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Non-Anogenital and Anogenital Injuries of Females Following Sexual Assault: A Retrospective, Descriptive Study from 5,464 Sexual Assault Forensic Medical Examination (SAFME) Reports

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A thesis submitted to the faculty of
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Master of Science

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ABSTRACT

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The focus of this retrospective, descriptive study is to describe non-anogenital and anogenital injuries documented in over 5,000 sexual assault forensic medical examination (SAFME) reports of female patients. The study findings expand understanding of injuries documented following sexual assault by exploring associations between injuries and a multitude of variables: patient demographics (age, race, gender); time between assault and examination; patient-perpetrator relationship; perpetrator actions (strangulation, hit, verbally threatened/coerced, use of restraints, grabbed/held); number of assaultive acts; multiple-perpetrators; suspected drug-facilitated assaults; patient and perpetrator use of alcohol and drugs; and physically or mentally impaired patients. The various types and locations of injuries are discussed in relationship to assault history. Implications of findings on forensic nursing practice are shared to improve patient assessment and care. In addition, methods to share findings with interdisciplinary partners, including law enforcement and criminal justice system professionals, are described to improve interdisciplinary collaboration and education.

Keywords: rape, sexual assault, sexual assault injuries, sexual assault forensic medical examinations, forensic nursing

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Non-Anogenital and Anogenital Injuries of Females Following Sexual Assault: A Retrospective, Descriptive Study from 5,464 Sexual Assault Forensic Medical Examination (SAFME) Reports

Nearly one in four women in the U.S. report experiencing sexual assault (SA) (Morbidity and Mortality Weekly Report, 2014). SA victimization negatively impacts women's physical, mental, and emotional health (Valentine et al., 2019). Trauma from SA includes physical injuries, adverse mental health effects, employment disruption, social isolation, and financial losses (MMWR, 2014). Physical injuries from SA are often divided into anogenital and non-anogenital injuries, where anogenital refers to anal or genital injuries and non-anogenital refers to any other bodily injury excluding the anus and genitals. Historically, presence of anogenital injury has been associated with higher prosecution rates (Gray-Eurom et al., 2002), yet research comparing anogenital injury prevalence between consensual and nonconsensual sexual intercourse has questioned the exclusive focus on anogenital injuries (Anderson et al., 2006; Jones et al., 2003; Lincoln et al., 2013; McLean et al., 2011).

To better inform interdisciplinary practices and policies, it is imperative researchers and practitioners adopt a holistic approach by ascertaining both anogenital and non-anogenital injuries as well as victim ("victim" and "patient" are used interchangeably based upon cited literature) and assault factors associated with SA. The purpose of this retrospective, descriptive study was to identify the location and type of anogenital and non-anogenital injuries resulting from SA of females through evaluation of 5,464 SA forensic medical examination (SAFME) reports and explore associated victim and assault factors.

Background

Following SAs, a victim can opt to have a SAFME up to five days or more depending on jurisdiction. The primary purpose for performing SAFMEs is to provide healthcare for victims as well as evidence collection for prosecution of perpetrators. The SAFME includes performing a complete head-to-toe examination with measurement, documentation, and photography of non-anogenital and anogenital injuries (U.S. Department of Justice, 2013; National Institute of Justice, 2013).

Non-Anogenital Injuries

During a SA forensic examination, thorough assessment and evaluation of non-anogenital injuries is completed and documented on standardized examination forms. Examiners assess for tenderness, redness, swelling, abrasions, bruises, lacerations, incisions, avulsions, fractures, burns, bite marks, and other forms of physical trauma (U.S. Department of Justice, 2013). Written and photo-documentation of identified injuries are completed.

Prevalence

The prevalence of non-anogenital injuries following SA varies from 30% to 76% (Carter-Snell, 2007). Certain patient, assault, and examiner factors are known to influence non-anogenital injury detection. Dark-skinned individuals are less likely to have bruises detected and documented, resulting in a health disparity (Scafide et al., 2016; Scafide et al., 2020; Sommer et al., 2008; Thavarajah et al., 2012). Time between SA and examination affects non-anogenital injury detection as some injuries, such as bruising, do not appear within the first 24 hours (Carter-Snell, 2007). These are significant factors that impact detection of injuries, especially as bruises are the most common type of non-anogenital injury (Alempijevic et al., 2007; Maguire et al., 2008; Palmer et al., 2004). Examiner type may also play a role in non-anogenital injury

detection. In a systematic review, Carter-Snell (2007) found that emergency department physicians reported twice the rate of non-anogenital injuries as compared to trained SA nurse examiners.

Location

Researchers report the most common location of non-anogenital injury varies between extremities and head/neck region with the majority of studies noting extremities as the primary location of non-anogenital injuries. Palmer et al.'s (2004) study showed extremities were the most common non-anogenital injury location. Maguire (2008) found that 47.5% of non-anogenital injuries occurred on the legs. Moller et al. (2012) also found extremities were the most common non-anogenital injury location (52%) followed by trunk (25%) and head (21%). Extremities were reported as the most common non-anogenital injury location in additional studies (Alempijevic et al., 2007; Hwa et al., 2010; Song and Fernandes, 2017). A smaller sample of studies found the head, neck, and face to be the most common non-anogenital injury location (Carter-Snell, 2007; Stermac et al., 2001).

Type

The most common type of non-anogenital injury is also corroborated by numerous studies. Maguire et al. (2008) found that 56% of non-anogenital injuries were bruises followed by abrasions (41%). Palmer et al. (2004) found similar rates of non-anogenital injuries: bruises consisted of 54% and abrasions 40%. Sugar et al. (2003) also found bruises and abrasions to be the most common non-anogenital injury type. In two other studies authored by McGregor et al. (2002) and Alempijevic et al. (2007), bruises were reported as the most common non-anogenital injury type. Research regarding non-anogenital injury type confirms bruises as the most common followed by abrasions.

Victim-Perpetrator Relationship

Victim-perpetrator relationship is often categorized as intimate partner, acquaintance, or stranger. Some researchers simplify victim-perpetrator relationship as known to victim (i.e. intimate partner or acquaintance) or unknown perpetrator (i.e. stranger). Intimate partner assaults result in more non-anogenital injury (Carter-Snell, 2007; Moller et al., 2012; Seyller et al., 2016). One study by Seyller et al. (2016) found that non-anogenital injury prevalence was higher in intimate partner assaults (52%) compared to acquaintance assaults (43%) and stranger assaults (33%). Moller et al. (2012) specifically reported that head injuries were most common in intimate partner assaults (34%) compared to stranger assaults (29%) and acquaintance assaults (17%). Moller et al. also reported intimate partner assaults had the highest prevalence of blunt force trauma from kicking and hitting the victim as well as more strangulation attempts (Moller et al., 2012). In a systematic review, Carter-Snell (2007) found a higher prevalence of non-anogenital injury with intimate partner assaults as compared to stranger assaults.

In contrast, other studies support a higher non-anogenital injury prevalence in stranger assaults. For example, Jones et al. (2004) found that stranger assaults presented with higher rates of non-anogenital injury compared to acquaintance assaults (61% vs 40%). Feeney et al. (2017) also reported higher non-anogenital injuries with stranger assaults compared to acquaintance assaults. Maguire et al. (2008) also found a higher prevalence of non-anogenital injuries in stranger assaults (68%) compared to acquaintance assaults (56%). Notably, all studies reporting a higher non-anogenital injury prevalence in stranger assaults did not include intimate partner data.

Alcohol/Drug Use

Victim alcohol use prior to assault appears to increase non-anogenital injury prevalence, but scarcity of research in this area makes it difficult to draw a sound conclusion. In one study,

Leclerc and colleagues (2016) found that the victim's use of alcohol or drugs prior to assault increased the likelihood of non-anogenital injuries. Carter-Snell's (2007) systematic review also reported a higher incidence of non-anogenital injuries if drugs or alcohol were used by the victim prior to the assault. In contrast, Siefert and colleagues (2009) found intoxicated victims had injuries to significantly fewer body areas, i.e., neck, face, head, back, or extremities compared to their sober counterparts. As few studies explore the relationship between alcohol and non-anogenital injuries from SA, it is difficult to make a conclusion regarding the relationship of these variables.

Age

Variable findings exist regarding the association between age and non-anogenital injuries. Palmer et al. (2004) found that women over 40 years of age had 3.1 times the odds of non-anogenital injury compared to women 14-19 years old. In a systematic review, Carter-Snell (2007) found the highest rate of non-anogenital injuries were in women over 20 years old, and the greatest number of total injuries were in women over 40 years old. It is difficult to evaluate the significance of total injuries being greater in women over 40 as this result could simply represent increased anogenital injuries. Additionally, Carter-Snell's findings regarding non-anogenital injuries and age >20 years lacks strength in proving that increasing age results in a higher non-anogenital injury prevalence. Other researchers have reported that younger women had less non-anogenital injuries compared to older women (Jones et al., 2003; Maguire et al., 2008). In Jones' (2003) study population, however, only two age categories were represented: 13-17 years old (43%) and ≥17 years old (57%). Similarly, 75% of Maguire's study population was <28 years old while only seven women were >50 years. As a result, both studies did not conclusively evaluate whether older age results in more non-anogenital injuries. Finally, a study

by Sommers et al. (2006) did not find any significant association between older age and increased non-anogenital injury prevalence.

Anogenital Injuries

A thorough anogenital examination is completed on SA victims who request SAFMEs. Assessment of injuries located on the external genitalia is completed prior to obtaining swabs for potential DNA evidence. Anatomical structure comprising female genitalia include perineum, labia majora, labia minora, clitoral hood, peri-urethral tissue and urethral meatus, hymen, fossa navicularis, and posterior fourchette (U.S. Department of Justice, 2013).

Prevalence

The prevalence of anogenital injuries following SA varies from 5% to 76% (Carter-Snell, 2007). Factors have been identified that influence identification of anogenital injuries. The examination process impacts identification of injury and ranges from direct visualization, direct visualization with toluidine dye, and colposcope examinations. Fewer injuries are documented with direct visualization than exams with toluidine dye and colposcope examinations (Astrup et al., 2012; Zink et al., 2010). Victim's race also influenced the number of identified injuries as darker-skinned victims often have fewer documented injuries (Sommers et al., 2006; Jocelyn & Sheridan, 2012; Sommers et al., 2008). The length of time between the SA and examination also affects the number of documented injuries as fewer injuries are noted if a longer length of time elapses between SA and examination (Sugar et al., 2003; Sachs & Chu, 2002).

Location

The location of anogenital injuries resulting from SA has been examined in multiple studies (Jones, et al., 2003; Jones et al., 2008; McLean et al., 2011). In a retrospective review, Hilden et al. (2005) found that nearly 50% of all anogenital injuries occur at the posterior

fourchette. Similarly, Moller et al. (2012) also found the posterior fourchette to be the most common anogenital injury location (35%). By comparison, Lincoln and colleagues (2013) found the most common anogenital injury location was the fossa navicularis. Rather than delineating an order of most common to least common injury location, some studies report on a grouping of locations. For example, Jones (2008) found that 80% of all anogenital injuries occurred at the posterior fourchette, fossa navicularis, and labia minora. Similarly, Rossman et al. (2004) found that 56% of all anogenital injuries were located at the fossa navicularis, labia minora, cervix, or posterior fourchette. These findings suggest that inserting the penis into the vagina is the most likely mechanism of injury (Jones et al., 2003).

Type

In the past, the universally utilized tool for describing injury type was TEARS, in which each acronym letter represents the following: T-tears, E-ecchymosis, A-abrasions, R- redness, S-swelling (Slaughter & Brown, 1992). While some practitioners and researchers continue to use TEARS to classify injury type, others have updated injury designation to include lacerations, bruising, and abrasions. Many researchers have excluded more subjective findings, such as redness and swelling, when determining prevalence of injury as redness and swelling may be normal variants of female genitalia (Carter-Snell, 2007).

Multiple researchers have identified lacerations as the most common type of female anogenital injury. In a study of 500 women, McLean et al. (2011) found lacerations were the most common anogenital injury type followed closely by abrasions. This study excluded redness and swelling as categories of injury. By comparison, Hilden et al. (2005) reported lacerations as the most common anogenital injury type (88%) followed by ecchymosis (16%). This study similarly excluded redness and swelling. Lacerations were likewise reported as the most

common anogenital injury type in two systematic reviews by Carter-Snell (2007) and Moller et al. (2012).

Victim-Perpetrator Relationship

Research delineating intimate partners among other victim-perpetrator relationships indicates that although intimate partner SAs are more violent, an increased prevalence of anogenital injuries is not apparent. Two different studies found that spousal perpetrators used the highest number of coercion methods compared to boyfriends and acquaintances, i.e. verbal threats, physical restraints, use of drugs/alcohol, or assault of a sleeping victim (Stermac et al., 2001; Stermac et al. 2008). Stermac and colleagues (2008) also found that intimate partner perpetrators were almost three times more likely to use physical violence resulting in more victim injuries, but this study did not differentiate between non-anogenital and anogenital injuries.

Some studies categorize victim-perpetrator relationship as only known/acquaintance or stranger. In this case, significantly more anogenital injury was associated with known perpetrator assaults (Carter-Snell, 2007; Feeney et al., 2017; Maguire et al., 2008) although this is difficult to compare to previous intimate partner results. Contrastingly, Palmer et al. (2004) found that assaults committed by a known perpetrator was a protective factor for anogenital injury. Anderson and Sheridan also found that acquaintance relationship was associated with a lower incidence of anogenital injury (2012). Again, comparison of known/acquaintance relationship data to intimate partner data is problematic, yet most research does not show an association between intimate partner assaults and increased anogenital injuries.

Alcohol/Drug Use

Victim alcohol use may enhance SA vulnerability and has been found to be associated with increased non-anogenital injuries as previously reported, yet it has not been found to be associated with increased anogenital injury. According to a study by Leclerc et al. (2016), perpetrators used alcohol before assaulting victims in 43.2% of cases. This study also found alcohol use increased the likelihood of perpetrators using physical force. Interestingly, both Maguire and Hilden did not find an association between victim alcohol use and increased frequency of anogenital injury (Maguire et al., 2008; Hilden et al., 2005). Further, Feeney et al. (2017) found anogenital injuries were greater when assaults did not involve drugs or alcohol. These collective research findings suggest victim alcohol use is associated with decreased prevalence of anogenital injury. One possible explanation is that inebriated women may not participate in as many resistant actions at the time of penetration, which could result in less anogenital injury compared to sober women.

Age

The association between age and anogenital injury is undecided based on current research findings. In a study specifically designed to evaluate age and anogenital injury risk, Sommers et al. (2006) failed to find any significant association. On the other hand, Sugar et al. (2003) found a bimodal relationship between age and anogenital injury. In this study, anogenital injury prevalence was evaluated in three age groups: <20, 20-49, and >49. Results showed an increased anogenital injury prevalence in the younger group (<20) and the older group (>49) compared to the middle group (20-49). Hilden et al. (2005) also found an increased anogenital injury risk in women over 40 years old and women under 19 years old. Palmer et al. (2004) specifically reported an increased odds of injury with older age such that women over 40 years had 5.6 times

the odds of anogenital injury compared to the 14-19 year-old group. While anogenital injury risk appears to be associated with age in some regard, it is difficult to determine the extent and relationship.

Race

Many researchers have focused on determining the role of race and observed anogenital injury. In their literature review of 13 studies, Anderson and Sheridan (2012) found white skin was associated with increased documented anogenital injury. Sommers et al. (2006) found that White women were four times as likely to have documented anogenital injury as compared to Black women. A study by Rossman et al. (2019) reported an anogenital injury prevalence of 76% for White females compared to 62% for Black females. Sommers et al. (2019) also reported a discrepancy of anogenital injury prevalence between Whites and Blacks (68% vs 43%). Their study also found Whites had nearly three times the number of documented anogenital injuries to the external genitalia compared to Blacks. The discrepancy of White and Black anogenital injuries was only apparent for outer genitalia, which is of variable color, but not for the anus or inner genitalia. Findings from multiple studies suggest skin pigmentation is a significant factor in documentation of anogenital injuries as injuries are more visually apparent on White skin compared to dark skin.

Anogenital Injuries from Consensual and Nonconsensual Sexual Contact

As cited by Anderson and Sheridan (2012), Masters and Johnson's theory purported that a women's natural sexual response including lubrication, greater tensity of muscles, and elongation of the vagina was protective against injury during consensual sex. They further hypothesized that anogenital injuries occurring during nonconsensual sex were directly related to a lack of these sexual responses. Masters and Johnson's theory has since been disproved as

research has shown that anogenital injuries occur in both consensual and nonconsensual sex (Anderson et al., 2006; Jones et al., 2003; Lincoln et al., 2013; McLean et al., 2011). In a literature review, Song and Fernandes found a nonconsensual anogenital injury prevalence of 6-87% and a consensual anogenital injury prevalence of 6-73% (2017). Yet, Lincoln et al. (2013) found a nonconsensual anogenital injury prevalence of 53.7% compared to a consensual anogenital injury prevalence of 9.9%.

Number of Injuries

While anogenital injury occurs in both consensual and nonconsensual intercourse, some studies have reported a higher number of anogenital injuries in cases of SA. Jones and colleagues (2003) found victims of SA had a higher number of anogenital injuries (2-2.6) compared to the consensual group (1.5-1.9). Anderson et al. (2006) similarly found that victims with two or more injury types were 9.7 times more likely to be in the nonconsensual group.

Location

Regardless of consent, the most common anogenital injury location remains constant. In a study comparing anogenital injury between consensual and nonconsensual subjects, Anderson et al. (2006) found the most common anogenital injury location was the posterior fourchette. McLean et al. (2011) also found the posterior fourchette to be the most common location of anogenital injury of both the consensual and nonconsensual group. Another study by Jones et al. (2003) found the most common nonconsensual anogenital injury location was the fossa navicularis followed by the labia. In the consensual group, the most common anogenital injury location was the hymen followed by fossa navicularis and the posterior fourchette. In their literature review, Song and Fernandes (2017) reported the posterior fourchette and the fossa

navicularis as the most common anogenital injury locations among both the consensual and nonconsensual groups.

Type

While the most common anogenital injury type among both consensual and nonconsensual groups are lacerations, (Jones et al., 2003; Lincoln et al., 2013; Song & Fernandes, 2017) patterns regarding ecchymosis (considered as bruising) and abrasions help to distinguish between the groups. For instance, Anderson et al. (2009) found the number of sites with ecchymosis/bruising higher in the nonconsensual group and a predictive factor of nonconsensual sex. The nonconsensual group also had more tears (21 subjects vs. 15 subjects) and abrasions (19 subjects vs. 10 subjects). In another study by Anderson et al. (2006), victims with ecchymosis were 5.4 times more likely to be in the nonconsensual group. Additionally, victims presenting with abrasions were 4.2 times more likely to be in the nonconsensual group (Anderson et al., 2006). In their literature review, Song and Fernandes found that women with ecchymosis or abrasions were four to five times more likely to be victims of nonconsensual sex. Lincoln and colleagues (2013) also found abrasions and bruises at a much higher rate in the nonconsensual versus consensual group.

Injury Definitions

For the parameters of this study, injuries refer to findings that were visualized, measured, documented, and photographed as part of SAFMEs. Redness or tenderness alone was not documented as an injury. Table 1 includes summarized definitions.

Table 1

Definition of Injury Types

Injury type	Definition
Abrasion	Scraping or rubbing away of skin layers

Avulsion	Pulling or tearing away of a part of the body resulting in missing skin/tissue
Bite marks	Patterned injury caused by the act of biting
Bruise	Occurs when blunt force ruptures or tears a blood vessel resulting in leakage of blood into the tissue manifested by discoloration, tender to palpation
Burn	Contact with heat destroying skin or tissue
Conjunctival hemorrhage	Rupture of superficial ocular capillaries
Discolored mark	Non-tender skin discoloration
Ecchymosis	Hemorrhagic spot or patch caused by extravasation of blood into the tissue. Generally caused by bleeding of a hematological nature, not trauma
Fracture	Continuity of a bone is broken
Incision	Separation of tissue caused by dragging or inserting a sharp object along tissue
Laceration	Tissue tearing or shearing due to blunt force trauma or overstretching of tissue
Missing/broken tooth/teeth	The state of missing or having broken a tooth
Petechiae	Red, non-elevated, pinpoint clusters of blood under the skin, less than 3mm in diameter from rupture of capillaries
Puncture wound	Body tissue pierced or penetrated with a pointed object
Redness/Erythema	Pink to red skin/tissue color; defined as injury for non-anogenital injury location, but not defined as injury in anogenital injury unless associated with another injury type (i.e. laceration or abrasion).
Swelling	Transient abnormal enlargement of a body part or area due to cell proliferation and/or fluid accumulation

*Study definitions of injuries were determined by the research team and clearly defined in study code book. The definitions were compiled from sexual assault nurse examiner (SANE) experts and established resources (Medical Dictionary, n.d; Diegel et al., 2013).

The Present Study

The purpose of this retrospective, descriptive study was to identify the location and type of non-anogenital and anogenital injuries and explore associated victim and assault factors related to injuries.

Research Questions

- Question 1: What are the descriptive findings of non-anogenital and anogenital injuries following sexual assault of female victims?

- Question 2: What variables are associated with non-anogenital and anogenital injuries following sexual assault of female victims?

Setting

The setting of this study is a U.S. Western state, which includes 29 counties with a total population of 3.2 million (United States Census Bureau, 2019). The 2018 Uniform Crime Report found a significantly higher rape rate in this state compared to the national average (55.5 per 100,000 compared to 42.6 per 100,000), and from 2014 to 2018, the rate of rape has increased by 12.1% (Complete Health Indicator Report of Sexual Violence, 2019). Contrastingly, all other violent crimes such as homicide, robbery, or aggravated assault have remained significantly lower than the national average (Complete Health Indicator Report of Sexual Violence, 2019).

The study is comprised of a convenience sample of reported rapes, which includes data from eight counties with combined estimated population of 2,712,494, which represents 84% of the state's total population. Each county currently has SANE programs, which provide SAFMEs within seven days of the sexual assault. One site, the second most populous county, had SAFMEs completed by medical residents rather than SANEs from 2010 to 2017.

Methodology

Sample

The study sample consisted of SAFME examination forms from SA kits collected from January 1, 2010 to December 31, 2018. Inclusion criteria consisted of the following: 1) patient was 14 years or older; 2) patient consented to a fully collected SA kit including both forensic evidence and written account of SA; 3) patient received a SAFME in one of the eight study sites and 4) patient agreed to interview with law enforcement for case prosecution (patients with restricted SA kits were not included in the study).

Measures

Non-anogenital injuries were documented from the SAFME form if injuries were visible with written documentation and description on location, size, color, and type of injury. Tenderness alone was not coded as an injury. Non-anogenital injuries were coded based upon the SAFME form's designation of location of injury, which included head, neck, breasts, chest/back, abdomen, or extremities. The injuries were also coded based upon the SAFME form's designation of type of injury, which included abrasion, avulsion, bite mark, bruise, burn, conjunctival hemorrhage, discolored mark, ecchymosis, fracture, incision, laceration, missing or broken teeth, petechiae, puncture wound, redness, and swelling (Table 1). Bruises and discolored marks were distinguished based on tenderness; tender, discolored marks were coded as bruises whereas nontender, discolored marks were coded as discolored marks. Generally, the type of injury coded by the research team was determined by the written documentation by the SANE. Photographs were not reviewed for research purposes.

Anogenital injuries were documented from the SAFME form if injuries were visible with written documentation and description on location, size, color, and type of injury. Tenderness and redness were not coded as an injury unless designated as a specific type of injury (i.e. abrasion). The injuries were coded based upon the SAFME form's designation of location, which included anal/rectal, cervix, clitoral hood, fossa navicularis, hymen, inner thighs, labia majora, labia minora, perihymenal tissue, perineum, periurethral or urethral tissue, posterior fourchette, and vagina. The injuries were also coded based on the SAFME form's designation of type, which included abrasion, avulsion, bruise, discolored mark, ecchymosis, incision, laceration, petechiae, puncture mark, redness (if associated with type of injury), and swelling.

The number of non-anogenital and anogenital injuries were obtained from either the written number on SAFME injury description or the SAFME body diagram. If injuries were referred to in plural form, such as bruises, and no specific number was given, then the plural injury was coded as two injuries. If injuries were noted as "multiple" or "several" and no specific number was given, then the injuries were coded as three injuries.

Procedures

Institutional Review Board approval was granted though Brigham Young University and Intermountain Healthcare. Memorandums of Understanding (MOU) from the SANE program directors from each of the eight sites with the research team granted approval to obtain data from SAFME forms. Each SA case was designated a unique study identification number with de-identified data.

Data from SAFME forms were obtained from both hard copy and electronic medical records (EMRs) based upon the year of data entry. From January 1, 2010 to May 1, 2017 the sites used hard copy SAFME forms, so data was coded directly from hard copy charts into Statistical Package for Social Sciences (SPSS) study database. Starting May 1, 2017, two sites transitioned to EMRs. In late 2018, the remaining six sites also transitioned to EMRs. Data were then coded from the EMRs in the SPSS study database.

To ensure interrater reliability, 10% of cases were recoded into SPSS 22.0 software to calculate Cohen's Kappa. Kappa is scored on a scale of -1 (perfect disagreement) to 1(perfect agreement). According to Vassar and Holzmann (2013), the minimum Kappa requirement for retrospective chart reviews is 0.60. This study's Kappa was calculated at 0.955 across variables, indicating excellent interrater reliability. This high reliability was established by coding data in a group consisting of the principal investigator, other research faculty, and graduate and

undergraduate research assistants. Any questions or coding discrepancies were quickly addressed in the group coding sessions. Additionally, a detailed coding book was created for uniformity in coding.

Analytic Plan

Descriptive statistical analyses were conducted of type and location of non-anogenital and anogenital injuries to determine frequencies of categorical data and central tendencies for interval level data. Chi square tests of association were completed to explore the relationship between variables.

Results

The study sample was 5,464 female patients. The mean time between assault and exam was 25.48 hours; 25% were seen within 6 hours or less, 50% were seen in 15 hours or less, and 75% were seen within 32.4 hours or less. Exams were primarily completed by SANEs (88.9%) with a smaller percent completed by medical residents (11.1%). Demographics of the study sample include majority White race (77.7%) and between the ages of 14 and 24 years. Nearly half reported physical and/or mental health problems (Table 2). Perpetrator characteristics include majority acquaintance relationship, single perpetrator, and lack of online/dating app meeting. If intimate partner perpetrator, then slightly more were a current spouse/partner versus ex-spouse/partner (Table 3).

Table 2

Patient Characteristics

Variables	Percent
Race	
White	77.7%
Hispanic	11.5%
Black	3.4%
American Indian	2.8%
Asian/Pacific Islander	2.2%

Other	1.6%
Unknown	0.7%
Age	
<19 years old	25%
<24 years old	50%
<33 years old	75%
Mean	27.44
Mode	18
Range	14-93
Current Physical Health Problems	
No	54.3%
Yes	45.7%
Current Mental Health Problem	
No	54%
Yes	46%
Victim Alcohol Use	
No	57.2%
Yes	41.8%
Victim Drug Use	
No	84.7%
Yes	15.3%

Table 3

Perpetrator Characteristics

Variables	Percent
Victim-Perpetrator Relationship	
Acquaintance	58.2%
Stranger	18.8%
Spouse/Partner	7.1%
Ex-Partner	5.7%
Other	5.7%
Unknown	4.4%
Domestic Violence Perpetrator	
Current Spouse/Partner	55.7%
Ex-Spouse/Partner	44.3%
Multiple Suspects	
No	86.1%
Yes	9.8%

Online Meeting of Suspect	
No	92.4%
Yes	7.0%
Perpetrator Alcohol Use	
No	20.3%
Yes	56.0%
Unknown	23.7%
Perpetrator Drug Use	
No	44.8%
Yes	16.9%
Unknown	38.3%

Assault characteristics included location and actions during SA. Most SAs occurred in a house or apartment. The majority of patients reported unknown ejaculation, lack of lubrication, and 1-2 assaultive acts. A female patient has a total of four possible assaultive acts, which includes forcible contact of the victim's mouth to the perpetrator's genitals or penetration of the victim's mouth, vagina, or anus with an object or the perpetrator's finger, tongue, or penis. Nearly half of patients reported loss of consciousness or awareness during the assault (Table 4).

Table 4

Assault Characteristics

Variables	Percent	Variables	Percent
Location of Assault		Number of Assaultive Acts	
House/Apartment	63.1%	Fondling	2%
Car	8.6%	1	34.6%
Outside	9.7%	2	25.5%
Other	14.4%	3	12.2%
Unknown	4.1%	4	4.4%
		Unknown	21.3%
Asleep and Awakened to Assault		Ejaculation	
No	85.6%	No	13.0%
Yes	13.2%	Yes	33.1%
Unknown	1.1%	Unknown	53.9%
Loss of Consciousness/Awareness		Use of lubrication	
No	50.3%	No	69.4%
Yes	48.6%	Yes	6.7%
Unknown	1.1%	Unknown	23.9%

Suspected Drug-Facilitated*	
No	80.1%
Yes	16.2%
Unknown	3.8%

*Suspected drug-facilitated indicates that in the assault history, the patient implies or states that they believe they were unknowingly given drugs to incapacitate them.

Patient and perpetrator actions were documented on examination forms. Patient actions, such as scratching, biting, hitting, or kicking during the assault, were not documented on the SA examination forms until 2017. The inclusion of perpetrator action of verbal threats or coercion was not included on the forms until 2016. The most common perpetrator action was grabbing or holding the patient (Table 5).

Table 5
Patient and Perpetrator Actions

	No	Yes	Unknown
Victim Actions			
Scratch	61.8%	9.9%	23.8%
Bite	72.4%	4.7%	22.9%
Hit	65.1%	11.6%	23.3%
Kick	65.7%	11.0%	23.3%
Perpetrator Actions			
Verbal Threat or Coercion	43.3%	36.4%	20.3%
Grabbed on Held	16.5%	62.2%	21.3%
Physical Blows	63.1%	15.6%	21.2%
Strangled or Choked	65.1%	14.0%	20.9%
Weapon Use	69.3%	9.5%	21.1%
Restraint Use	74.8%	5.1%	20.2%
Burned Victim	81.6%	1.5%	16.9%

Non-Anogenital Injury

Non-anogenital injury prevalence was 72.7% of the study sample. The mean number of injuries was 6.2 (range 0-126), median of 3, and mode of 0. One quarter of the study sample had zero non-anogenital injuries. The most common non-anogenital injury location was the

extremities (Figure 1). The most common types of non-anogenital injuries were bruises followed by abrasions (Figure 2).

Figure 1

Non-Anogenital Injury Location

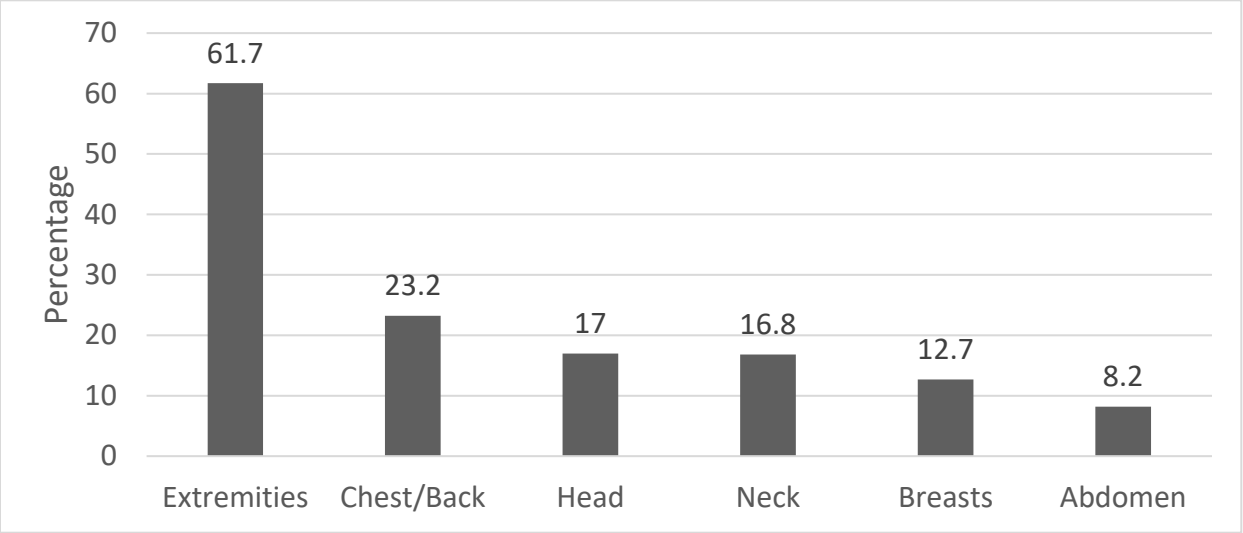
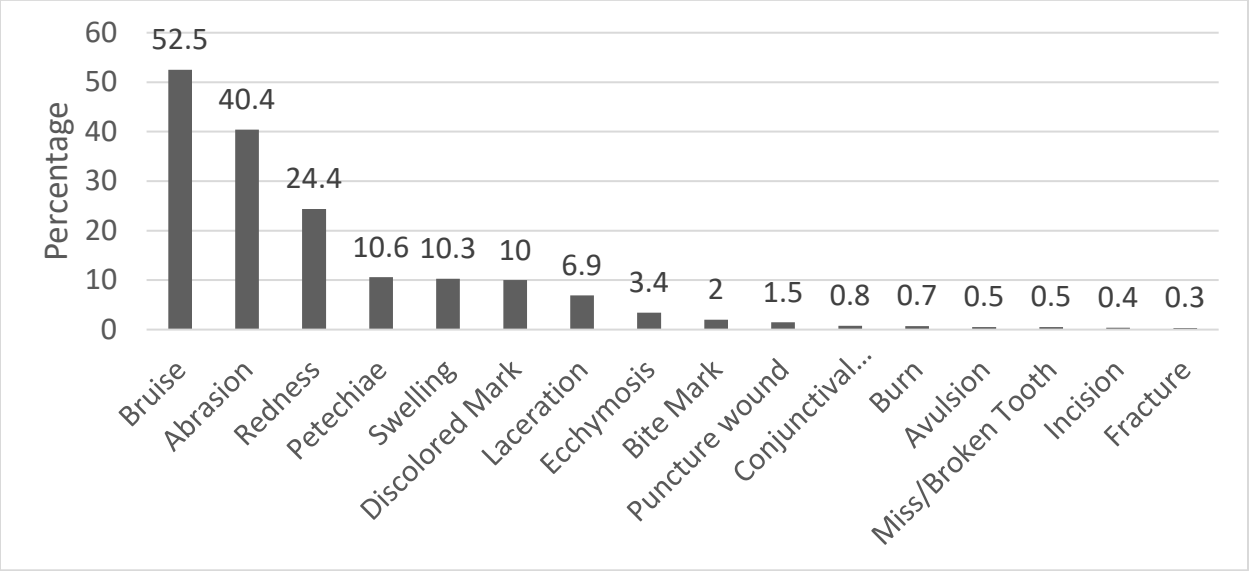


Figure 2

Non-Anogenital Injury Type



Continuous variables of patient age and time between assault and exam in hours were evaluated in relationship to incidence of non-anogenital injuries. Patient age >18 years was significantly associated with a higher mean number of non-anogenital injuries (M=6.64 injuries, SD 10.178 vs. M=3.64 SD=6.114, t=11.410, p=.000, CI= .111, .434). Time between assault and exam was not found to be a significant variable.

Categorical variables associated with more non-anogenital injuries included exam by SANE, site of exam (two of five sites), White race, reported pain, multiple perpetrators, and patient and perpetrator drug and alcohol use (Table 5). Regarding patient-perpetrator relationship, more non-anogenital injuries were associated with intimate partner perpetrators and strangers. If patient met perpetrator through an online dating app, more non-anogenital injuries were documented. If the assault was drug-facilitated or the patient reported loss of consciousness or awareness, more non-anogenital injuries were documented. Location of assault in a car, outside, or unknown location was significantly associated with more non-anogenital injuries. A higher documented number of non-anogenital injuries was also present in more violent assaults, manifested by a higher number (3-4) or unknown number of penetrative acts as well as any perpetrator actions including verbal threats, holding patient, physical blows, weapon or restraint use, strangulation, or burning patients. Patient actions including scratching, biting, hitting, or kicking resulted in more documented non-anogenital injuries (Table 6).

Variables associated with fewer documented non-anogenital injuries included site of exam (three of five sites), Black race, acquaintance or other relationship (defined as person in authority or family member), location of assault in house/apartment, and patient age less than 18 years. If the patient had a physical/mental impairment or was asleep and awakened to the assault,

non-anogenital injures were less likely. Less violent assaults manifested by fondling alone or only one penetrative act also resulted in fewer non-anogenital injuries (Table 6).

Table 6

Chi-Square Tests of Association: Non-Anogenital Injuries

Variables	Chi-Square Value	Df	P-value
Physical/medical problem	3.715	1	.054
DV perpetrator	6.294	2	.043
Online meeting of perpetrator	8.226	2	.016
Physical/mental impairment	10.566	2	.005
Exam by SANE	12.666	1	.000
Asleep and awakened to assault	14.715	2	.001
Ejaculation occurred	17.592	2	.000
Patient drug use	19.233	2	.000
Lubrication used	25.414	3	.000
Patient action hit	28.208	2	.000
Patient action kick	30.231	2	.000
Race of patient	33.202	6	.000
Patient action bite	33.376	2	.000
Location of assault (house/apartment, car, outside)	35.335	4	.000
Patient action scratch	39.484	2	.000
Patient age < 18	41.141	1	.000
Perpetrator alcohol use	49.896	2	.000
Perpetrator action burn	50.686	2	.000

Suspected drug-facilitated	56.856	2	.000
Patient alcohol use	60.264	2	.000
Perpetrator action verbal threat/coercion	64.625	2	.000
Number of penetrative acts (oral, vaginal, anal)	66.353	5	.000
Multiple perpetrators	67.977	2	.000
Perpetrator drug use	68.431	2	.000
Perpetrator action use of restraints	74.165	2	.000
Patient reported pain	78.711	1	.000
Patient relationship to perpetrator	81.828	5	.000
Perpetrator action use of a weapon	109.004	2	.000
Site of exam	115.852	4	.000
Loss of consciousness/awareness	123.127	2	.000
Perpetrator action strangled/choked	205.975	2	.000
Perpetrator action grabbed held	241.917	2	.000
Perpetrator action physical blows	267.099	2	.000

One year of data (2018, n=788) was analyzed to further explore non-anogenital injury type related to location. Extremities were the most common location for non-anogenital injuries followed by the chest/back, neck, head, breasts, and abdomen. Bruises and abrasions were the most common non-anogenital injury type in every location excluding the neck (Table 7).

Table 7

Percentage of Non-Anogenital Injury Type Related to Location (2018 Cases, n=788)

	Abdomen (n=56, 7%)	Breasts (n=106, 14%)	Chest/back (n=156, 20%)	Head (n=117, 15%)	Extremities (n=449, 58%)	Neck (n=129, 17%)
Abrasion	21%	18%	38%	22%	37%	18%
Bruise or ecchymosis	41%	38%	27%	44%	60%	36%
Laceration	5%	8%	17%	6%	5%	2%
Petechiae	4%	9%	4%	10%	4%	25%
Redness or discoloration	9%	11%	13%	14%	13%	14%
Swelling	0%	3%	20%	15%	1%	3%
Other	7%	4%	11%	9%	2%	5%

Anogenital Injury

Anogenital injury prevalence was 51.0% of the study population. The mean number of anogenital injuries was 1.56 (range 0-47), mean of 6.20, mode of 0. One quarter of the study population had zero anogenital injuries. The most common location of anogenital injury was the fossa navicularis (Figure 3). The most common types of anogenital injuries were lacerations and abrasions (Figure 4).

Figure 3
Anogenital Injury Type

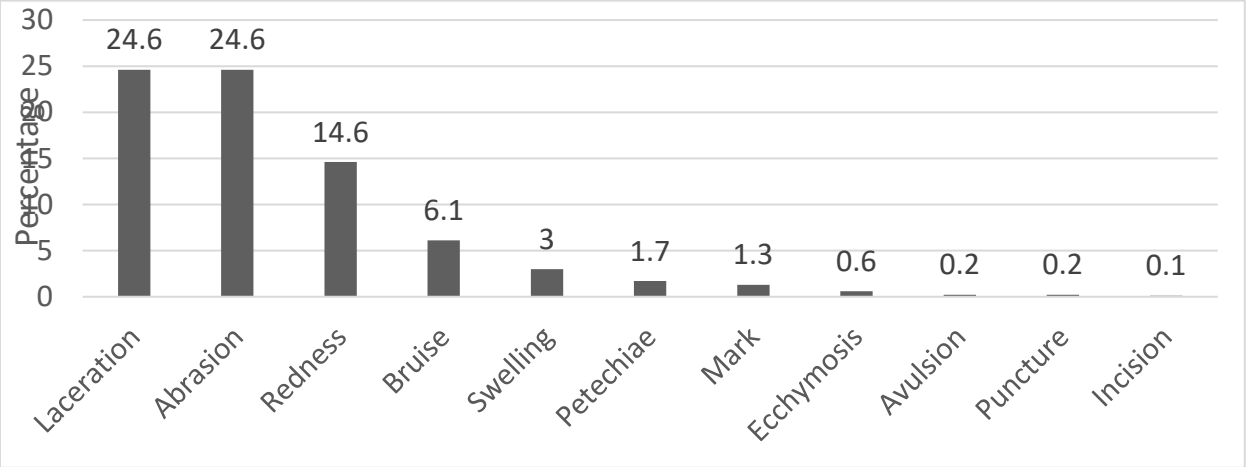
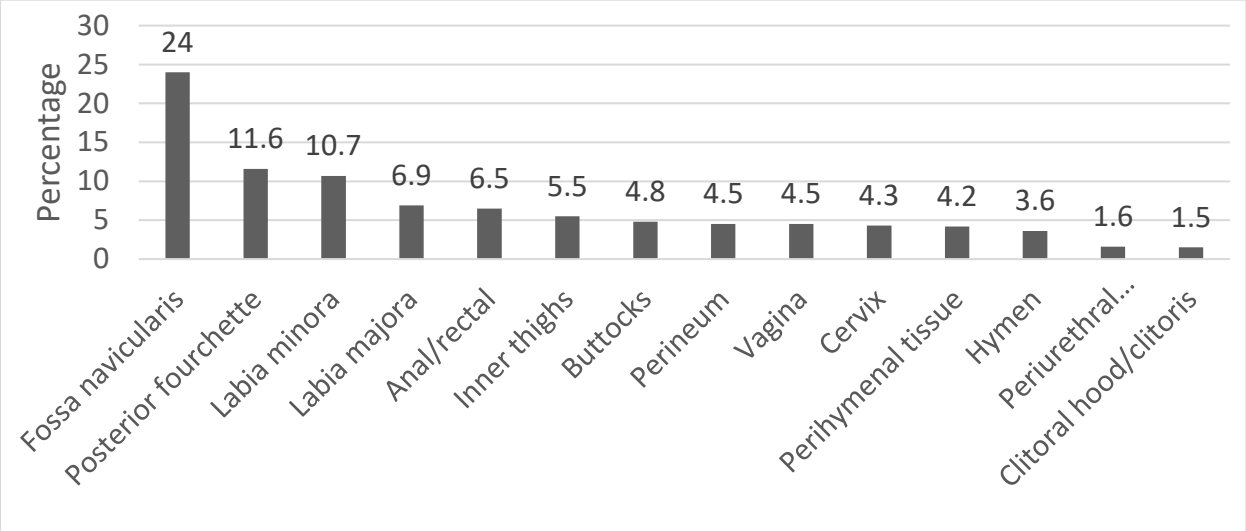


Figure 4
Anogenital Injury Location



Continuous variables of number of anogenital injuries and time between assault and examination were explored for significance through t-tests analysis. Patient age >18 years was significantly associated with a higher mean number of anogenital injuries (M=1.60, SD=2.838, vs. M=1.32, SD=1.987, t=3.317, p= .001, CI= .111, .434). More anogenital injuries were also

documented among patients who presented sooner for examination (M=23.014 hours, SD=27.5998 vs. M=28 hours, SD=34.8224, t=5.750, p=.000, CI: 3.3067,6.7284).

Categorical variables associated with documentation of more anogenital injuries included White race, site of exam (two of five sites) patient and perpetrator alcohol use, and reported pain. If the assault was drug-facilitated or if patient had a physical or medical problem, more anogenital injuries were documented. Patient actions including scratching, hitting, or kicking and perpetrator actions including verbal threats, holding patient, physical blows, strangulation, or burning patient resulted in more anogenital injuries. The effect of the use of lubrication on anogenital injuries was unclear as 23% of the patients reported "unknown" to lubrication use resulting in a high percentage of missing data (Table 8).

Categorical variables resulting in fewer documented anogenital injuries included Black patients, site of exam (three of five sites), and patients who reported drug use. If the assault was fondling alone or only one penetrative act, less anogenital injuries were documented. Insignificant variables (p>.05) included patient relationship to perpetrator, age <18 years, exam by SANE, location of assault, patient action bite, perpetrator use of weapon or restraints, multiple perpetrator assault, online meeting of perpetrator, patient physical or mental impairment, patient loss of consciousness/awareness, perpetrator drug use, and patient awakened to assault (Table 8).

Table 8

Chi-Square Tests of Association: Anogenital Injuries

Variables	Chi-Square Value	df	P-value
Exam by SANE	.018	1	.893
Loss of consciousness or awareness	.306	2	.858

Asleep and awakened to assault	1.027	2	.598
Perpetrator drug use	1.068	2	.586
Physical or mental impairment	1.499	2	.473
Multiple perpetrators	1.800	2	.407
Perpetrator action use of restraints	2.034	2	.362
Patient under the age of 18	2.137	1	.144
Patient action bite	2.659	2	.265
Online meeting of perpetrator	2.785	2	.248
Perpetrator action use of weapon	4.564	2	.102
Patient action kick	5.380	2	.068
Location of assault	5.538	4	.236
DV suspect	6.034	1	.886
Suspected drug-facilitated	6.400	2	.041
Patient action scratch	6.585	2	.037
Patient action hit	7.357	2	.025
Perpetrator action burned	8.299	2	.016
Patient drug use	8.457	2	.015
Patient relationship to perpetrator	10.604	5	.060
Current physical or medical problem	12.421	1	.000
Perpetrator action physical blows	12.970	2	.002

Ejaculation occurred	14.627	2	.001
Perpetrator alcohol use	18.875	2	.000
Patient alcohol use	19.726	2	.000
Race	20.925	6	.002
Reported pain	24.921	1	.000
Perpetrator action verbal threat or coercion	30.221	2	.000
Perpetrator action strangled or choked	36.198	2	.000
Number of assaultive acts	54.622	5	.000
Perpetrator action grabbed or held	54.647	2	.000
Site of exam	74.680	4	.000

One year of data (n=788) was analyzed to further explore patterns of anogenital injury type related to location. Interestingly, for this year, while the fossa navicularis remained the most common anogenital injury location (19%), the second most common location was the labia minora (8%) instead of the posterior fourchette (6%). Lacerations and abrasions were the most common anogenital injury types for each of the following locations: fossa navicularis, labia majora, labia minora, perineum, and posterior fourchette. At the vagina, 25% of the study population had redness, bruises, and abrasions. At the cervix, lacerations and bruises were the most common anogenital injury type. Regarding the anal/rectal area, lacerations were the most common anogenital injury types followed by an equal percentage of abrasions and bruises (Table 9).

Table 9

Percentage of Anogenital Injury Type Related to Location, (2018 Cases, n=788)

	Anal/rectal (n=28, 4%)	Cervix (n=23, 3%)	Fossa navicularis (n=141, 19%)	Labia majora (n=28, 4%)	Labia minora (n=63, 8%)	Perineum (n=21, 3%)	Posterior fourchette (n=45, 6%)	Vagina (n=32, 4%)
Abrasion	14%	4%	33%	25%	24%	33%	20%	25%
Bruise or ecchymosis	14%	17%	7%	14%	11%	24%	4%	3%
Laceration	39%	22%	43%	18%	21%	33%	47%	25%
Petechiae	0%	9%	0%	0%	0%	0%	0%	3%
Redness or discoloration	7%	22%	6%	11%	10%	0%	2%	25%
Swelling	0%	9%	1%	11%	5%	0%	2%	3%
Other	0%	0%	0%	0%	0%	0%	0%	6%

Discussion

Documentation and description of both non-anogenital and anogenital injuries are necessary in SA examination forms. In addition, a clear understanding of the prevalence, location, and type of injuries is necessary for interdisciplinary partners including forensic practitioners, SA nurse examiners, law enforcement, and criminal justice professionals.

Non-Anogenital Injuries

Non-anogenital injuries are explored in relation to the findings from prior published studies.

Prevalence, Location, and Type

Previous research reports non-anogenital injury prevalence of 30-76% (Carter-Snell, 2007). This study's non-anogenital injury prevalence of 73% was likely on the higher end because participants were primarily White. The most common location of non-anogenital injuries were the extremities as documented in other research studies (Alempijevic et al., 2007; Hwa et al., 2010; Maguire, 2008; Moller et al., 2012; Palmer et al., 2004; Song and Fernandes, 2017). One possible explanation for this is that the most common perpetrator action (62%) includes grabbing or holding the patient, frequently on the extremities to control the victim. The most common types of non-anogenital injuries were bruises (53%) followed by abrasions (40%) which is analogous to previous research (Alempijevic et al., 2007; Maguire et al., 2008; McGregor et al., 2002; Palmer et al., 2004; Sugar et al., 2003).

Victim-Perpetrator Relationship Type and Alcohol/Drug Use

Other studies suggested that intimate partner assaults result in more non-anogenital injuries (Carter-Snell, 2007; Moller at al., 2012; Seyller et al., 2016). This study's findings similarly indicated that patients of intimate partner assaults are more likely to present with non-

anogenital injuries. SA research to date is confounding on the relationship of alcohol or drug use and non-anogenital injuries (Carter-Snell, 2007; Leclerc et al., 2016; Siefert et al., 2009). Interesting, this study indicated that non-anogenital injuries were more likely in the case of both patient and perpetrator alcohol or drug use.

Age and Race

Regarding age, other studies have failed to clearly demonstrate the relationship between age and non-anogenital injuries (Carter-Snell, 2007; Jones et al., 2003; Maguire et al., 2008; Palmer et al., 2004). This study adds to previous SA research by indicating that patients <18 years old were less likely to present with non-anogenital injuries. Further, patient age >18 years were significantly associated with a higher mean number of non-anogenital injuries. Possible explanations for this include decreased physical resistance to SA among adolescent victims or increased likelihood of women >18 years old to be assaulted by an intimate partner. White race was associated with more documented non-anogenital injuries as found in other studies. This finding raises concerns about health and justice equity for darker-skinned victims if their injuries are less likely to be documented in SA examination forms.

Anogenital Injuries

Review of the study findings in relationship to prior study findings are summarized.

Prevalence, Location, and Type

Previous studies have reported an anogenital injury prevalence of 5-76% (Carter-Snell, 2007). This study's anogenital injury prevalence was 51%. Prior research has reported the two most common locations of anogenital injury as the posterior fourchette and the fossa navicularis (Hilden et al., 2005; Jones, et al., 2003; Jones et al., 2008; Lincoln et al., 2013; McLean et al., 2011; Moller et al., 2012). This study reports similar findings with the fossa navicularis as the

most common anogenital injury location (24%) followed by the posterior fourchette (12%). Other studies have reported lacerations are the most common type of anogenital injury (Carter-Snell, 2007; Hilden et al., 2005; McLean et al., 2001;; Moller et al., 2012;), while this study found the most common type were lacerations (25%) *and* abrasions (25%).

Victim-Perpetrator Relationship Type and Alcohol/Drug Use

SA research also indicates that while intimate partner assaults are more violent, results vary on whether these assaults lead to more anogenital injuries (Moller et al., 2012; Stermac et al., 2001; Stermac et al., 2008). Indeed, this study found patients of intimate partner assaults were not more likely to present with anogenital injuries. One possible explanation for these findings includes the sexual familiarity or "muscle memory" of an intimate partner. Previous studies have suggested that alcohol/drug use was a protective factor for anogenital injury (Feeney et al., 2017; Hilden et al., 2005; Maguire et al., 2008). By contrast, this study found that patient and perpetrator alcohol use was associated with more anogenital injuries. Interestingly, patient drug use was associated with fewer injuries and perpetrator drug use was not a significant variable. More research needs to be done in this area.

Age and Race

The relationship between age and anogenital injury is variable—some studies have failed to find any association, while others have found a bimodal relationship, and still others have found a unimodal relationship such that older women are at a higher risk for anogenital injury (Hilden et al., 2005; Palmer et al., 2004; Sugar et al., 2003; Sommers et al., 2006). In the present study, although age <18 years was not a significant variable for determining a greater likelihood of anogenital injury, age >18 years was significantly associated with a higher mean number of anogenital injuries. One possible explanation for this finding could be age-related changes to the

female genitalia including increased vaginal dryness and decreased elasticity. Similar to previous studies (Anderson and Sheridan, 2012; Rossman et al., 2019; Sommers et al., 2006; Sommer et al., 2019), this study found a discrepancy between race and anogenital injury, such that Whites are more likely to have documented anogenital injuries. This finding appears more related to the ease in detecting anogenital injuries in lighter-skinned patients rather than an actual increased incidence of injuries among Whites.

Implications for Practice

As these findings suggest that non-anogenital injuries occur more frequently than anogenital injuries in SA (73% vs. 51%), it is imperative for criminal justice professionals to be educated to regard both injury types as vital evidence. LE and prosecutors should also be educated regarding injury patterns of SA, such as common locations and types of injury, as well as the importance of correlating injuries with the patient history.

SANEs should be educated to be clear and objective in documentation. While SANEs cannot document the cause of injury, clear documentation of the patient history as well as the type, location, and description of injuries is vital. As our findings indicated a statistically significant difference in injury detection between sites, standardization of injury identification and description would prove beneficial in terms of consistency. One approach would be utilization of a standardized scale, such as Genital Injury Severity Score (GISS), developed by Larkin and Kelly, which includes categories of swelling, color change, tissue breaks (lacerations and abrasions), hymen and introitus tear, and toluidine blue dye uptake with descriptive levels of severity per category (Kelly & Larkin, 2013; Kelly et al., 2017; Larkin et al., 2011).

Similar to previous studies (Anderson & Sheridan, 2012; Rossman et al., 2019; Sommers et al., 2006; Sommers et al., 2019), our findings reveal a disparity between injury detection in

lighter vs darker-skinned individuals. Developing better methods of injury detection for darker-skinned individuals is key to improving the health and legal outcomes of this population. One possible method to explore is the use of white light or alterative light sources, as suggested by Scafide and colleagues (Scafide et al., 2020), who demonstrated excellent validity and reliability of white and alternative light sources in the evaluation of bruises across skin tones.

Conclusion

SA victimization is a public health crisis affecting the physical, mental, and emotional health (Valentine et al., 2019) of nearly one in four women in the United States (MMWR, 2014). Injury findings from this large retrospective, descriptive study inform both nursing and interdisciplinary practice, with the objective of improving patient care and criminal justice outcomes of SA victims. Forensic nurses can improve patient care and criminal justice outcomes through thorough assessment and documentation of injuries following SA. In turn, it is imperative for LE and criminal justice to equally consider anogenital *and* non-anogenital injuries; together, injury findings can provide information regarding the events of an assault and provide evidence for case prosecution.

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