining access/isolation; trust development), moderate (victim selection; post-abuse maintenance), and large (desensitization to sexual content and physical contact) effect sizes.

5.1.3. CSA versus non-CSA subgroups

In order to test if the sexual behaviors differed between the group who experienced CSA and those that did not based upon the relationship to the individual, the CSA group was compared to the three Non-CSA subgroups as described below.

5.1.4. Red flag behaviors

The frequency and percentage of the endorsement of *SGS-V* items by the CSA and the three Non-CSA subgroups, as well as the chi-square comparisons and ORs, are presented in Table 5. When comparing the CSA group to the Non-CSA Family, Non-CSA Non-Family, and Non-CSA Community groups, there were 35, 39, and 38 significant differences, respectively, across the 42 comparisons. While most of the significant comparisons showed the CSA group endorsed the item more than the Non-CSA Subgroups, there were three items for the Non-CSA Family (i.e., compliant/trusting; involvement in youth-serving organization; rewards/privileges), three for Non-CSA Non-Family (i.e., involvement in youth-serving organizations; charming/nice/likable; insider status/good reputation) and three for Non-CSA Community (i.e., compliant/trusting; involvement in youth-serving organization; insider status/good reputation) that were higher for the Non-CSA Subgroup than the CSA group. When examining the ORs for the significant findings, the vast majority of ORs fell in at least the small effect range (32 of 35 for Non-CSA Family; 34 of 39 for Non-CSA Non-Family; 35 of 38 for Non-CSA Community).

5.1.5. Number of behaviors

A series of Mann-Whitney *U* tests were conducted to examine whether the total number of sexual grooming behaviors experienced by the CSA group differed from each of the Non-CSA subgroups (see Table 4). When examined the total sexual grooming score, results showed the CSA group ($M = 13.68$) reported significantly more sexual grooming behaviors compared to the Non-CSA Family ($M = 7.15$), Non-CSA Non-Family ($M = 7.08$), and Non-CSA Community ($M = 6.16$); these reflected moderate effect sizes. Each SGM stage was examined, which showed the CSA group had significantly more behaviors within every SGM stage compared to each Non-CSA

subgroup; the effect sizes ranged from small to large.

6. Discussion

Even though elements of sexual grooming appear to be involved in most cases of CSA, relatively little is known about these behaviors empirically. In recent years, there has been increased research on identifying and quantifying the specific behaviors involved in the sexual grooming process (SGM in Winters et al., 2020; *SGS-V* in Winters & Jeglic, 2021) which is pivotal for the prevention and detection of CSA. However, the biggest impediment to detection and prevention of sexual grooming is that it remains unclear which sexual grooming behaviors may differ from normal adult/child interactions. It is necessary to better understand this differentiation to determine which behaviors are more concerning and indicative of potential sexual abuse. This study was the first to compare victims' experiences of SGM behaviors to individuals who never experienced CSA. Overall, the results showed there were significant differences in the experience of sexual grooming behaviors between the CSA and Non-CSA groups, which revealed the extent to which each behavior serves as a red flag for adult male perpetrated CSA. The findings also supported the hypothesis that cases of CSA will involve more sexual grooming behaviors compared to Non-CSA relationships, suggesting it is important to consider the *number* of behaviors used from the SGM. Moreover, there were some interesting patterns that emerged when examining the specific Non-CSA Groups (Family, Non-Family, Community), suggesting there may be unique considerations for adult interactions with children based on the relationship to the child.

6.1. Sexual grooming versus normative interactions

The findings showed significant differences in 38 of 42 (90 %) of the sexual grooming behaviors experienced by victims of CSA and those who did not experience CSA. These "red flag" behaviors fell into all five stages of the SGM. Based on the results of the first four SGM stages, we compiled a list of "Red Flag" grooming behaviors (see Supplemental Fig. 1), which designates the behaviors that showed ORs that were in the small (yellow; "enhanced risk"), moderate (orange; "moderate risk"), and large (red; "high risk") effect size range. The behaviors reflect those found in the pre-abuse stages of the SGM to assist in identifying sexual grooming *before* the actual abuse has occurred (i.e., post-abuse maintenance is not included), which were two to 34 times more likely to occur in cases of CSA.

We also found that cases of CSA included a higher number of different sexual grooming behaviors than cases not involving abuse suggesting that when an increased variety of sexual grooming behaviors are present, it could be indicative of possible CSA. In this study we found that on average, those who experienced CSA endorsed twice as many sexual grooming behaviors as those who did not report CSA, with those experiencing CSA reporting approximately 14 sexual grooming behaviors. This is similar to Winters and Jeglic's (2021) study where they found that on average, undergraduate students who reported CSA endorsed 15 sexual grooming behaviors. Therefore, while there have been 42 identified sexual grooming behaviors, on average only about one third of them are experienced by those who experience CSA and depending upon the behaviors experienced, sexual grooming may look quite different across cases.

6.2. Victim selection

In line with previous research, several victim characteristics differed between individuals who reported CSA and those that did not. In particular, a lack of supervision or parents who were not resources for the child was identified to occur more frequently (5.5 and 3.75 times, respectively) among those experiencing CSA as compared to those who did not experience CSA. This has important implications for prevention as a lack of supervision is something that can be addressed through policy and education. Efforts should be made to ensure parents/guardians are aware of supervision as a necessity throughout childhood and adolescence and assistance should be provided to those parents/guardians who are unable to provide comprehensive supervision. Policies can be proposed to fund programs that provide free or low-cost childcare and summer camps for those that cannot afford it or are incapable of providing it. This is important because one study found that most CSA was happening in the afterschool hours and summer months when it is more likely that children may not have had adequate adult supervision if, for example, their parents are working (Colombino, 2017). Feeling like parents were not resources also falls in line with inadequate parental supervision. While this characteristic is arguably more relevant to the psychological neglect of children, it still suggests that children not feeling their parents' emotional presence may also be a risk factor that those who want to abuse children may exploit (Finkelhor & Baron, 1986). Talking to their children and keeping open lines of communication with their children has been recommended as a way parents can protect their children from sexual abuse (See Jeglic & Calkins, 2018).

The psychological vulnerability of the child themselves, such as having low self-esteem, feeling lonely or isolated, being troubled (i.e., having psychological or behavioral problems), and feeling needy, unwanted, and unloved, was also identified as differentiating those who were abused as children from those who were not. It has long been known that those who perpetrate sex crimes seek out vulnerable victims, such as children who are socially isolated or have emotional issues (see Finkelhor & Baron, 1986; Fleming et al., 1997). This is important in prevention efforts as children and teens who are struggling emotionally and socially can be identified and additional protections put in place to help them such as school counseling, family counseling, and on-line monitoring. Additional training and resources can be provided to those who work with youth such as teachers, coaches and childcare workers help identify vulnerable youth and make appropriate referrals. Research suggests that teens who are vulnerable may be more likely to seek support through on-line forums (Wells & Mitchell, 2008) and so having trained moderators or artificial intelligence to flag at risk individuals and provide referrals and on-line resources can be helpful.

Historically, it has been believed that coming from a single parent home increased a child's vulnerability as the person perpetrating the abuse may seek to fill the "father figure" role (Finkelhor, 1984; Radhakrishna et al., 2001). In this study, coming from a single parent home was not identified as being a red flag behavior, and was the only characteristic identified in the victim selection stage that did not differ between those who experienced CSA and those that did not. This is similar to recent studies looking at victim selection characteristics used in the sexual grooming of minors by Catholic Clergy (Winters et al., 2022) and the Boy Scouts (Winters & Jeglic, in submission). The finding in those youth-serving contexts was derived from archival cases wherein the abuse took place many decades earlier when divorce was not as commonplace in the U.S.; Goldstein, 1999), and in the case of the clergy study, the families were Catholic and divorce was frowned upon (Gray, 2013). Thus, in the research examining historical cases of CSA it was not surprising that coming from a single parent home was not found to be a risk factor for sexual grooming because there were few children in those samples that came from single parent homes. However, this study, which represented a range of CSA cases within and outside youth-serving organizations, suggests that it may not be that the child comes from a single parent home that serves as a risk factor, but rather that it is inadequate supervision and poor parental relationships regardless of the parents' marital status that causes vulnerability.

6.3. Gaining access and isolation

The biggest red flag behavior that was identified in this stage was separating the child from peers and family (20 times more likely in cases of CSA). This can mean both physically separating them but, perhaps more importantly, psychologically separating them so the child feels they do not have social supports outside the abusive relationship. This can further exacerbate the feelings of parental alienation and isolation described in the victim selection stage, making the child more vulnerable to abuse. Other key behaviors include spending time with the family to gain access to the child (3.8 times more likely) and doing activities alone with the child without other adults present (3.4 times more likely). Spending time with the family to gain access to the child is a strategy known as familial grooming (McAlinden, 2006, 2012) wherein the person hoping to perpetrate the abuse befriends the family to gain their trust so that they can have access to the child without suspicion. This tactic was particularly salient when the group who was assigned to the community member (coach, teacher, religious leader) was compared to those who experienced CSA. This suggests that a community member seeking to spend time with the family should be closely monitored around children and all activities should be done as a family unit. This monitoring should be facilitated by the organization through which the community member is employed (e.g., through policies and procedures to prohibit certain contact outside of the position), as well as parents and caregivers who the perpetrator may also try to groom to gain access to the child.

While overnight stays and outings were found to significantly differ between those in the overall Non-CSA condition and those who experienced CSA, and then specifically between the Non-CSA Non-Family and Non-CSA Community conditions and those who experienced CSA, this difference was not observed when the group assigned to the Non-CSA Family condition was compared to the CSA group. This makes sense as children will often have sleepovers or outings with family members and this is not necessarily indicative of sexual grooming; however, such behaviors when engaged in by non-family and community members may be more worrisome.

6.4. Trust development

While several of the trust development behaviors differed significantly between the CSA and Non-CSA groups, this was the stage that demonstrated the smallest effect size between groups. When combined, only providing the child with drugs and/or alcohol emerged as a moderate risk behavior, while being affectionate/loving, giving the child attention, favoritism and spending time with the child emerged as enhanced risk behaviors (see Supplemental Fig. 1). It was in this stage that the relationship with the individual became particularly relevant. For example, behaviors thought to be indicative of grooming, such as engaging in childlike behaviors and giving the child rewards and privileges, did not differ between the CSA and Non-CSA groups overall, but when broken down by relationship it was found that giving rewards and privileges and engaging in childlike activities could be indicative of sexual grooming when it involves a non-family member or community member, respectively. This underscores the need to consider context when examining potential grooming behaviors and that loving, caring behaviors may be normative with a family member, but should be regarded with caution when exhibited by a non-family member or community member. It also stresses the importance of not over-pathologizing normal healthy adult/child interactions involving trust development, as these may involve mentoring or developing a close relationship with the child. A recent meta-analysis of 70 youth mentoring programs found that youth who were mentored by non-parent adults were more likely to have improved academic performance and less likely to have behavioral and psychosocial problems because of their participation in the mentoring program (Raposa, 2019). This suggests that developing trusting relationships with non-parent adults can be important for youth success, but that these mentoring relationships must be monitored and follow guidelines for the prevention of CSA as described by the Centers for Disease Control (CDC; Saul & Audage, 2007).

6.5. Desensitization to sexual content and physical touch

As hypothesized, the most high and moderate risk behaviors were identified in this stage of the SGM, which is consistent with prior literature (Winters & Jeglic, 2016). In this sample, behaviors in the desensitization to sexual content and physical touch stage were four to 34 times more likely to be present in cases of CSA. This is the stage likely to immediately precede the actual CSA and the one in which the individual who perpetrates the abuse is pushing the physical comfort and sexual content limits of the child, testing whether they will be able to engage in the abuse without the child reporting it. Importantly, these boundary violation behaviors are significant regardless of the relationship between the child and the male adult. As such any sexual touching, exposing of the adult's nude body,

excessive touching of the child, exposure to sexual content such as pornography or discussion of sexual behaviors should be considered red flags and investigated immediately. As most of these behaviors are objective and readily observable it is important for all parents, guardians, and supervisory adults to be able to identify these red flag behaviors and know how to respond should they observe a male adult engaging in them with a child.

6.6. Post-abuse maintenance behaviors

Along with the desensitization stage, most behaviors in the post-abuse maintenance stage had large effect sizes ($n = 6$). For example, telling a child not to tell anyone and misstating moral standards were respectively 46 and 57 times more likely to be observed in the CSA condition compared to the Non-CSA conditions. Other red flag behaviors also emerged including encouraging secrets, giving the child rewards or bribes, making the child feel like the abuse was their fault and threats of abandonment and rejection. This intuitively makes sense, as these behaviors technically happen after the abuse has occurred according to the SGM and thus, it is understandable this category would likely differentiate those who were abused from those who were not. Also, it should be considered that the observed differences emerged because the prompt for the Non-CSA condition read: "There are many behaviors that an adult may use after spending time with a child" and therefore behaviors such as misstating moral standards and making a child feel responsible would not necessarily make sense in this context. However, the theme of secret keeping is an important one. In a study by Elliott et al. (1995) in which they interviewed individuals convicted of CSA about how they committed the abuse and what could be done to prevent it, one individual stated "secrecy and blame were my best weapons. Most kids worry that they are to blame for the abuse and that they should keep it a secret." (p. 590). Consequently, the authors recommended that "parents should emphasize openness and a 'no secrets' attitude throughout their children's upbringing" (p. 590), advice that has been echoed in other sexual violence prevention strategies for parents (see Jeglic & Calkins, 2018). Given Supplemental Fig. 1 highlighted only the pre-offense behaviors that can prevent abuse before it occurs, in Supplemental Fig. 2, we present the red flag post-abuse maintenance behaviors that may be observed in cases where a child is suspected of having been abused; these behaviors were between four and 57 times more likely in cases of CSA than Non-CSA.

6.7. Limitations

This study is not without limitations. First, the study is both retrospective and subjective in nature. As has been documented, memory of events that happen in childhood, particularly those that are traumatic, may change over time (Goodman et al., 2019); thus, there may be retrospective bias in responding to the questions. Second, some of the behaviors and tactics are subjective. While it is easy to determine if a child lived in a single parent home, identifying that a child is compliant and/or needy and vulnerable is more subjective and may vary based upon the person responding. As such, future studies can seek corroborative/collateral information to verify the accounts of CSA. Furthermore, as we continue to gain empirical information on the behaviors and tactics used in sexual grooming, it is our goal to make the behaviors more specific and objective so that they can be more easily identified.

As noted earlier, in this study we made a conscious decision to use adult males as the Non-CSA comparison group. This was done because the majority of sexual abuse perpetrated against children is perpetrated by an adult male (Basile et al., 2011; World Health Organization, 2012). However, recent research suggests that as many as 11.6 % of all perpetrators of sexual abuse are women (Cortoni et al., 2017), and approximately one third are minors themselves (Finkelhor et al., 2009). The SGM and *SGS-V* were developed based upon the existing sexual grooming literature which did not separate behaviors by the gender of the perpetrator and this study represents an overall summary of how these behaviors may differ for those that experience CSA and those who do not, but will not account for variability in tactic selection based upon the gender and age of the individual perpetrating the abuse. Furthermore, the sample size and presence of missing data (e.g., related to age of the perpetrator) did not allow for a more nuanced investigation of how sexual grooming may differ based upon the characteristics of the victim and individual perpetrating the abuse (e.g., age, gender, race/ethnicity; Kaylor et al., 2022). We are planning future studies using females, minors, and individuals from different cultural, ethnic, and racial backgrounds to address this limitation.

Additionally, the sample of participants in the present study was not particularly diverse, with the majority (71 %) identifying as White. It may be that race/ethnicity of the individual could impact their experience and relationship with others, given varied cultural norms. Another limitation of the sample was the CSA group had more woman in the sample than the Non-CSA group (74 % versus 55 % based on self-identified gender), which was a statistically significant difference. Although it should be noted that more girls than boys experience CSA (CDC, n.d.). Relationships between adults and boys or girls could vary, so some of the endorsements (or lack thereof) of certain behaviors could be a product of the gender of the individual.

Caution should also be taken in interpreting the findings of this study as these results are cross-sectional in nature and we are only presenting reported behaviors that differ between groups. Thus, while we believe that the identified red flag grooming behaviors are indicative of CSA, especially given the large and moderate effect sizes between the groups that experienced CSA and those that did not, a longitudinal study would be important to identify which behaviors predict CSA. However, such a study would be next to impossible to conduct for multiple logistic and ethical reasons and thus the findings of this study may be the best proxy that we can access.

6.8. Conclusions and implications

This study represents a big step forward in the identification of red flag grooming behaviors. One of the key criticisms of the sexual grooming research to date has been that many of the identified sexual grooming behaviors are similar to normal adult-child

interactions and thus it was not possible to identify sexual grooming behaviors until after the CSA occurred. We now have specific behaviors that are identified as red flags that are indicative of high, moderate, and enhanced risk for CSA, meaning that those who experienced CSA were between two to 34 times more likely than those who did not experience to report them. Moreover, the findings have shown that cases of confirmed CSA involved a higher number of sexual grooming behaviors than those that represented non-offending relationships, showing that caution should be taken when more of these behaviors are observed. The findings of this study have multiple implications for the prevention and detection of CSA as listed below.

1. First and foremost, these behaviors can be used for prevention education. Using the infographic included in Supplemental Fig. 1, parents, guardians, and those involved in youth-serving organizations can be educated on the identification of these red flag sexual grooming behaviors and what to do if they should be observed or reported. Supplemental Fig. 1 can be an important educational tool for these individuals to better identify and intervene before the abuse has occurred. Of course, none of these behaviors together or in combination can 100 % predict that abuse will occur, but these serve as important red flags that should raise concern and further inquiry/action taken if they are observed. While the emphasis of CSA prevention should fall to adults and not children (Rudolph & Zimmer-Gembeck, 2018), it is not always possible for parents to always supervise their children personally. In line with legislation such as Erin's Law, child sex abuse prevention education can also focus on sharing these red flag behaviors with children and let them know what they should do if they experience them.

   First and foremost, these behaviors can be used for prevention education. Using the infographic included in Supplemental Fig. 1, parents, guardians, and those involved in youth-serving organizations can be educated on the identification of these red flag sexual grooming behaviors and what to do if they should be observed or reported. Supplemental Fig. 1 can be an important educational tool for these individuals to better identify and intervene before the abuse has occurred. Of course, none of these behaviors together or in combination can 100 % predict that abuse will occur, but these serve as important red flags that should raise concern and further inquiry/action taken if they are observed. While the emphasis of CSA prevention should fall to adults and not children (Rudolph & Zimmer-Gembeck, 2018), it is not always possible for parents to always supervise their children personally. In line with legislation such as Erin's Law, child sex abuse prevention education can also focus on sharing these red flag behaviors with children and let them know what they should do if they experience them.
2. These red flag behaviors can also be used for the detection of CSA. If an adult is observed or reported to be engaging in one or more of the identified red flag behaviors with a minor, action should be taken immediately. The action taken will depend upon a multitude of factors including but not limited to the nature, type, and frequency of the behavior, as well as situational and contextual factors. Based on an evaluation of the aforementioned factors, action could involve contacting authorities, preventing contact between the adult and child, monitoring a situation more closely, providing documented oral/written feedback to the adult and/or conducting an internal investigation. If a child is identified to be vulnerable, then depending upon the identified vulnerability, interventions such as increased supervision, counseling or family intervention may be warranted.
3. These red flag sexual grooming behaviors can be used for the investigation of CSA. Those investigating allegations of CSA, such as law enforcement or social services, can use these red flag behaviors when they are interviewing the child and those around them. While the *SGS-V* has been designed to be used with adults who have experienced CSA, we are currently working on adapting the tool for use with children so that the grooming behaviors can be probed in a non-suggestive manner in line with recommendations for child forensic examiners (U.S. DOJ, 2001).
4. Finally, these red flag sexual grooming behaviors can be used in the prosecution of cases of CSA. Few cases of sexual abuse result in conviction (RAINN, n.d.). and because many of the sexual grooming behaviors take place when the child is isolated from others and there may not be physical signs of abuse, cases often come down to the credibility of the child's report (U.S. DOJ, 2001). Having documented or reported evidence of these red flags behaviors and how they align with child sexual grooming may help the prosecution make a stronger case. Importantly, as noted above, the presence of sexual grooming cannot prove that abuse occurred but may be helpful in gathering information about the context leading up to the abuse and how certain behaviors may impact victim responses (e.g., delayed disclosure). Of note, further validation is needed on the SGM to further understand and identify sexual grooming, although the research to date provides a basis for empirical data in understanding this construct.

The empirical identification of red flag sexual grooming behaviors is major advancement in the protection of children from sexual abuse. This study is a first step and additional research can further our knowledge of how to differentiate sexual grooming from normative adult-child interactions. For example, it may be there are certain clusters or constellations of behaviors that are particularly worrisome and thus, deserve greater caution and concern. Additionally, research should seek to examine whether there are differences across populations in terms of what behaviors are more worrisome (e.g., males versus female perpetrators, juveniles versus adult perpetrators, child versus adolescent potential victims). Taken together, for these findings to be meaningful, it is integral that they be integrated into existing CSA prevention policies and procedures.

Supplementary data to this article can be found online at https://doi.org/10.1016/j.chiabu.2022.105998.

Data availability

Data will be made available on request.

References

Basile, K. C., Black, M. C., Breiding, M. J., Chen, J., Merrick, M. T., Smith, S. G., & Walters, M. L. (2011). *National Intimate Partner and Sexual Violence Survey (NISVS): 2010 Summary Report*. Altlanta, GA: Centers for Disease Control and Prevention.

Bennett, N., & O'Donohue, W. (2014). The construct of grooming in child sexual abuse: Conceptual and measurement issues. *Journal of Child Sexual Abuse: Research, Treatment, & Program Innovations for Victims, Survivors, & Offenders, 23*(8), 957–976. https://doi.org/10.1080/10538712.2014.960632

Canter, D., Hughes, D., & Kirby, S. (1998). Paedophilia: Pathology, criminality, or both? The development of a multivariate model of offence behaviour in child sexual abuse. *Journal of Forensic Psychiatry, 9*(3), 532–555. https://doi.org/10.1080/09585189808405372

Centers for Disease Control. Fast facts: Preventing child sexual abuse. https://www.cdc.gov/violenceprevention/childsexualabuse/fastfact.html.

Colombino, N. (2017). *Preventing sexual violence where it most often occurs: An investigation of the situational and structural components of child sexual abuse in residential settings*. CUNY Academic Works. https://academicworks.cuny.edu/gc_etds/2274.

Cortoni, F., Babchishin, K. M., & Rat, C. (2017). The proportion of sexual offenders who are female is higher than thought: A meta-analysis. *Criminal Justice and Behavior, 44*(2), 145–162. https://doi.org/10.1177/0093854816658923

Craven, S., Brown, S., & Gilchrist, E. (2006). Sexual grooming of children: Review of literature and theoretical considerations. *Journal of Sexual Aggression, 12*(3), 287–299. https://doi.org/10.1080/13552600601069414

Elliott, M., Browne, K., & Kilcoyne, J. (1995). Child sexual abuse prevention: What offenders tell us. *Child Abuse & Neglect, 19*(5), 579–594. https://doi.org/10.1016/0145-2134(95)00017-3

Finkelhor, D. (1984). *Child sexual abuse: New theory and research*. Free Press.

Finkelhor, D., & Baron, L. (1986). Risk factors for child sexual abuse. *Journal of Interpersonal Violence, 1*(1), 43–71. https://doi.org/10.1177/088626086001001004

Finkelhor, D., Ormrod, R., & Chaffin, M. (2009). *Juveniles who commit sexual offenses*. Retrieved from. Office of Justice Programs https://www.ojp.gov/pdffiles1/ojjdp/227763.pdf.

Fleming, J., Mullen, P., & Bammer, G. (1997). A study of potential risk factors for sexual abuse in childhood. *Child Abuse & Neglect, 21*(1), 49–58. https://doi.org/10.1016/S0145-2134(96)00126-3

Goldstein, J. (1999). The leveling of divorce in the United States. *Demography, 36*(3), 409–414. https://doi.org/10.2307/2648063

Goodman, G. S., Quas, J. A., Goldfarb, D., Gonzalves, L., & Gonzalez, A. (2019). Trauma and long-term memory for childhood events: Impact matters. *Child Development Perspectives, 13*(1), 3–9. https://doi.org/10.1111/cdep.12307

Gray, M. (2013). Divorce (still) less likely among Catholics. http://nineteensixty-four.blogspot.com/2013/09/divorce-still-less-likely-among.html.

Groth, A. N., & Birnbaum, H. J. (1978). Adult sexual orientation and attraction to underage persons. *Archives of Sexual Behavior, 7*(3), 175–181. https://doi.org/10.1007/bf01542377

Hébert, M., Tourigny, M., Cyr, M., McDuff, P., & Joly, J. (2009). Prevalence of childhood sexual abuse and timing of disclosure in a representative sample of adults from Quebec. *Canadian Journal of Psychiatry., 54*(9), 631–636. https://doi.org/10.1177/070674370905400908

Jeglic, E. L., & Calkins. (2018). *C. Protecting your child from sexual abuse: What you need to know to keep your kids safe*. New York: Skyhorse.

Kaylor, L., Winters, G. M., & Jeglic, E. L. (2022). Exploring sexual grooming in female perpetrated child sexual abuse. *Child Sexual Abuse, 31*(5), 503–521. https://doi.org/10.1080/10538712.2021.1994505

Lanning, K. V. (2010). *Child molesters: A behavioral analysis* (5th ed.). Alexandria, VA: National Center for Missing & Exploited Children.

McAlinden, A. M. (2006). 'Setting'Em Up': Personal, familial and institutional grooming in the sexual abuse of children. *Social & Legal Studies, 15*(3), 339–362. https://doi.org/10.1177/0964663906066613

McAlinden, A. M. (2012). *'Grooming'and the Sexual Abuse of Children: Institutional, Internet and Familial Dimensions*. Oxford University Press.

Palan, S., & Schitte, C. (2018). Prolific.ac—A subject pool for online experiments. *Journal of Behavioral and Experimental Finance, 17*, 22–27. https://doi.org/10.1016/j.jbef.2017.12.004

Radhakrishna, A., Bou-Saada, I. E., Hunter, W. M., Catellier, D. J., & Kotch, J. B. (2001). Are father surrogates a risk factor for child maltreatment? *Child Maltreatment, 6*(4), 281–289. https://doi.org/10.1177/1077559501006004001

RAINN. The criminal justice system: Statistics. https://www.rainn.org/statistics/criminal-justice-system.

Raposa, E. B., Rhodes, J., Stams, G. J. J., Card, N., Burton, S., Schwartz, S.Hussain, S., … (2019). The effects of youth mentoring programs: A meta-analysis of outcome studies. *Journal of Youth and Adolescence, 48*(3), 423–443. https://doi.org/10.1007/s10964-019-00982-8

Rudolph, J., & Zimmer-Gembeck, M. J. (2018). Reviewing the focus: A summary and critique of child-focused sexual abuse prevention. *Trauma, Violence & Abuse, 19*(5), 543–554. https://doi.org/10.1177/1524838016675478

Saul, J., & Audage, N. C. (2007). *Preventing child sexual abuse within youth-serving organizations: Getting started on policies and procedures*. Atlanta, GA: Centers.

Spenard, K. D., & Cash, D. K. (2022). Retrospective perceptions of grooming in same-sex versus opposite-sex child sexual abuse. *Journal of Child Sexual Abuse, 31*(6), 692–706. https://doi.org/10.1080/10538712.2022.2123755

U.S. Department of Justice. (2001). Law enforcement response to child abuse. https://www.ojp.gov/pdffiles/162425.pdf.

van Dam, C. (2001). *Identifying child molesters: Preventing child sexual abuse by recognizing the patterns of the offenders*. Binghamton, NY, US: Haworth: Maltreatment and Trauma Press/The Haworth Press.

Wells, M., & Mitchell, K. J. (2008). How do high-risk youth use the Internet? Characteristics and implications for prevention. *Child Maltreatment, 13*(3), 227–234. https://doi.org/10.1177/1077559507312962

Winters, G. M., & Jeglic, E. L. (2016). I knew it all along: The sexual grooming behaviors of child molesters and the hindsight bias. *Journal of Child Sexual Abuse, 25*(1), 20–36. https://doi.org/10.1080/10538712.2015.1108945

Winters, G. M., & Jeglic, E. L. (2017). Stages of sexual grooming: Recognizing potentially predatory behaviors of child molesters. *Deviant Behavior, 38*(6), 724–733. https://doi.org/10.1080/01639625.2016.1197656

Winters, G. M., & Jeglic, E. L. (2021). The sexual grooming scale-victim version: The development and pilot testing of a measure to assess the nature and extent of child sexual grooming. *Victims & Offenders, 1–22*. https://doi.org/10.1080/15564886.2021.1974994

Winters, G. M., Jeglic, E. L., & Kaylor, L. E. (2020). Validation of the sexual grooming model of child sexual abusers. *Journal of Child Sexual Abuse, 29*(7), 855–875. https://doi.org/10.1080/10538712.2020.1801935

Winters, G. M., Jeglic, E. L., & Terry, K. J. (2022). The prevalence of sexual grooming behaviors in a large sample of clergy. *Sexual Abuse, 34*(8), 923–947. https://doi.org/10.1177/10790632211070803

Winters, G. M., Kaylor, L. E., & Jeglic, E. L. (2021). Toward a universal definition of child sexual grooming. *Deviant Behavior, 1-13*, 1–13. https://doi.org/10.1080/01639625.2021.1941427

World Health Organization. (2012). *Understanding and addressing violence against women: Intimate partner violence (No. WHO/RHR/12.36)*. World Health Organization.

Mini-Review

Updated Guidelines for the Medical Assessment and Care of Children Who May Have Been Sexually Abused

Joyce A. Adams MD [1,*], Nancy D. Kellogg MD [2], Karen J. Farst MD [3], Nancy S. Harper MD [4], Vincent J. Palusci MD, MS [5], Lori D. Frasier MD [6], Carolyn J. Levitt MD [7], Robert A. Shapiro MD [8], Rebecca L. Moles MD [9], Suzanne P. Starling MD [10]

[1] *Department of Pediatrics, University of California, Davis Medical Center, Sacramento, California*
[2] *Department of Pediatrics, University of Texas Health Science Center at San Antonio, San Antonio, Texas*
[3] *Department of Pediatrics, University of Arkansas for Medical Sciences, Arkansas Children's Hospital, Little Rock, Arkansas*
[4] *Department of Pediatrics, University of Minnesota; University of Minnesota Masonic Children's Hospital, Minneapolis, Minnesota*
[5] *Department of Pediatrics, New York University School of Medicine, New York, New York*
[6] *Department of Pediatrics, Penn State Milton S. Hershey Children's Hospital, Hershey, Pennsylvania*
[7] *Department of Pediatrics, University of Minnesota; Children's Hospitals and Clinics of Minnesota, St. Paul, Minnesota*
[8] *Department of Pediatrics, Cincinnati Children's Hospital Medical Center, Cincinnati, Ohio*
[9] *Department of Pediatrics, Yale School of Medicine, New Haven, Connecticut*
[10] *Department of Pediatrics, Eastern Virginia Medical School; Children's Hospital of The King's Daughters, Norfolk, Virginia*

A B S T R A C T

The medical evaluation is an important part of the clinical and legal process when child sexual abuse is suspected. Practitioners who examine children need to be up to date on current recommendations regarding when, how, and by whom these evaluations should be conducted, as well as how the medical findings should be interpreted. A previously published article on guidelines for medical care for sexually abused children has been widely used by physicians, nurses, and nurse practitioners to inform practice guidelines in this field. Since 2007, when the article was published, new research has suggested changes in some of the guidelines and in the table that lists medical and laboratory findings in children evaluated for suspected sexual abuse and suggests how these findings should be interpreted with respect to sexual abuse. A group of specialists in child abuse pediatrics met in person and via online communication from 2011 through 2014 to review published research as well as recommendations from the Centers for Disease Control and Prevention and the American Academy of Pediatrics and to reach consensus on if and how the guidelines and approach to interpretation table should be updated. The revisions are based, when possible, on data from well-designed, unbiased studies published in high-ranking, peer-reviewed, scientific journals that were reviewed and vetted by the authors. When such studies were not available, recommendations were based on expert consensus.
Key Words: Child sexual abuse, Differential diagnosis, Sexually transmitted infections, Expert opinion, Medical history taking, Peer review, Expert testimony

Introduction

A set of guidelines and recommendations, published in 2007,[1] were developed using a process of consensus development after a review of the medical literature available at the time regarding the medical evaluation and interpretation of medical and laboratory findings in children brought for examination for suspected sexual abuse. This report presents updated guidelines, developed after a review of recently published research and recommendations from the Centers for Disease Control and Prevention (CDC)[2] and the American Academy of Pediatrics (AAP).[3] The authors searched the medical literature to identify well-designed, unbiased studies published in high-ranking journals that addressed the topic of medical evaluation of suspected child sexual abuse and the interpretation of medical findings. The group reached consensus on the revision of the 2007 guidelines, based on literature critique and review.

Medical History

An accurate and complete history is essential in making the medical diagnosis and determining appropriate treatment of child abuse.[4] The history includes physical symptoms, emotional/behavioral symptoms, and information about the abuse needed to assess and manage suspected victims of abuse. Obtaining details about the abuse is typically coordinated with a multidisciplinary team and may be obtained by a forensic interviewer or a medical professional. Due to differences in purpose and approach, the medical history may differ, yet complement, the forensic interview. For example, a medical history identifying physical symptoms of painful urination may be directly related to a recent episode of sexual abuse and provide additional information of forensic significance.[5]

The authors indicate no conflicts of interest. The authors received financial support from the Midwest Regional Children's Advocacy Center, Office of Juvenile Justice and Delinquency Prevention (DOJ) by grant number 2013-CI-FX-K001.
* *Address correspondence to:* Joyce A. Adams, MD, UC Davis Pediatrics, 2516 Stockton Blvd, 3rd Floor, Sacramento, CA 95817; Phone: +1 (916) 734-3112
E-mail address: jadams@ucsd.edu (J.A. Adams).

http://dx.doi.org/10.1016/j.jpag.2015.01.007

Table 1
Examination Techniques

Genital Examination, Prepubertal Child		Anal Examination, Prepubertal Child	
Examination Positions	Supine Frog-leg or Lithotomy Prone Knee-chest (PKC)	Examination Positions (In Order of Preference)	Supine Knee-chest PKC Lateral Decubitus
Examination technique	Labial separation and traction PKC with gluteal lift Speculum examinations not indicated unless child sedated	Examination technique	Buttock separation PKC with gluteal lift
Confirmatory technique	Floating hymen with water or saline PKC with gluteal lift	Confirmatory technique	Reassess after bowel movement, ambulating, or alternate position
Genital Examination, Pubertal Child		**Anal Examination, Pubertal Child**	
Examination positions	Supine lithotomy PKC with gluteal lift	Examination positions	Supine knee-chest PKC Lateral decubitus
Examination technique	Labial separation and traction Speculum examination can be done if Tanner 3 or greater	Examination technique	Lateral buttock separation Gluteal lift in PKC
Confirmatory technique	Trace hymenal rim with cotton tip swab Foley catheter[58] PKC with gluteal lift	Confirmatory technique	Reassess after bowel movement, ambulating, or alternate position

The process of obtaining the history from the child and nonoffending caregiver also provides an opportunity to assess fears or concerns related to the abuse[4] and to stress the importance of engaging in evidence-based trauma-focused mental health therapy. A recent study found that trauma symptoms in children were highly associated with the degree of self-blame the child felt about the abuse incident(s), an issue that can be addressed during the medical evaluation.[6] This can also be an opportunity to assess whether the caregiver is supportive and protective of the child through the disclosure process. At the conclusion of the examination, the medical provider should explain to the caregivers the significance of physical findings, if any, and that a normal examination does not exclude abuse.

Table 2
Timing of Medical Examinations

Indications for *emergency* evaluation[13,59]
- Medical, psychological, or safety concerns such as acute pain or bleeding, suicidal ideation, or suspected human trafficking
- Alleged assault that may have occurred within the previous 72 hours (or other state-mandated time interval) necessitating collection of trace evidence for later forensic analysis
- Need for emergency contraception
- Need for postexposure prophylaxis (PEP) for STIs including human immunodeficiency virus (HIV)

Indications for *urgent* evaluation
- Suspected or reported sexual contact occurring within the previous 2 weeks, without emergency medical, psychological, or safety needs identified

Indications for *nonurgent* evaluation
- Disclosure of abuse by child, sexualized behaviors, sexual abuse suspected by a multidisciplinary team, or family concern for sexual abuse, but contact occurred more than 2 weeks prior without emergency medical, psychological, or safety needs identified

Indications for *follow-up* evaluation
- Findings on the initial examination are unclear or questionable necessitating reevaluation
- Further testing for STIs not identified or treated during the initial examination
- Documentation of healing/resolution of acute findings
- Confirmation of initial examination findings, when initial examination was performed by an examiner who had conducted fewer than 100 of such evaluations

Examination

All children who are suspected victims of child sexual abuse should be offered an examination performed by a medical provider with specialized training in sexual abuse evaluation (Table 1). The urgency of the medical evaluation can be prioritized as emergency, urgent, or nonurgent (Table 2). An emergency evaluation should be done without delay, and urgent and nonurgent evaluations should be done within 1 to 7 days. Some children will benefit from follow-up examinations with a specialized provider to reassess findings and conduct further testing,[7] particularly if acute injury or sexually transmitted infection (STI) is suspected (Table 2).

Previous versions of the guidelines suggested changing the "72-hour rule" for evidence collection in prepubertal children to the "24-hour rule."[8] Subsequent studies have confirmed that DNA is predominantly recovered when examinations of prepubertal children are conducted less than 24 hours from the time of the assault.[9,10] Research on the use of DNA amplification in sexual assault is limited in young children, but Y-chromosome specific DNA has been recovered in young female victims presenting 24 hours after assault.[11,12] Importantly, the presence of significant physical findings does not predict recovery of foreign DNA and should not be the basis for collecting forensic evidence.[10] Additionally, DNA can still be recovered following genital wiping after the event.[12]

At this time, forensic evidence collection is recommended for sexual contact that may have resulted in the exchange of biologic material within 24 hours in prepubertal children and within 72 hours in adolescents.[13] Some young children will still benefit from evidence collection beyond 24 hours,[13] especially in areas where DNA amplification is performed as part of crime lab analysis. Some

jurisdictions have expanded the evidence collection window on adolescent and adult sexual assault to 5 to 7 days because sperm may be recovered from the cervix more than 72 hours after an assault.[14] Collection of clothing, bedding, or other household items that may harbor potential trace evidence can occur at a later time and is not the role of the medical provider. Clinicians should become familiar with regional resources and recommendations regarding collection of evidence.

Documentation

The medical record should include history, physical examination, and laboratory findings.[15] The results and interpretation of the medical evaluation should be summarized carefully with unambiguous language that can be understood by nonmedical professionals.[16] Photodocumentation is recommended as a standard of care,[15] especially for examinations with positive findings, because abnormal examination findings are rare. Diagnostic-quality still images or videos allow for expert review for quality assurance, teaching, and legal proceedings[17]; however, photographs never substitute for detailed written descriptions of the examination findings.

Testing for STIs

Culture of potentially infected sites has traditionally been the diagnostic gold standard for cases of possible sexual abuse/assault.[18,19] Culture is costly and limited by low sensitivity, especially in the identification of *Chlamydia* infection (as low as 20% sensitive in prepubertal girls).[20] Nucleic acid amplification testing (NAAT) has been in use for years in the sexually active adolescent and adult populations due to its higher sensitivity (100% by transcription mediated amplification),[20] ability to collect a sample noninvasively, ability to test for both *Neisseria gonorrheae* and *Chlamydia trachomatis* with 1 sample, and its lower cost compared with culture. The US Food and Drug Administration has not approved the commercially available NAATs for use in prepubertal children, because the low prevalence of STIs in this population (<5 %)[20] compared with adolescents and adults makes it difficult to perform large randomized controlled trials for validation. However, their use has been studied in this population,[20] and the CDC discusses their use in the 2010 Sexually Transmitted Diseases Treatment Guideline: “NAATs can be used as an alternative to culture with vaginal specimens or urine from girls whereas culture remains the preferred method for urethral specimens or urine from boys and for extra-genital specimens for all children.”[2] Black et al[20] performed a multisite study comparing genital culture to NAAT in prepubertal and postpubertal children being evaluated for sexual abuse, which serves as the foundation for the CDC's recommendations on this topic. Even though there boys were included in the study population (51/536), none of the boys tested positive for an STI and extragenital site comparison testing was not included. Therefore, the CDC recommendations for NAATs for STIs in young children are limited to recommendations on genital testing in girls.

In 2014, the CDC removed its recommendation for *routine* additional testing when a NAAT is positive for *C trachomatis*; however, there is still a recommendation to consider retesting with an alternate target for *N gonorrhoeae* and for “consultation with an expert” when using NAATs in cases of child sexual abuse evaluation.[21] When NAATs are used to diagnose infection in prepubertal children or older children and the result could have significance in legal proceedings, confirmatory testing should be performed to exclude a possible false-positive result.[20,22,23]

Although the CDC still recommends culture for nongenital sites, many practitioners find it difficult to access cultures. NAATs have been evaluated in adult studies for pharyngeal[24,25] and anorectal[26,27] infections. NAATs (especially strand displacement amplification [SDA] and transcription mediated amplification [TMA]) have been found to have superior sensitivity to detecting infection at these sites compared with culture and specificity rates that are well within the range of acceptable for clinical practice. The practitioner must be familiar with the validation and confirmation practices of the laboratory processing specimens from their patients. If NAATs are used for testing in young children and the results could have forensic significance, the practitioner should develop a strategy for confirmatory testing, because the low prevalence of infection in this population lowers the positive predictive value of the result.

Culture by using Diamond's or InPouch TV© media remains the most specific method of diagnosing *Trichomonas vaginalis*.[28] When identified by wet mount examination, there is a potential to misidentify nonpathogenic intestinal species of *Trichomonas* (such as *T hominis*) due to morphologic similarities[23] and the possibility of fecal cross-contamination. Additionally, the wet mount is estimated to be only 50% sensitive in detecting trichomonads. Rapid testing is now available by nucleic acid probe hybridization and TMA, but there have been no published studies regarding the use of these techniques for detecting *T vaginalis* in children. While these tests may offer more rapid turnaround and higher sensitivity than culture, confirmatory testing should be considered in cases where the result could have forensic significance and the population has a low prevalence of infection (eg, young children). At present, NAAT for *T vaginalis* is limited to TMA. However, several research polymerase chain reaction tests are being studied that show greater sensitivity compared with wet mount or culture.[23]

Interpretation of Findings

See Table 3. Additions to the guidelines table since the prior version are noted in bold, including a section on conditions that often are erroneously attributed to sexual abuse trauma.[29] Several deletions also were made. Flattened anal folds were removed from “findings commonly caused by medical conditions other than trauma or sexual contact” because no studies have addressed the association of flattened anal folds with sexual contact. The language “anal dilatation to less than 2 centimeters” was removed since the significance of anal dilation of a certain size is

Table 3
The 2015 Approach to Interpretation of Medical Findings in Suspected Child Sexual Abuse

Findings Documented in Newborns or Commonly Seen in Nonabused Children*
Normal Variants
1. Normal variations in appearance of the hymen
a. Annular: Hymenal tissue present all around the vaginal opening including at the 12 o'clock location
b. Crescentic hymen: hymenal tissue is absent at some point above the 3 to 9 o'clock locations
c. Imperforate hymen: hymen with no opening
d. Microperforate hymen: hymen with one or more small openings
e. Septate hymen: hymen with one or more septae across the opening
f. Redundant hymen: hymen with multiple flaps, folding over each other
g. Hymen with tag of tissue on the rim
h. Hymen with mounds or bumps on the rim at any location
i. **Any notch or cleft of the hymen (regardless of depth) above the 3 and 9 o'clock locations**
j. **Superficial notches of the hymen at or below the 3 and 9 o'clock locations**
k. Smooth posterior rim of hymen that appears to be relatively narrow along the entire rim
2. Periurethral or vestibular band(s)
3. Intravaginal ridge(s) or column(s)
4. External ridge on the hymen
5. Linea vestibularis (midline avascular area)
6. Diastasis ani (smooth area)
7. Perianal skin tag(s)
8. Hyperpigmentation of the skin of labia minora or perianal tissues in children of color
9. Dilation of the urethral opening
Findings commonly caused by medical conditions other than trauma or sexual contact†
10. Erythema of the genital tissues
11. increased vascularity of vestibule and hymen
12. Labial adhesion
13. Friability of the posterior fourchette
14. Vaginal discharge
15. **Molluscum contagiosum**
16. Anal fissure(s)
17. Venous congestion or venous pooling in the perianal area
18. Anal dilatation in children with predisposing conditions, such as current symptoms or history of constipation and/or encopresis, or children who are sedated, under anesthesia or with impaired neuromuscular tone for other reasons, such as post-mortem
Conditions mistaken for abuse
19. Urethral prolapse
20. Lichen sclerosus et atrophicus
21. Vulvar ulcer(s)
22. Erythema, inflammation, and fissuring of the perianal or vulvar tissues due to Infection with bacteria, fungus, viruses, parasites, or other infections that are not sexually transmitted
23. Failure of midline fusion, also called perineal groove
24. Rectal prolapse
25. **Visualization of the pectinate/dentate line at the juncture of the anoderm and rectal mucosa**
26. **Partial dilatation of the external anal sphincter, with the internal sphincter closed, causing the appearance of deep creases in the perianal skin**
27. **Red/purple discoloration of the genital structures (including the hymen) from lividity post-mortem, confirmed by histological analysis.**
Findings With No Expert Consensus on Interpretation With Respect to Sexual Contact or Trauma‡
28. Complete anal dilatation with relaxation of both the internal and external anal sphincters, in the absence of other predisposing factors such as constipation, encopresis, sedation, anesthesia, and neuromuscular conditions
29. **Notch or cleft in the hymen rim, at or below the 3 or 9 o'clock location, which is deeper than a superficial notch and may extend nearly to the base of the hymen, but is not a complete transsection. Complete clefts/transsections at 3 or 9 o'clock are also findings with no expert consensus in interpretation.**
30. Genital or anal condyloma acuminatum in the absence of other indicators of abuse; **lesions appearing for the first time in a child older than 5 years may be more likely to be the result of sexual transmission**[22]
31. Herpes type 1 or 2, confirmed by culture or PCR testing, in the genital or anal area of a child with no other indicators of sexual abuse[22]
Findings Caused by Trauma and/or Sexual Contact§
Acute trauma to external genital/anal tissues, which could be accidental or inflicted
32. Acute laceration(s) or bruising of labia, penis, scrotum, perianal tissues, or perineum
33. Acute laceration of the posterior fourchette or vestibule, not involving the hymen
Residual (healing) injuries to external genital/anal tissues (These rare findings are difficult to diagnose unless an acute injury was previously documented at the same location.)
34. Perianal scar
35. Scar of posterior fourchette or fossa
Injuries indicative of acute or healed trauma to the genital/anal tissues
36. Bruising, **petechiae, or abrasions** on the hymen
37. Acute laceration of the hymen, of any depth; partial or complete
38. **Vaginal laceration**
39. **Perianal laceration with exposure of tissues below the dermis**
40. **Healed hymenal transection/complete hymen cleft- a defect in the hymen between 4 o'clock and 8 o'clock that extends to the base of the hymen, with no hymenal tissue discernible at that location.**
41. A defect in the posterior (inferior) half of the hymen wider than a transsection with an absence of hymenal tissue extending to the base of the hymen.
Infections transmitted by sexual contact, unless there is evidence of perinatal transmission or clearly, reasonably and independently documented but rare nonsexual transmission
42. Genital, rectal or pharyngeal *Neisseria gonorrheae* infection
43. Syphilis
44. Genital or rectal *Chlamydia trachomatis* infection
45. *Trichomonas vaginalis* infection
46. HIV, if transmission by blood transfusion has been ruled out
Diagnostic of sexual contact
46. Pregnancy
47. Semen identified in forensic specimens taken directly from a child's body

This table lists medical and laboratory findings; however, most children who are evaluated for suspected sexual abuse will not have physical signs of injury or infection. The child's description of what happened and report of specific symptoms in relationship to the events described are both essential parts of a full medical evaluation. **Items in bold type have been added or revised in this updated version of the table.**

* These findings are normal and are unrelated to a child's disclosure of sexual abuse.

† These findings require that a differential diagnosis be considered, as each may have several different causes.

‡ These physical and laboratory findings may support a child's disclosure of sexual abuse, if one is given, but should be interpreted with caution if the child gives no disclosure. Physical findings (numbers 28 and 29) should be confirmed using additional examination positions and/or techniques. Additional information, such as mother's gynecologic history or child's history of oral lesions may clarify likelihood of sexual transmission for children with condyloma or herpes. After complete assessment, a report to Child Protective Services may be indicated in some cases. Photographs or video recordings of these findings should be evaluated and confirmed by an expert in sexual abuse evaluation to ensure accurate diagnosis.

§ These findings support a disclosure of sexual abuse and are highly suggestive of abuse even in the absence of a disclosure, unless a timely and plausible description of accidental injury is provided by the child and/or caretaker. Physical findings (items 32 through 41) should be confirmed using additional examination positions and/or techniques. Diagnoses of the sexually transmitted infections must be confirmed by additional testing to avoid assigning significance to possible false positive screening test results. Photographs or video recordings of these findings should be evaluated and confirmed by an expert in sexual abuse evaluation to ensure accurate diagnosis.

unknown. Anal dilation is a dynamic sign and measuring maximum anal dilation during the examination is difficult. Earlier studies on measurement using photographs[30,31] used different techniques, so results cannot be compared. One recent study reports reflex anal dilation in 36% of sexually abused children when examined in the lateral position with buttock separation for 30 seconds.[32] In

another study, total anal dilation occurred in 12% of the suspected abuse group and was significantly associated with reported anal penetration, after controlling for examination position and presence of anal symptoms.[33] Further research is needed to assess the significance of anal findings with respect to abuse and the impact of examination positions, techniques, and other factors on the frequency of these findings.

The "Indeterminate" category has been relabeled as "No Consensus" regarding the significance of a particular examination finding for sexual abuse. The term "Indeterminate" was often misinterpreted by clinicians to mean case information is insufficient or inadequate.[34] The lack of expert consensus does not mean that there is no scientific evidence regarding the findings in this category. These findings have been associated with sexual abuse in some studies in which study populations were too small, whereas other studies have documented the finding in a nonabused population or have not found an association with sexual abuse.

One examination finding that is listed under the "No Consensus" heading is a notch in the inferior rim of the hymen that may extend nearly to the base of the hymen. This finding has some support as being associated with sexual abuse,[35,36] but there is currently no consensus among experts as to the level of certainty that the finding is due to trauma. One challenge in interpreting the significance of a deep notch is defining it. Previously, a deep notch was defined as a notch that extended through more than 50% of the width of the hymen.[36] However, in clinical practice it is virtually impossible to measure or estimate the percentage of the hymenal width through which a notch extends. This finding must be differentiated from other variations such as a scalloped edge of hymen or a narrow section of the hymen rim adjacent to a mound. Even if a notch in the inferior rim of the hymen clearly extends nearly to the base of the hymen, the expert panel did not reach consensus that it should be considered clear evidence of prior injury.

Providers

The provision of medical care to child sexual abuse victims has become increasingly specialized. In December 2013, there were 324 diplomates of the American Board of Pediatrics with subspecialty certification in Child Abuse Pediatrics (CAP).[37] Additionally, the International Association of Forensic Nurses (IAFN) has established guidelines for the specialized training of pediatric sexual assault nurse examiners (SANE-P) in the care of the child victims of sexual assault,[38] which include a competency-based clinical preceptorship with an experienced provider.

Medical evaluations should be performed by a qualified provider with experience in child sexual abuse. These professionals may include child abuse pediatricians, SANE-Ps, or physicians and mid-level practitioners with advanced training in child abuse evaluation. The medical provider, regardless of degree, should have formal education and training in the medical evaluation of child sexual abuse. Medical providers need to be familiar with guidelines and recommendations on the medical evaluation of children available from the American Academy of Pediatrics (AAP)[3] and on the identification and treatment of STIs.[2]

Qualified medical providers need to maintain currency of practice through continuing education and peer review. Photodocumentation is recommended by the AAP,[3] National Children's Alliance (NCA),[15] and IAFN.[38] Medical peer review involves participation in expert review of photodocumented findings, particularly those thought to be abnormal or indicative of sexual abuse. Medical providers who perform higher numbers of child sexual abuse examinations,[39] read current medical literature, and regularly review cases with an expert demonstrate greater diagnostic accuracy in child sexual abuse evaluations.[40]

All medical programs evaluating victims of child sexual abuse, including programs that use nurse examiners or SANEs, benefit from the supervision and guidance of a qualified medical director who demonstrates competency and currency of practice in the evaluation of child sexual abuse. A medical director is necessary to develop protocols and delegated orders, formulate medical diagnoses, and provide medical treatment plans and prescriptions.

Expert Review of Examination Findings

The purpose of peer review in any medical context is the improvement of quality of care for patients. Standardization of medical processes is designed to reduce variability, improve care, reduce mortality and morbidity, and decrease costs. The cost of misdiagnosis can be both financial, in the case of expensive medical procedures, and societal, if child abuse is inaccurately diagnosed based on an examiner's misinterpretation of physical findings. Those in image-based specialties such as radiology and pathology have studied interrater reliability issues and have proposed methodology for improvement.[41–43]

While the child's history remains the most important piece of evidence in child sexual abuse evaluations, physical findings resulting from sexual abuse, when present, are important in the investigative and legal arenas. Examiners must critically evaluate findings in the context of the known medical literature. Many studies suggest that inexperienced examiners are far more influenced by the history than are more experienced examiners in assessing examination findings.[44] These studies also show that an experienced examiner provides more consistent and objective interpretation of examination findings.[40,44,45] Although it is not clear at what level of experience an examiner becomes an expert, it is certainly through training, clinical experience, knowledge of the current literature, continuing education, and engagement in review or oversight of cases. One study demonstrated that variability in interpretation of such findings appears to be linked to level of training, profession, experience, and knowledge of the literature.[46]

Clinicians without sexual abuse expertise can access expert consultation remotely. One example is myCaseReview, a secure Web-based telehealth product in which medical providers submit images for review by a medical panel of board-certified CAP experts (http://www.mrcac.org/medical-academy/mycasereview/). Other telehealth and telemedicine applications are available commercially

Table 4
Recommendations for Providers

- Obtain a medical history from the child/adolescent patient for the purpose of diagnosis and treatment
- Develop skills in the use of examination positions and techniques for the best assessment of anogenital findings
- Know the differential diagnosis of entities confused with sexual abuse, to avoid an incorrect diagnosis
- Remain current in the state of the art and science of child sexual abuse medical evaluation and treatment
- Obtain high-quality, interpretable photodocumentation of examination findings
- Develop a peer review system to have all abnormal cases reviewed by an expert provider
- Teach multidisciplinary teams that all children benefit from a medical evaluation by a qualified provider
- Provide court testimony that is objective, fact-based, educational, and clear for medical and nonmedical audiences

that can provide secure HIPAA-compliant case review.[46–48] The use of such programs satisfies the requirements of the National Children's Alliance (NCA) but may not go far enough in providing comprehensive assessment of the quality of examinations. Feedback to examiners, followed by documented improvement against shared baselines, is the backbone of an iterative process for continuous quality improvement in the field.

Court Testimony

Providing expert medical testimony requires a thoughtful, thorough approach and knowledge of court proceedings that often is outside the realm of standard medical practice.[49,50] The AAP has a policy on Guidelines for Expert Witness Testimony,[51] and other medical specialties have published guidelines as well.[52–56] The role of the expert medical provider in courtroom proceedings is as an educator to the judge and jury, explaining why and how the evaluation was completed, providing details of the examination, and providing expert opinion on the significance of any examination findings. Since a majority of sexual abuse victims have normal genital examinations,[36,57] a common theme in testimony is the explanation of the findings and that a physical examination alone does not prove or disprove that sexual abuse occurred.

Table 5
Suggested Research Questions

- What is the role of the medical history in the forensic investigation of child sexual abuse?
- With new forensic evidence analyses available, should the timing of forensic collection change for children or adolescents?
- Can NAATs be used for extragenital site testing for gonorrhea and chlamydia in children and/or adolescents?
- Can NAATs be used to detect *Trichomonas* or herpes in children and adolescents?
- Should NAATs be used for routine screening in prepubertal boys?
- What is the significance of findings listed in the "No Expert Consensus" category with regards to likelihood of sexual contact/abuse?
- How do examination position and techniques and/or anal symptoms affect anal findings?
- Can deep notches be readily differentiated from complete transsections in photographs and/or videos?

Conclusion

The recommendations in these revised guidelines incorporate current research and practice guidelines for clinicians who evaluate children and adolescents for suspected sexual abuse (Table 4). During the revisions of these guidelines, several areas of focus for additional research were identified (Table 5). In addition, several terms are clarified, components of the Interpretation Table have been reorganized, and recommendations for improving overall quality of care have been elaborated. While the Interpretation Table remains an important component of this evolving treatise, the importance of the child's history in the diagnosis of sexual abuse cannot be overstated. Similarly, the patient's medical and mental health needs must be prioritized during the medical assessment. The provider has a key role in gathering the medical history, evaluating the medical and mental health needs of the child, and educating families, multidisciplinary partners, judges, and jurors in the appropriate assessment, interpretation of findings, and management of sexually abused children and adolescents.

Acknowledgments

The authors thank Tim Kutz, MD, Mark Hudson, MD, and Deborah Lowen, MD, for their contribution to the consensus document. We also are grateful to Jane Braun, MA, and Kori Stephens, MPH, of the Midwest Regional Children's Advocacy Center for their financial and administrative support of this project.

The authors would like to add a special dedication to our friend and collaborator, Rich Kaplan, MD, who was instrumental in getting us together and keeping the process going.

References

1. Adams JA, Kaplan RA, Starling SP, et al: Guidelines for medical care of children who may have been sexually abused. J Pediatr Adolesc Gynecol 2007; 20:163
2. Workowski KA, Berman S, CDC, et al: Sexually transmitted diseases treatment guidelines, 2010. MMWR Recomm Rep 2010; 59:1
3. Jenny C, Crawford-Jakubiak JE, Committee on Child Abuse, et al: The evaluation of children in the primary care setting when sexual abuse is suspected. Pediatrics 2013; 132:e558
4. Finkel MA, Alexander RA: Conducting the medical history. J Child Sex Abuse 2011; 20:486
5. Delago C, Deblinger E, Schroeder C, et al: Girls who disclose sexual abuse: urogenital symptoms and signs after genital contact. Pediatrics 2008; 122:e281
6. Melville JD, Kellogg ND, Perez N, et al: Assessment for self-blame and trauma symptoms during the medical evaluation of suspected sexual abuse. Child Abuse Negl 2014; 38:851
7. Gavril AR, Kellogg ND, Nair P: Value of follow-up examinations of children and adolescents evaluated for sexual abuse and assault. Pediatrics 2012; 129:282
8. Adams JA: Guidelines for medical care of children evaluated for suspected sexual abuse: an update for 2008. Curr Opin Obstet Gynecol 2008; 20:435
9. Thackeray JD, Hornor G, Benzinger EA, et al: Forensic evidence collection and DNA identification in acute child sexual assault. Pediatrics 2011; 128:227
10. Girardet R, Bolton K, Lahoti S, et al: Collection of forensic evidence from pediatric victims of sexual assault. Pediatrics 2011; 128:233
11. Sibille I, Duverneuil C, Lorin De La Grandmaison G, et al: Y-STR DNA amplification as biological evidence in sexually assaulted female victims with no cytological detection of spermatozoa. Forensic Sci Int 2002; 125:212
12. Maiquilla SM, Salvador JM, Calacal GC, et al: Y-STR DNA analysis of 154 female child sexual assault cases in the Philippines. Int J Legal Med 2011; 125:817
13. Christian CW: Timing of the medical examination. J Child Sex Abuse 2011; 20:505
14. US Department of Justice: A national protocol for sexual assault medical forensic examinations adults/adolescents. Washington, DC, Office on Violence Against Women, 2013
15. National Children's Alliance: Standards for accredited members, revised. Washington, DC, Author, 2011
16. Finkel MA, Ricci LR: Documentation and preservation of visual evidence in child abuse. Child Maltreat 1997; 2:322

17. Ricci LR: Photodocumentation in child abuse cases. In: Jenny C, editor. Child Abuse and Neglect: Diagnosis, Treatment and Evidence. St. Louis, MO, Elsevier Saunders, 2011
18. Esernio-Jenssen D, Barnes M: Nucleic acid amplification testing in suspected child sexual abuse. J Child Sex Abuse 2011; 20:612
19. Shapiro RA, Makoroff KL: Sexually transmitted diseases in sexually abused girls and adolescents. Curr Opin Obstet Gynecol 2006; 18:492
20. Black CM, Driebe EM, Howard LA, et al: Multicenter study of nucleic acid amplification tests for detection of *Chlamydia trachomatis* and *Neisseria gonorrhoeae* in children being evaluated for sexual abuse. Pediatr Infect Dis J 2009; 28:608
21. Centers for Disease Control and Prevention: Recommendations for the laboratory-based detection of Chlamydia trachomatis and Neisseria gonorrhoeae: 2014. MMWR Recomm Rep 2014; 63:1
22. Hammerschlag MR, Guillen CD: Medical and legal implications of testing for sexually transmitted infections in children. Clin Microbiol Rev 2010; 23:493
23. Hammerschlag MR, Gaydos CA: Guidelines for the use of molecular biological methods to detect sexually transmitted pathogens in cases of suspected sexual abuse in children. Methods Mol Biol 2012; 903:307
24. Giannini CM, Kim HK, Mortensen J, et al: Culture of non-genital sites increases the detection of gonorrhea in women. J Pediatr Adolesc Gynecol 2010; 23:246
25. Bachmann LH, Johnson RE, Cheng H, et al: Nucleic acid amplification tests for diagnosis of *Neisseria gonorrhoeae* oropharyngeal infections. J Clin Microbiol 2009; 47:902
26. Bachmann LH, Johnson RE, Cheng H, et al: Nucleic acid amplification tests for diagnosis of *Neisseria gonorrhoeae* and *Chlamydia trachomatis* rectal infections. J Clin Microbiol 2010; 48:1827
27. Cosentino LA, Campbell T, Jett A, et al: Use of nucleic acid amplification testing for diagnosis of anorectal sexually transmitted infections. J Clin Microbiol 2012; 50:2005
28. Gallion HR, Dupree LJ, Scott TA, et al: Diagnosis of *Trichomonas vaginalis* in female children and adolescents evaluated for possible sexual abuse: a comparison of the InPouch TV culture method and wet mount microscopy. J Pediatr Adolesc Gynecol 2009; 22:300
29. Ambrosetti F, Palazzo E, Gibelli D, et al: The risk of misinterpreting genital signs of sexual abuse in cadavers: a case report. Int J Legal Med 2013; 127:907
30. Mccann J, Voris J, Simon M, et al: Perianal findings in prepubertal children selected for nonabuse: a descriptive study. Child Abuse Negl 1989; 13:179
31. Myhre AK, Bemtzen K, Bratlid D: Perianal anatomy in non-abused preschool children. Acta Paediatr 2001; 90:1321
32. Hobbs CJ, Wright CM: Anal signs of child sexual abuse: a case-control study. BMC Pediatr 2014; 14:128
33. Myhre AK, Adams JA, Kaufhold M, et al: Anal findings in children with and without probable anal penetration: a retrospective study of 1115 children referred for suspected sexual abuse. Child Abuse Negl 2013; 37:465
34. Starling SP, Frasier LD, Jarvis K, et al: Inter-rater reliability in child sexual abuse diagnosis among expert reviewers. Child Abuse Negl 2013; 37:456
35. Berkoff MC, Zolotor AJ, Makoroff KL, et al: Has this prepubertal girl been sexually abused? J Am Med Assoc 2008; 300:2779
36. Berenson AB, Chacko MR, Wiemann CM, et al: A case-control study of anatomic changes resulting from sexual abuse. Am J Obstet Gynecol 2000; 182:820. discussion 831.
37. The American Board of Pediatrics: Workforce Data 2013-2014. Chapel Hill, NC, Author, 2014
38. International Association of Forensic Nurses: Sexual Assault Nurse Examiner (SANE) Education Guidelines. Elkridge, MD, Author, 2013
39. Campbell R, Patterson D, Dworkin E, et al: Anogenital injuries in childhood sexual abuse victims treated in a pediatric Forensic Nurse Examiner (FNE) program. J Forens Nursing 2010; 6:188
40. Adams JA, Starling SP, Frasier LD, et al: Diagnostic accuracy in child sexual abuse medical evaluation: role of experience, training, and expert case review. Child Abuse Negl 2012; 36:383
41. Bender LC, Linnau KF, Meier EN, et al: Interrater agreement in the evaluation of discrepant imaging findings with the Radpeer system. AJR Am J Roentgenol 2012; 199:1320
42. Ng WK, Chiu CS, Cheng Y, et al: Toward implementation of a regional quality assurance program in cytopathology: the Hong Kong experience. Acta Cytol 2006; 50:164
43. Nisbet D, Mclennan A, Robertson A, et al: Reducing inter-rater variability in the assessment of nuchal translucency image quality. Fetal Diagn Ther 2011; 30:128
44. Sinal SH, Lawless MR, Rainey DY, et al: Clinician agreement on physical findings in child sexual abuse cases. Arch Pediatr Adolesc Med 1997; 151:497
45. Adams JA: Medical evaluation of suspected child sexual abuse: it's time for standardized training, referral centers, and routine peer review. Arch Pediatr Adolesc Med 1999; 153:1121
46. Frasier LD, Thraen I, Kaplan R, et al: Development of standardized clinical training cases for diagnosis of sexual abuse using a secure telehealth application. Child Abuse Negl 2012; 36:149
47. Kellogg ND, Lamb JL, Lukefahr JL: The use of telemedicine in child sexual abuse evaluations. Child Abuse Negl 2000; 24:1601
48. Thraen IM, Frasier L, Cochella C, et al: The use of TeleCAM as a remote Web-based application for child maltreatment assessment, peer review, and case documentation. Child Maltreat 2008; 13:368
49. Johnson SL: Paediatric expert witness. J Paediatr Child Health 2013; 49:611
50. Frasier LD, Makoroff KL: Medical evidence and expert testimony in child sexual abuse. Juv Fam Court J 2006; 57:41
51. American Academy of Pediatrics Committee of Medical Liability: Guidelines for expert witness testimony. Pediatrics 1989; 83:312
52. Kesselheim AS, Studdert DM: Role of professional organizations in regulating physician expert witness testimony. J Am Med Assoc 2007; 298:2907
53. Committee on Ethics: ACOG: ACOG Committee Opinion No. 374: Expert testimony. Obstet Gynecol 2007; 110:445
54. American Medical Association: Opinion 9.07-Medical Testimony, 2004.
55. Phillips E, Stark SW: Stepping up to be an expert witness. Nurse Pract 2013; 38:8
56. Williams MA, Mackin GA, Beresford HR, et al: American Academy of Neurology qualifications and guidelines for the physician expert witness. Neurology 2006; 66:13
57. Adams JA, Harper K, Knudson S, et al: Examination findings in legally confirmed child sexual abuse: it's normal to be normal. Pediatrics 1994; 94:310
58. Starling SP, Jenny C: Forensic examination of adolescent female genitalia: the Foley catheter technique. Arch Pediatr Adolesc Med 1997; 151:102
59. Floyed RL, Hirsh DA, Greenbaum VJ, et al: Development of a screening tool for pediatric sexual assault may reduce emergency-department visits. Pediatrics 2011; 128:221