



Contents lists available at ScienceDirect

Disability and Health Journal

journal homepage: www.disabilityandhealthjnl.com

Prevalence of sexual abuse and intimate partner violence in adults with spina bifida[☆]

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ARTICLE INFO

Keywords:
Sexuality
Spina dysraphism
Adult
Neurogenic urinary bladder

ABSTRACT

Background: People with disabilities and chronic medical conditions are known to be at higher risk of sexual abuse (SA) and intimate partner violence (IPV). People with spina bifida (SB) are vulnerable, but little is known about the prevalence of abuse in this population.

Objective: To evaluate the prevalence and risk factors of SA and IPV in adults with SB.

Methods: An anonymous international cross-sectional online survey of adults with SB asked about history of SA ("sexual contact that you did not want") and IPV ("hit, slapped, kicked, punched or hurt physically by a partner").

Results: Median age of the 405 participants (61% female) was 35 years. Most self-identified as heterosexual (85%) and were in a romantic relationship (66%). A total of 19% reported a history of SA (78% no SA, 3% preferred not to answer). SA was more frequently reported by women compared to men (27% vs. 5%, $p < 0.001$) and non-heterosexual adults compared to heterosexuals (41% vs. 15%, $p < 0.001$). Twelve percent reported a history of IPV (86% no IPV, 2% preferred not to answer). IPV was more frequently reported by women compared to men (14% vs. 9%, $p = 0.02$), non-heterosexuals compared to heterosexuals (26% vs. 10%, $p = 0.002$), and adults with a history of sexual activity versus those without (14% vs. 2%, $p = 0.01$).

Conclusion: People with SB are subjected to SA and IPV. Women and non-heterosexuals are at higher risk of both.

1. Introduction

Spina bifida (SB) is the most common permanently disabling, non-chromosomal birth defect.¹ SB leads to a variety of physical disabilities affecting the neurologic, orthopedic, gastrointestinal, and genitourinary systems. Many require ventriculoperitoneal shunts (VPS) to treat their hydrocephalus. Mobility, which is largely dependent on the spinal level of the SB defect, varies from no restrictions to non-ambulation. The resultant neurogenic bowel and bladder dysfunction is addressed with both medical and surgical treatments to achieve continence and preserve intestinal, bladder and renal health. These chronic conditions can be well-managed and over 75% of children with SB reach adulthood.^{2,3}

With this growing population of adults with SB, increasing emphasis has been placed on their psychosocial development, healthy interpersonal relationships, and good sexual health.⁴⁻⁷ Part of this includes identifying unhealthy interpersonal interactions including sexual abuse (SA) and intimate partner violence (IPV). Both adults and children with disabilities are at higher risk of abuse. Children with disabilities are specifically vulnerable due to their physical limitations, desire to please and be compliant with adults/caregivers, and their dependency on others for physical care.^{8,9} This last factor is particularly true of those with SB who require close physical contact with caregivers for the management of their neurogenic bladder via intermittent catheterization or incontinent stomal care. This is concerning especially in the context that one-third of abusers are known to disabled victims with

Abbreviations: (SB), Spina bifida; (VPS), Ventriculoperitoneal shunts; (SA), Sexual abuse; (IPV), Intimate partner violence; (AAP), American Academy of Pediatrics; (SBA), Spina Bifida Association; (y), Years old.

[☆] **Prior presentations:** 33rd Congress of the European Society for Paediatric Urology, April 19, 2023, Lisbon, Portugal.

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<https://doi.org/10.1016/j.dhjo.2024.101617>

Received 18 July 2023; Received in revised form 12 March 2024; Accepted 19 March 2024

Available online 20 March 2024

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44% of abused children being in a care-providing relationships with their abusers.^{9,10}

While 62% of disabled individuals have had a history of childhood abuse, abuse is not limited to childhood; nearly a quarter of young adults with a disability report experiencing some form of abuse within the past year.¹¹ Females with disabilities are at a particularly high risk with an 83% lifetime risk of SA. Males with disabilities have 3 times higher lifetime risk of SA than males without disabilities.¹² Similarly, sexual orientation plays a role; disabled non-heterosexuals report higher rates of SA compared to their non-disabled counterparts.¹³ Based on these findings, we sought to evaluate the prevalence of SA and IPV and associated risk factors specifically in the SB population.

SB healthcare providers, healthcare organizations and patient advocacy groups, including the American Academy of Pediatrics (AAP) and the Spina Bifida Association (SBA), recognize the importance in addressing abuse especially in sexual health education.^{14,15} However, impactful sexual health education for young adults and adults with SB depends on quality data. There are little data on the prevalence of SA or IPV specifically in the SB population.^{16,17} These studies are limited to small young adult cohorts within specific geographic locations. With a more expansive evaluation, providers can more accurately gauge the extent of these issues within the SB population. A better assessment of SA and IPV would aid providers in counseling people with SB and their caregivers on the risks, advocating for improved preventative and therapeutic interventions, and assessing the impact of such interventions.

This study sought to address this knowledge gap by identifying the prevalence of SA and IPV in the SB population. We aimed to evaluate the prevalence and risk factors of SA and IPV in adults with SB. We hypothesized that (1) a non-negligible proportion of adults with SB have experienced both SA and IPV, and (2) females, non-heterosexuals, and those managing their neurogenic bladder with either catheterization or with an incontinent stoma would be at higher risk.

2. Methods

2.1. Data collection & survey design

An anonymous, international online survey was administered to English- and German-speaking adults (≥ 18 years old [y]) with SB. Between 2016 and 2020, a convenience- and snowball-sample of participants was recruited in-person from SB clinics and through local, national, and international SB organizations via social media (Facebook) and internal email lists (**Acknowledgements**). Study information was posted on an independent website, allowing potential participants to learn about the study, the investigators, and complete informed consent to access the survey.

Results reported here represent a subset of a comprehensive survey of sexuality-related outcomes. No identifiable data, such as name, date of birth, and address, were collected. Of the 456 individuals who completed the survey, 405 (89%) provided answers on the variables of interest, SA and/or IPV, and were included in the analysis of this paper.

As previously described,¹⁴ the Internal Review Board-approved survey was developed by the authors, including an adult and adolescent sexuality expert. The survey was reviewed by 3 additional pediatric urologists and 2 nurse practitioners who care for adults with SB. It was then reviewed for clarity and comprehension by a group of adults with SB (2 men, 5 women, median age 30y) and a Health Literacy Educator. Translation into German was performed by 2 native German speaking urologists (forward translation) and a professional translator (backwards).

2.2. Variables of interest

Surveys included questions on demographics, clinical history, and social/sexual history (**Supplement**). Participants were considered non-

ambulators if they used a wheelchair or only walked in therapy sessions. Those walking inside or outside with or without the use of a walker/braces/crutches were considered community ambulators. Relationship status was determined by asking, "What is your relationship status right now?" Those who reported being single, divorced/separated, widowed, or preferred not to answer were considered to not be in a relationship. Participants who were dating someone, in a relationship, or married were categorized as being in a relationship. Lastly, participants were asked how they empty their bladder either by voiding or leaking per urethra, by catheterization, or by an incontinent stoma.

Sex was defined by responses to the question, "I was born as" with options of "male" or "female." As previously published,^{18,19} sexual orientation was determined by asking "How would you describe your sexual orientation (who are you attracted to)?" Participants were considered heterosexual if they selected "straight/heterosexual (not gay)" versus non-heterosexual if they selected one of the following: "gay, lesbian, or homosexual," "bisexual (I am attracted to both men and women)," "asexual (I am not sexually attracted to others)," "Other (free text to describe)," and prefer not to answer. SA history was determined by asking "Have you ever had sexual contact that you did not want?" (yes/no/prefer not to answer). IPV history was obtained by asking "Have you ever been hit, slapped, kicked, punched, or hurt physically by a partner?" (yes/no/prefer not to answer).

2.3. Statistical analysis

Data were managed in a secure online platform, REDCap.²⁰ Fisher's exact test was used for univariate comparisons and logistic regression for multivariate analysis. Variables with a $p < 0.05$ on univariate analysis were included in the multivariate analysis (Stata, StataCorp, College Station, TX, USA). Missing data were labeled as "unknown" and included within the analysis.

3. Results

Participants included 405 adults with SB with a median age of 35y (IQR: 29-43, Range: 17-89, [Table 1](#)). Although the most frequently reported country of residence was the United States ($n = 195$, 48%), participants were from 37 different countries over 5 continents (North America $n = 215$, 53%; Europe $n = 129$, 32%; Australia $n = 36$, 9%; Asia $n = 13$, 3%; Africa $n = 7$, 2%). The majority were female ($n = 247$, 61%) and heterosexual ($n = 344$, 85%). Non-heterosexual participants included 3% gay/lesbian/homosexual ($n = 13$), 8% bisexual ($n = 33$) and 1% asexual ($n = 5$). Approximately half had a VPS ($n = 216$, 53%), were non-ambulators ($n = 162$, 53%), and managed their urinary tract by either catheterization or urinary stoma ($n = 211$, 51%).

3.1. Sexual abuse

A total of 75 respondents (19%) had a history of SA compared to 78% ($n = 75$) that did not ($n = 13$, 3% preferred not to answer). Of those with a history of SA, 89% were female ($n = 67$) and 67% were heterosexual ($n = 50$, [Table 1](#)). Females reported SA more frequently than males (27% versus 5% respectively, $p < 0.001$, [Table 2](#)). Sexual orientation correlated with SA history: non-heterosexuals reported significantly higher rates of SA (41%) compared to heterosexuals (15%, $p < 0.001$). Those currently in relationships reported similar rates of SA compared to those who were single (20% vs. 16% respectively, $p = 0.67$). Ambulation and VPS status did not result in significantly different rates ($p \geq 0.23$). While 27% of those voiding per urethra reported SA compared to 15% of those who catheterized or had a urinary stoma, this did not reach statistical significance ($p = 0.15$).

On multivariate analysis, sex and sexual orientation were both independently associated with higher risk of SA. Females were independently more likely to have a history of SA compared to males (OR 6.3 [95% CI 3.1-12.7, $p < 0.001$]). Non-heterosexuals were also more likely

Table 1
Demographics of adults with spina bifida with a history of sexual abuse or intimate partner violence.

Demographic	Total n = 405	SA History n = 75	IPV History n = 48
Age (median, IQR)	35y (29-43)	34y (28-42)	36y (22-44)
Location			
United States	195 (48%)	43 (57%)	28 (58%)
Outside the United States	210 (52%)	32 (43%)	20 (42%)
Sex			
Male	158 (39%)	8 (11%)	14 (29%)
Female	247 (61%)	67 (89%)	34 (71%)
Sexual Orientation			
Heterosexual	344 (85%)	50 (67%)	33 (69%)
Gay/Lesbian/Homosexual	13 (3%)	3 (4%)	4 (8%)
Bisexual	33 (8%)	17 (23%)	10 (21%)
Asexual	5 (1%)	2 (3%)	0 (0%)
Other	6 (2%)	3 (4%)	1 (2%)
Unknown	4 (1%)	0 (0%)	0 (0%)
Relationship Status			
Single	135 (66%)	22 (29%)	13 (27%)
In a relationship	268 (33%)	53 (71%)	35 (73%)
Unknown	2 (1%)	0 (0%)	0 (0%)
Ventriculoperitoneal shunt	216 (53%)	39 (52%)	25 (52%)
Ambulatory status			
Non-ambulatory	162 (40%)	25 (33%)	19 (40%)
Ambulatory	243 (60%)	50 (67%)	29 (60%)
Bladder management			
Incontinent stoma	21 (5%)	2 (7%)	1 (2%)
Catheterizes	190 (47%)	29 (39%)	21 (44%)
Voids/Leaks per urethra	63 (16%)	17 (23%)	9 (19%)
Unknown	134 (33%)	27 (36%)	17 (35%)

*y = years, SA = sexual abuse, IPV = intimate partner violence.

to have experienced SA than heterosexuals (OR 3.0 [95% CI 1.6–5.6, $p < 0.001$]). Stratifying study participants based on these two variables, 51% of non-heterosexual females experienced SA (Table 3), followed by 22% of heterosexual females. Among non-heterosexual males, 13% reported SA, compared to 4% heterosexual males.

Table 2
Risk factors for sexual abuse in adults with spina bifida.

	Sexual Abuse History n = 405				Intimate Partner Violence n = 396			
	No n = 317	Yes n = 75	PNA n = 13	p	No n = 340	Yes n = 48	PNA n = 8	p
Age								
18-35y	146 (75%)	41 (21%)	7 (4%)	0.36	165 (87%)	20 (10%)	5 (3%)	0.52
≥35y	168 (81%)	34 (16%)	6 (3%)		175 (85%)	28 (14%)	3 (1%)	
Unknown	3 (100%)	0 (0%)	0 (0%)		–	–	–	
Sex								
Male	148 (94%)	8 (5%)	2 (1%)	<0.001	138 (91%)	14 (9%)	0	0.02
Female	169 (68%)	67 (27%)	11 (5%)		202 (83%)	34 (14%)	8 (3%)	
Sexual Orientation								
Heterosexual	282 (82%)	50 (15%)	12 (3%)	<0.001	298 (88%)	33 (10%)	6 (2%)	0.002
Other or PNA	35 (57%)	25 (41%)	1 (2%)		42 (71%)	15 (26%)	2 (3%)	
Relationship Status								
Single	111 (81%)	22 (16%)	4 (3%)	0.67	117 (89%)	13 (10%)	2 (1%)	0.65
In a relationship	206 (77%)	53 (20%)	9 (3%)		223 (85%)	35 (13%)	6 (2%)	
Sexual Activity History								
No	–	–	–	–	54 (95%)	1 (2%)	2 (3%)	0.01
Yes	–	–	–		286 (84%)	47 (14%)	6 (2%)	
Community Ambulator								
Ambulator	143 (75%)	42 (22%)	6 (3%)	0.23	159 (84%)	26 (14%)	4 (2%)	0.62
Non-ambulator	174 (81%)	33 (16%)	7 (3%)		181 (87%)	22 (11%)	4 (2%)	
VP Shunt								
Yes	168 (78%)	39 (18%)	9 (4%)	0.64	182 (86%)	25 (12%)	5 (2%)	0.89
No	148 (79%)	36 (19%)	4 (2%)		157 (86%)	23 (12%)	3 (2%)	
Unsure	1 (100%)	0 (0%)	0 (0%)		1 (100%)	0 (0%)	0 (0%)	
Bladder Management								
Voids	44 (70%)	17 (27%)	2 (3%)	0.15	52 (84%)	9 (14%)	1 (2%)	0.93
Catheterization or Urinary diversion	172 (83%)	31 (15%)	5 (2%)		176 (87%)	22 (11%)	4 (2%)	
PNA	101 (75%)	27 (20%)	6 (5%)		112 (85%)	17 (13%)	3 (2%)	

*PNA=Prefer not to answer.

3.2. Intimate partner violence

Of the total cohort, 396 respondents provided information on IPV (Table 1). Forty-eight adults with SB (12%) reported a history of IPV and 340 (86%) denied IPV history (n = 8, 2% preferred not to answer). Females had significantly higher rates of IPV than males (14% versus 9% respectively, $p = 0.02$, Table 2). Non-heterosexuals also reported IPV more frequently compared to heterosexuals (26% versus 10% respectively, $p = 0.002$). Although relationship status was not associated with IPV risk, those with a history of sexual activity more frequently reported IPV (14%) than those who have never been sexually active (2%, $p = 0.01$). Other clinical factors, including ambulation, bladder management method, and presence of VPS, were not associated with IPV ($p \geq 0.62$).

On a multivariate analysis of sex, sexual orientation, and sexual history as potential predictors of IPV, only sexual orientation was an independent risk factor for IPV. Non-heterosexuals were more likely to have experienced IPV compared to heterosexuals (OR 2.9 [95% CI 1.5–5.7, $p = 0.002$]). IPV risk differences were not statistically significant between females and males (OR 1.8 [95% CI 0.9–3.4, $p = 0.083$]), or between sexually active to non-active adults (OR 3.2 [95% CI 1.0–10.8, $p = 0.059$]).

This was reflected in assessing both sex and sex orientation risk for IPV (Table 3). Among non-heterosexual females, 32% reported IPV. Conversely, IPV was reported by 7–10% of heterosexual females, heterosexual males, and non-heterosexual males.

Table 3
Risk of sexual abuse and intimate partner violence stratified by sex and sexual orientation.

	Sexual Abuse (n = 405)		Intimate Partner Violence (n = 396)	
	Male	Female	Male	Female
Heterosexual	6/142 (4%)	44/202 (22%)	13/137 (9%)	20/200 (10%)
Other	2/16 (13%)	23/45 (51%)	1/15 (7%)	14/44 (32%)

4. Discussion

Although our study expands on the limited knowledge of abuse within the SB population, previously published studies provided important glimpses into this topic. A retrospective review of outpatient visits of 86 young adults with SB (median age 21y) in London noted 2 women disclosing rape and 2 men disclosing physical abuse.¹⁶ In 1999, Sawyer and Roberts surveyed a small group of adolescents in Australia; 10 of 27 women (37%) and 1 in 24 men (4%) reported unwanted sexual attention with a mean age of occurrence of 14y.¹⁷ A more recent qualitative study interviewed 25 women with SB and 4 shared their experiences SA although the researchers did not explicitly ask about abuse.²¹ These previous reports were the first to publish on abuse in the SB population; however, larger, population-based studies with more expansive age ranges and a broader geographic coverage were needed to better characterize the topic. Van Horne et al. conducted a larger, population-based study of maltreatment in 893 children with SB and identified only 3 cases of physical abuse and 0 cases of SA. This study differed in its evaluation of Child Protective Service reports rather than being interview- or survey-based, and in its focus on children aged 2-10y.²²

To build upon this foundation, our study represented the largest international adult cohort surveyed from 37 different counties. We had an expansive age range of 18 to 79y, with participants self-reporting lifetime experiences of abuse. Additionally, we separately evaluated the prevalence of two types of abuse: 19% reported SA and 12% reported IPV. It is our hope that these data, which represent a comprehensive and generalizable assessment, can help educate and improve the psychosocial functioning of people with SB.

Similar to previously published studies, we found that SA and IPV were more likely to be reported by females with SB. Twenty-seven percent experienced SA and 14% were victims of IPV. Although females with SB compared to males were more likely to experience SA on multivariate analysis, the same was not true for a history for IPV. Literature comparing women with disabilities to non-disabled women suggests no differences when it comes to the risk of abuse in general²³ but does show a higher risk of SA for women with disabilities compared non-disabled women.^{21,24} Irrespective of disability status, the overall lifetime prevalence SA for women in the United States is 44%²⁴ and IPV 25%.²⁵ It should be noted that our study sample was young and abuse prevalence would be expected to increase with age. In evaluating both sex and sexual orientation as risk factors for abuse, we found that females, whether heterosexual or non-heterosexual, had greater odds of SA than males.

Sexual orientation, in and of itself, was a significant risk factor for SA and IPV in this study. Of the non-heterosexual participants, 41% reported SA and 26% IPV. Sexual minorities, including those with disabilities, have been previously reported to be at increased risk of both physical and sexual violence.¹³ In the general population up to 79% of non-heterosexual women and 59% of non-heterosexual men have experienced either sexual or physical abuse.²⁶ Non-heterosexual adolescents are twice more likely than heterosexual adolescents to report abuse.²⁷ Specific sexual orientations, such as bisexuality, may be at a higher risk of abuse than others.²⁸ In our study, bisexuality was the most frequently reported non-heterosexual orientation with 54% (33/61) of non-heterosexuals SB adults. However, we were not sufficiently powered to specifically compare the abuse risk among different sexual orientations given the low numbers in each group.

We hypothesized that participants managing their bladder with catheterizations or an incontinent stoma would report higher abuse rates. Many of these adults require close physical contact by caregivers from early childhood. Specifically, this includes genitals being touched for urethral catheterization and exposing their abdomen for stomal care, which could place them in vulnerable situations. Our findings did not support this hypothesis. However, our results may not have been sufficiently powered, as one-third of respondents did not provide bladder

management information. Further clarification on who was performing the catheterization or stomal care would be needed to properly assess the hypothesis as well.

IPV and SA have both immediate and lifelong consequences. In the general population, 33% of victims of SA or IPV are physically injured and 12% require acute medical attention.²⁶ In addition to the physical injuries, 28% of female and 11% of male survivors endure long-term mental and emotional struggles.²⁶ Victims of both childhood and adulthood abuse, including those with development disabilities, are more likely to have psychiatric issues (e.g., depression, post-traumatic stress disorder, suicidal ideation), substance abuse disorders, perform poorly in school, and commit crimes.^{29,30} Furthermore, child victims are also 2.5 times more likely to experience repeat abuse in adulthood.³¹ To break this cycle of abuse and optimize long-term health, screening and prompt evaluation at every age are critical.³² Evaluating patients throughout childhood and adulthood is important as there is often a significant delay in abuse disclosure with over half of children not reporting abuse until adulthood.³³

Sexual health education is a key element to both preventing abuse itself and minimizing delays in disclosure.³⁴ Comprehensive sexual health education goes beyond anatomy, sexual activity, and pregnancy. The AAP recommends children and adolescents should also be educated on topics spanning interpersonal relationships, gender identity, and body image.³² Abuse education should be both victimization-based (e.g. identifying, resisting, and disclosing abuse) and perpetrator-based (e.g. promoting healthy sexual relationship and preventing inappropriate/illegal activities).³⁵ Development of a healthy sexual and social identity is a complex and important part of growing up for both the general population and those with disabilities.

Despite the well-established emphasis on sexual education for able-bodied children, those with disabilities, including SB, receive insufficient sexual education.⁵⁻⁸ Delays or complete lack of such education in the SB population has notable impacts on reproductive health with SB adults being at high risk for unplanned pregnancies and sexually transmitted infections.¹⁷ Numerous factors play a role in this process, including both provider-related factors (e.g., lack of disability-specific sexual health medical training) and parent-related factors (e.g., anxiety from protective parents).^{6,7} Ableism biases also incorrectly assume the disabilities of people with SB render people them asexual.⁹ This misconception has been repeatedly disproven with over 70% of adults with SB reporting desire for sexual contact and up to 97% having a history of sexually activity.^{14,36} In our cohort, 86% had a history of sexual activity, 73% were dating or in a relationship, and only 1% of respondents identified as asexual.

To better address this issue, the SBA included Sexual Health and Education in their 2018 Guidelines for the Care of People Living with Spina Bifida.¹⁵ These guidelines outline longitudinal, age-based counseling for both parents and patients on psychosocial development and sexual health. As early as 6-12y, children with SB should be educated about their body autonomy, inappropriate touching, and how to seek help in dangerous situations. As they mature, these conversations should continue and evolve to include SA and IPV emphasizing the importance of disclosure.¹⁵ If they are taught the language to discuss SA and IPV, people with SB will be better prepared to identify abuse or seek the help they deserve.

Our study is limited by several factors. First, the anonymous aspect of our survey was both potentially beneficial and limiting. It may have allowed respondents to comfortably answer sensitive questions about abuse with unrestricted honesty. Thus, those with a history of abuse may have been more likely to respond to the survey questions. Conversely, those with significant cognitive impairments were not able to participate in this survey. Thus, abuse history was potentially underreported in this specific cohort. However, we could not link participants' answers to their medical records or clinical histories.

Self-reporting can also be subject to bias and misreporting. As previously discussed, individuals with SB are poorly educated on sexuality

and, thus, may not be able to accurately identify or report their abuse history. This may be another reason that the prevalence reported in this study may be an underestimate. Being a survey of specific outcomes administered within a larger study of sexuality, we did not gather data regarding the nature of the abuse. We did not capture the age at which it occurred, duration of abuse, number of abuse experiences, relationship to the abuser, and sequelae of abuse. It is also unknown if the respondents reported the abuse to others and if they sought out medical or psychological support. Additionally, the question about IPV did not specifically assess if the hit, slap, kick, or punch was unwanted or wanted, such as during sexual activity; it was assumed to be unwanted. To effectively counsel parents and people with SB, further studies are needed to identify risk factors of abuse and understand the psychological needs of victims.

Although we sampled an international cohort with over half of respondents residing outside the United States, we did not capture information on race or ethnicity. Minorities, especially Black and Hispanic populations, are at higher risk of abuse.³⁰ Additionally, we did not obtain any responses from participants in Mexico, Central or South America likely because the survey was not available in Spanish. Similarly, socioeconomic status has been shown to play a role in abuse history. We did not obtain information on income, education, insurance status, or homelessness.

5. Conclusion

People with SB are subjected to SA and IPV. All individuals with SB are at risk, but women and adults reporting non-heterosexual orientation are at highest risk. SB providers should help educate their patients to prevent abuse, regularly screen for this often-unrecognized issue, and aim to create a safe, supportive environment for patients to disclose abuse.

Funding

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

CRediT authorship contribution statement

Ashley W. Johnston: Writing – review & editing, Writing – original draft, Methodology, Investigation, Formal analysis. **Devon J. Hensel:** Writing – review & editing, Writing – original draft, Methodology, Data curation, Conceptualization. **Joshua D. Roth:** Writing – review & editing, Writing – original draft, Methodology, Conceptualization. **John S. Wiener:** Writing – review & editing, Writing – original draft, Methodology, Investigation, Conceptualization. **Rosalia Misseri:** Writing – review & editing, Writing – original draft, Methodology, Investigation, Conceptualization. **Konrad M. Szymanski:** Writing – review & editing, Writing – original draft, Methodology, Investigation, Formal analysis, Data curation, Conceptualization.

Declaration of competing interest

The authors have no conflict of interest to report.

Acknowledgements

We thank the adults with spina bifida who participated in the study and the following organizations for their support of this project: Spina Bifida Association (United States), the International Federation of Hydrocephalus and Spina Bifida (International) We thank the many adults with spina bifida who participated in the study and the following organizations for their support of this project: Spina Bifida Association (United States), the International Federation of Hydrocephalus and Spina Bifida (International), Gesellschaft für Spina bifida und

Hydrozephalus Österreich (Austria), Spina Bifida and Hydrocephalus Association of Canada (Canada), Arbeitsgemeinschaft Spina Bifida und Hydrocephalus e.V. (Germany), Spina Bifida Association of New Zealand (New Zealand) Festus Fajemilo Foundation (Nigeria), National Council for Persons with Physical Disabilities in South Africa (South Africa), Spina Bifida & Hydrozephalus Schweiz (Switzerland), Spina Bifida hydrocephalus Information Networking Equality (SHINE, United Kingdom).

Appendix A. Supplementary data

Supplementary data to this article can be found online at <https://doi.org/10.1016/j.dhjo.2024.101617>.

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