Biopsychosocial Factors Associated with Dyspareunia in a Community Sample of Adolescent Girls

Tina Landry · Sophie Bergeron

Abstract Although various biopsychosocial factors have been associated with dyspareunia, research to date has focused on retrospective reports of adult women, and lack of consensus regarding etiology remains. By targeting girls at the beginning of their reproductive life, this study aimed to examine the biomedical, behavioral, and psychosocial correlates of chronic painful intercourse in sexually active adolescents compared to pain-free girls. With written informed consent, data were obtained from 1425 girls (12–19 year olds) from seven metropolitan high schools using self-report questionnaires pertaining to gynaecologic/biomedical history, physical/psychological/sexual abuse, anxiety, depression, attitudes towards sexuality, and social support. While the chronic painful intercourse ($n = 51$) and pain-free comparison group ($n = 167$) did not differ significantly on biomedical variables, painful intercourse was associated with significantly more pain during tampon insertion, and avoidance of tampons was linked to a fourfold risk of experiencing pain during sex. Cases also reported engaging in significantly more detrimental vulvar hygiene habits than pain-free girls, whereas no significant group differences were observed for self-treatment using over-the-counter antifungal preparations. Sexual abuse, fear of physical abuse, and trait anxiety were identified as significant psychosocial correlates of chronic painful intercourse. A logistic regression further identified pain during first tampon insertion and trait anxiety as statistical predictors of adolescent pain during intercourse. In addition to a possible intrinsic dysfunction in central pain processing, findings suggest that psychological variables, such as anxiety, play a significant role in painful intercourse's very first manifestations in adolescent girls.

Keywords Dyspareunia · Etiology · Biopsychosocial correlates · Adolescents · Girls

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Introduction

Despite growing public and medical awareness concerning the importance of healthy female sexuality, women with dyspareunia are often still caught in an insidious biopsychosocial pain cycle that is not adequately addressed by health professionals (Danielsson, Sjöberg, Stenlund, & Wikman, 2003; Graziottin & Brotto, 2004; Harlow & Stewart, 2003). This is especially alarming in light of recent epidemiological data indicating that 12–21% of premenopausal women experience dyspareunia (Fisher, Boroditsky, & Bridges, 1999; Harlow & Stewart, 2003; Laumann, Paik, & Rosen, 1999) and that its incidence may be increasing (Danielsson et al., 2003). In addition, studies show that dyspareunia not only disrupts each phase of the female sexual response cycle, but also many important aspects of daily functioning, such as dyadic adjustment, psychological well-being, and quality of life (Arnold, Bachmann, Rosen, Kelly, & Rhoads, 2006; Farmer & Meston, 2007; Meana, Binik, Khalifé, & Cohen, 1997). Whereas the clinical importance of pain during intercourse is increasingly recognized, lack of consensus still prevails concerning the etiology of this distressing female sexual health problem (Desrochers, Bergeron, Landry, & Jodoin, 2008; Farage & Galask, 2005).

Apart from basic methodological limitations (e.g., no comparison groups, small sample sizes), there are potentially two important contributors to the elusiveness of dyspareunia's etiology. First, although most investigated factors may already be

present during adolescence, the wide majority of studies to date have invited adult women to retrospectively recall their early pain and sexual experiences, thus creating a possible recall bias. This sampling limitation should be addressed in light of findings from a recent large scale epidemiological study showing that 20% of sexually active high school girls aged 12–19 reported chronic pain during intercourse (Landry & Bergeron, 2009). Second, the predominantly dualistic view of dyspareunia as either having a biomedical or psychological cause could also explain the lack of etiologic consensus. This reductionist approach seems outdated considering the now widely accepted biopsychosocial model that may shed a new light on etiological research by examining the interplay of different factors that create and maintain the pain and associated sexual impairment (Gatchel, Peng, Peters, Fuchs, & Turk, 2007).

While research efforts to date have been mostly unidimensional, factors investigated in controlled studies can be divided into three broad categories: biomedical, behavioral, and psychosocial. First, biomedical variables have been the most researched by far. For example, while many studies do not show any association (e.g., Edgardh & Abdelnoor, 2007; Meana & Lykins, 2009), some indicate a higher risk of reporting dyspareunia in adult women having used oral contraceptives (OC), especially before age 16 and for a period of 2 years or more (Bouchard, Brisson, Fortier, Morin, & Blanchette, 2002; Sjöberg & Nylander Lundqvist, 1997). This link with prolonged use of OCs has also been found in the only study to date sampling adolescents and young women aged between 12 and 26 (Berglund, Nigaard, & Rylander, 2002). Because this clinical study involved a mixed sample of adolescents and young women consulting for contraceptive counselling or vulvo-vaginal symptoms, a community-based study limited to adolescents could provide a more rigorous evaluation of OC's role in painful intercourse.

Age of menarche debut has also been examined, with contradictory results (e.g., Bazin et al., 1994; Danielsson, Sjöberg, & Wikman, 2000). Furthermore, whereas some studies find no association whatsoever (e.g., Meana & Lykins, 2009; Reed, Crawford, Couper, Cave, & Haefner, 2004), dyspareunia has been associated with younger age of first intercourse in one mixed sample of adolescents/young women (Berglund et al., 2002) and older age of first intercourse in adult women (Smith et al., 2002; Tchoudomirova, Mårdh, & Hellberg, 2001). With regards to infectious diseases, two factors seem to have generated invariable results. The most robust finding concerns history of recurrent vaginal infections, which has been consistently linked with dyspareunia (e.g., Berglund et al., 2002; Harlow, Wise, & Stewart, 2001; Smith et al., 2002), while most sexually transmitted infections have not shown a significant association (e.g., Berglund et al., 2002; Edgardh & Abdelnoor, 2007; Laumann et al., 1999). However, studies investigating human papillomavirus (HPV) and history of urinary infections still report conflicting results (e.g., Berglund et al., 2002; Bornstein et al.,

2000; Morin et al., 2000; Sobhgol & Alizadeli Charndabee, 2007). In sum, given that the investigation of biomedical factors relies on adult women's ability to remember specific ages and number of lifetime infections since teenage years, a re-evaluation of these factors in an adolescent population would correct this limitation.

Despite the importance of behavioral factors in gynecologic/sexual health, few controlled studies have investigated how they interact with dyspareunia. First, while some clinical studies reveal that dyspareunia is linked to a 5 to 7-fold risk of reporting using over-the-counter antifungal preparations (Edgardh & Abdelnoor, 2003; Sarma, Foxman, Bayirli, Haefner, & Sobel, 1999), others find no such association (Berglund et al., 2002). Replication in a non-clinical setting is warranted since participants were mostly consulting for vaginal symptoms thereby reducing variability between study groups. Moreover, non-significant results regarding potentially detrimental vulvar hygiene habits (e.g., shaving pubic hair, constantly wearing pantyliners, vaginal douching) may be attributable to the very few habits analyzed statistically in an isolated way (e.g., Berglund et al., 2002; Edgardh & Abdelnoor, 2003). Finally, though studies with adult women find mixed results, avoidance of tampon use and intercourse requires further investigation (e.g., Reed et al., 2000; Sarma et al., 1999; Tchoudomirova et al., 2001; White & Jantos, 1998). More specifically, since initial experiences with tampon use usually take place before young girls' sexual debut, their avoidance in teenagers could possibly serve as an early detection marker for vulvo-vaginal pain and/or a fear of penetration problem.

In the last decade, many controlled studies have examined the role of psychosocial factors in dyspareunia, but conflicting data continue to accumulate. For example, results on depressive symptoms and on negatives attitudes towards sexuality are evenly split between studies linking them with dyspareunia (e.g., Bachmann et al., 2006; Meana et al., 1997; Nylander Lundqvist & Bergdahl, 2003) and those demonstrating no association (e.g., Aikens, Reed, Gorenflo, & Haefner, 2003; Edgardh & Abdelnoor, 2003; Farmer & Meston, 2007; Payne et al., 2007; Reed et al., 2000). However, above all other psychosocial factors, history of physical and sexual victimization has been the most contested etiologic variable despite studies predominately refuting an association with dyspareunia (Dalton, Haefner, Reed, Senapati, & Cook, 2002; Danielsson et al., 2000; Laumann et al., 1999; Reissing, Binik, Khalifé, Cohen, & Amsel, 2003). In fact, the use of clinical samples has recently been criticized for these non-significant results due to the different treatment-seeking behavior of study groups. More precisely, while women with a history of victimization tend to consult more often (John, Johnson, Kukreja, Found, & Lindow, 2004), victimized women with dyspareunia seem to consult less (Harlow & Stewart, 2005). Consequently, in clinical studies, whereas comparison groups would be inclined to over-report victimization, dyspareunia groups would suffer from an under-

reporting bias, thus yielding non-significant results. Accordingly, the first study focusing solely on victimization in a representative general population sample recently showed that severe physical or sexual childhood abuse was linked to a 4 to 6-fold risk of reporting vulvar pain in adulthood. Moreover, dyspareunia was associated with living in fear of such abuse and with a lack of social support; these two new variables now require replication (Harlow & Stewart, 2005). Lastly, anxiety is the psychosocial factor that currently benefits from the most consistent association with dyspareunia (e.g., Granot, Friedman, Yarnitsky, & Zimmer 2002; Johannesson, de Boussard, Brodda Jansen, & Bohm-Starke, 2007; Meana & Lykins, 2009). Nevertheless, in addition to the predominance of clinical samples possibly explaining this significant relation, studies to date have focused on adult women in whom dyspareunia has been present for a number of years. Hence, as with all other psychosocial variables, it remains impossible to know whether anxiety is a precursor of dyspareunia or a consequence of living with such a pain problem often undiagnosed for years (Harlow & Stewart, 2003). While a longitudinal design is the only definitive way of putting this cause-effect debate to rest, a study targeting adolescents could minimize the confound of repeated painful intercourse experiences over several years and clarify anxiety's role in the onset of dyspareunia.

By applying the biopsychosocial framework presented above to provide the first etiologic portrait of painful intercourse in a community-based sample of adolescents, the goals of the present study were two-fold:

1. Identify differences in the biomedical, behavioral, and psychosocial profile of sexually active adolescents with chronic painful intercourse compared to sexually active pain-free adolescents.
2. Identify the statistical predictors of chronic painful intercourse in sexually active adolescents.

Based on past research, we hypothesized that biomedical variables, such as vaginal infections and oral contraceptive use, would be most strongly linked to chronic painful intercourse in adolescents. Concerning behavioral variables, we predicted that cases would be avoiding vulvo-vaginal insertion activities by reducing their intercourse frequency and tampon use compared to pain-free girls. Finally, among psychosocial factors, only victimization and anxiety were suspected to be significant correlates of chronic painful intercourse.

Method

Participants

The following method has also been described in a previous publication concerning the prevalence and characteristics of vulvo-vaginal pain (Landry & Bergeron, 2009). Our cohort consisted of adolescent girls between 12 and 19 years of age who were recruited from seven high schools in a large metropolitan area. Recruitment was conducted in two distinct phases: school recruitment and participant recruitment within selected schools. The main goal of these two phases was to obtain a representative sample of adolescent girls. Therefore, schools having different socioeconomic backgrounds as well as Caucasian and multicultural populations were selected. However, given the difficulty to recruit schools in this region due to over-solicitation for research purposes, they were also chosen based on their interest to participate in the study. Hence, of the 12 schools initially solicited, seven agreed to take part in the study. Five of the seven participating schools were public with multicultural student populations, while the two other schools were private with mostly Caucasian students. This provided an initial population of approximately 5500 adolescent girls from which to sample. Two to four classes from every grade were selected by the schools' administration to take part in the participant recruitment sessions (i.e., approximately 2025 girls).

Following the recruitment sessions, 1439 agreed to complete the questionnaires, resulting in a participation rate of 71% (see Fig. 1 for flow chart). Fourteen participants were excluded from the analyses due to missing data, resulting in a final sample size of 1425 adolescent girls. Echoing norms found in representative Canadian samples, 25.5% of adolescent girls were sexually active with the mean age of first intercourse being 14.6 years old (Canadian Federation for Sexual Health, 2007; Frappier et al., 2008). Among girls having had more than five intercourse experiences ($n = 251$), 51 (20.3%) girls reported having pain during intercourse for at least 6 months thus forming the chronic painful intercourse group, while 167 sexually active pain-free girls formed the comparison group.

Sociodemographic characteristics of the adolescent girls are shown in Table 1. The chronic painful intercourse and comparison groups' mean age was 16 years old ($SD = 1$). Although the sample included a wide range of sociodemographic backgrounds, most adolescents reported feeling associated with the Canadian/Quebec, having French as their mother tongue, being Catholic, and perceiving their familial socioeconomic status to be above the mean. Concerning possible confounding factors, Pearson correlations did not reveal any statistically significant association between chronic painful intercourse cases and pain-free girls on any of the sociodemographic variables (age, culture, mother tongue, religion, perceived familial socioeconomic status).

Procedure

Data collection took place during two separate periods: May–June 2005 and May–June 2006. During participant

Fig. 1 Flow chart of recruitment session used to identify the adolescent chronic painful intercourse and comparison groups from a large metropolitan area, May–June 2005 and 2006
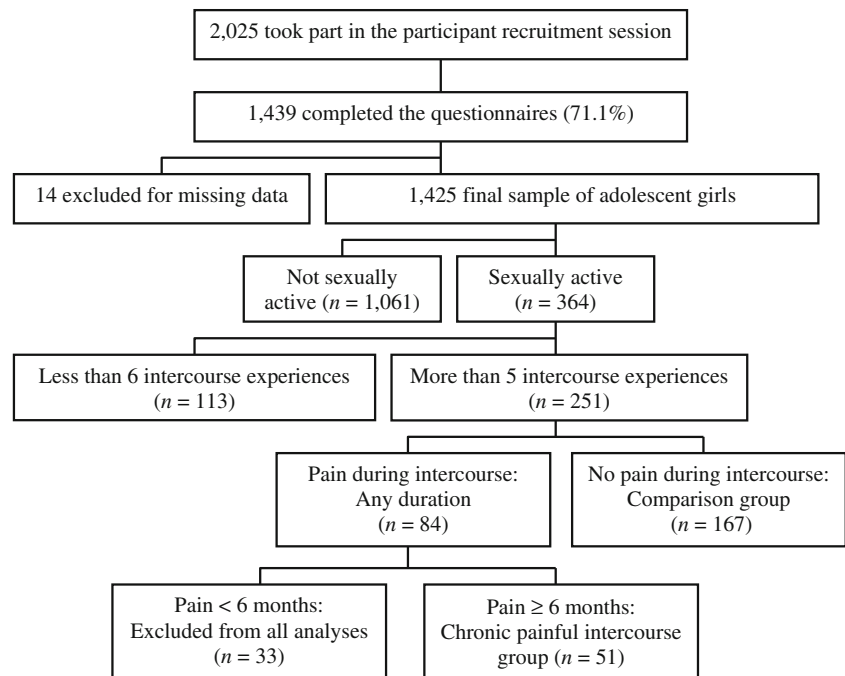
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          ┌──────────────────────────────────────────────────────┐
          │ 2,025 took part in the participant recruitment session │
          └──────────────────────────────────────────────────────┘
          ┌──────────────────────────────────────────────────────┐
          │      1,439 completed the questionnaires (71.1%)        │
          └──────────────────────────────────────────────────────┘
   ┌────────────────────────────┐   ┌──────────────────────────────────┐
   │ 14 excluded for missing data │   │ 1,425 final sample of adolescent girls │
   └────────────────────────────┘   └──────────────────────────────────┘
              ┌──────────────────┐   ┌──────────────────┐
              │   Not sexually   │   │  Sexually active │
              │ active (n = 1,061)│   │    (n = 364)     │
              └──────────────────┘   └──────────────────┘
   ┌──────────────────────────────┐   ┌──────────────────────────────┐
   │ Less than 6 intercourse       │   │ More than 5 intercourse       │
   │ experiences (n = 113)         │   │ experiences (n = 251)         │
   └──────────────────────────────┘   └──────────────────────────────┘
         ┌──────────────────────────┐   ┌──────────────────────────────┐
         │ Pain during intercourse: │   │ No pain during intercourse:  │
         │      Any duration        │   │     Comparison group         │
         │        (n = 84)          │   │        (n = 167)             │
         └──────────────────────────┘   └──────────────────────────────┘
   ┌──────────────────────────────┐   ┌──────────────────────────────┐
   │ Pain < 6 months:              │   │ Pain ≥ 6 months:              │
   │ Excluded from all analyses    │   │ Chronic painful intercourse   │
   │        (n = 33)               │   │      group (n = 51)           │
   └──────────────────────────────┘   └──────────────────────────────┘
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Table 1 Sociodemographic characteristics

	Painful intercourse cases (n)	Pain-free girls (n)	Total N	%
Culture				
Canadian/Quebec	37	116	153	70.2
Other	14	51	65	29.8
Mother tongue				
French	39	125	164	75.2
Other	12	42	54	24.8
Religion				
Catholic	35	103	138	63.3
Other	16	64	80	36.7
Familial socioeconomic status				
Above middle class	22	84	106	48.6
Middle class	22	78	100	45.9
Under middle class	7	5	12	5.5
Total	**51**	**167**	**218**	**100.0**

recruitment sessions, research team members explained the study in detail to adolescent girls who had been taken out of their classrooms in groups (i.e., no boys were present). General gynecological health was presented as the research subject instead of dyspareunia, which could have encouraged more girls with this problem to participate. The research team members emphasized that all girls were invited to participate regardless of their sexual/pubertal status (i.e., being sexually active or not, having had their first menstruation or not, etc.). The study presentation was followed by distribution of the consent form. As the legal age of consent is 14 years, only

girls under the age of 14 required informed consent by a parent or legal guardian to participate in the study.

Testing took place approximately 2 weeks after the participant recruitment session. Groups of participants were taken out of their classrooms for about 1 h to complete the study questionnaire. This questionnaire was distributed and explained by research team members who remained available during the entire testing period and afterwards to answer questions or offer help if participants felt any distress. Adolescents were also told that they could communicate with research team members at the laboratory at any time following

participation in case of questions or distress. The questionnaire was completed anonymously. Following participation, girls received an information package concerning gynecological and sexual health, a reference list of useful health services, and a coupon for a chance to win a $50, $75 or $100 gift certificate to a local shopping center. All procedures were reviewed and approved by our university Institutional Review Board and by the city's School District's Research Committee.

Measures

Sociodemographic and Biomedical Variables

Because no validated instrument was available, a 35-item self-administered questionnaire was designed specifically for this study and is an adaptation (for adolescents) of the one used in clinical studies with adult women for over 10 years by our research team. This questionnaire first focused on sociodemographic characteristics, which included information about the adolescents' age, grade, culture, mother tongue, religion, and perceived familial socioeconomic status (i.e., either middle class, above or below). Concerning biomedical variables, the questionnaire first focused on participants' age at first menstruation, age at first tampon insertion for girls having used tampons before, and age at first intercourse experience for sexually active girls. Participants were then questioned on OC pill use by specifying whether they had ever or never used them before, their age at first use, and the total number of months they had used them. Number of vaginal infections, number of urinary tract infections, and number of times having used emergency contraceptives (i.e., "morning after pill") in the last year also figured among biomedical questions. Furthermore, participants were asked to circle from a list of nine items whether or not they had ever suffered from sexually transmitted infections in their lifetime (e.g., chlamydia, genital herpes, condyloma, trichomoniases, HPV).

This questionnaire was also designed to detect self-reported painful intercourse in adolescents in order to classify them either in the chronic pain or comparison group. Painful intercourse was assessed by asking sexually active girls if they regularly (at least 75% of the time) experienced pain during intercourse. Following a positive answer, pain duration was reported, this duration being used to classify girls as having chronic painful intercourse when they experienced pain for 6 months or longer (Danielsson et al., 2003). Girls experiencing painful intercourse for less than 6 months were thus deleted from all analyses, while those reporting no pain whatsoever during intercourse formed the comparison group.

Finally, the questionnaire assessed three kinds of vulvovaginal insertion pain symptoms related to non-sexual contexts: pain during first tampon insertion, pain during usual tampon insertion, and pain during the last pelvic exam. These symptoms, in addition to dysmenorrhea (i.e., pain during menstruation), were all assessed with visual analogue scales from 0 (no pain) to 10 (worst pain ever).

Behavioral and Psychosocial Variables

With regards to specific behaviors, the self-administered questionnaire first asked girls to specify the total number of intercourse experiences in their lifetime, number of days having applied a vaginal treatment cream in the last year (with/without prescription), and if they avoided using tampons following a first insertion attempt. Total number of potentially detrimental vulvar hygiene habits was also evaluated in this questionnaire by asking the adolescent if she usually engaged in the following nine behaviours (answer: yes/no): washing the genitalia with perfumed soap, washing the genitalia with antibacterial soap, washing the genitalia with moist wipes, shaving pubic hair, vaginal douching, wearing tanga or g-string underwear, wearing pants that are tight on genitalia, wearing pantyliners when not menstruating, and piercing/tattooing the genitalia.

Physical, psychological, and sexual abuse were assessed using the self-administered questionnaire designed specifically for the study, this choice being due to the time-limited testing period which restricted the use of longer standardized questionnaires. However, abuse was measured with 9 items derived and adapted from the Revised Conflict Tactics Scales (Straus, Hamby, Boney-McCoy, & Sugarman, 1996) and showed acceptable internal reliability in the current sample (Cronbach's α on six subscales = .60–.89). For all abuse items, adolescents were first asked to specify their lifetime frequency of actual occurrence followed by their lifetime frequency of fearing such events (none, 1–2 times, 3–5 times, or more than 5 times). Five items were used to measure physical abuse (pushing/slapping/grabbing; throwing object that could hurt; punching/kicking; hitting with something that could hurt; other type of physical attack), while psychological abuse was measured with 2 items (name calling to hurt/insult you; threats of physical harm/destroying personal belongings). Finally, sexual abuse was measured with the two following items: (1) someone has forced you to engage in a sexual contact (touching or oral/anal/vaginal sex) when you did not want to, and (2) someone exposed their genitalia to you or forced you to show your genitalia when you did not want to.

Four standardized self-report questionnaires validated with adolescent populations were used to assess the remaining psychosocial variables. First, state and trait anxiety were measured with the State-Trait Anxiety Inventory-Form Y, this questionnaire having excellent psychometric qualities (Spielberger, 1983). In the state anxiety scale, participants indicated the intensity of their current feelings on a 1 (almost never) to 4 (almost always) Likert-type scale, while the trait anxiety scale rather refers to the intensity of their general feelings. Each

20-item scale has its own total score with higher scores reflecting higher anxiety (possible score range per scale: 20–80). Cronbach's alphas for this sample were .88 for the State Anxiety scale and .90 for Trait Anxiety, respectively.

The Beck Depression Inventory-II was also administered, a widely used measure of depressive symptoms with good reliability and validity (Beck, Steer, & Brown, 1996). Participants were asked to assess the severity of their depressive symptoms in the past 2 weeks on a scale from 0 to 3 with a higher score indicating higher severity (possible score range: 0–60). While this questionnaire usually has 21 items, the one pertaining to loss of interest in sexual activity was omitted due to its common association with painful intercourse and was also judged to be less relevant for an adolescent population. In the current sample, Cronbach's alpha was .91.

Furthermore, participants completed the Attitudes Toward Sexuality Scale which has shown good reliability and construct validity (Fisher & Hall, 1988). This 13-item questionnaire was specifically developed to evaluate adolescents' attitudes related to topics such as nudity, abortion, contraception, premarital sex, pornography, prostitution, homosexuality, and sexually transmitted infections. The 5-point Likert-type scale ranged from strongly disagree to strongly agree, with lower scores indicating greater conservatism and higher scores reflecting greater permissiveness (possible score range: 13–65). A Cronbach's alpha of .79 was obtained in this sample.

Finally, girls completed the Social Support Perception Questionnaire (Bouffard, Seidah, McIntyre, Vezeau, & Goulet, 2003), a 23-item questionnaire with good psychometric qualities. In addition to the questionnaire's total score, three subscales were included: parental emotional support perception (i.e., perceived availability dimension), parental unconditional support perception (i.e., perceived conditionality dimension), and general support from friends perception. Lower scores indicate perception of poor support while higher scores reflect good support perception (possible total score range: 23–92). In the present sample, Cronbach's alpha was .90.

Statistical Analysis

In order to exclude pain/discomfort caused by first vaginal intercourse experiences from the chronic painful intercourse group, painful intercourse was only considered in girls having had more than five intercourse experiences in their lifetime. Since no normative data concerning the number of painful first intercourse experiences were found in the literature, this threshold was determined by conducting an Internet survey among 40 women in their early 20 s, asking them to recall the number of painful intercourse experiences when they first started to be sexually active, and then setting a conservative threshold above the highest reported number (i.e., five). Thus, the chronic painful intercourse group was composed of girls having had more than five intercourse experiences and who

reported having pain during intercourse for at least 6 months, while the comparison group was composed of girls having had more than five intercourse experiences but who did not report having pain whatsoever during intercourse.

The following continuous variables had to be dichotomized into scores of 0 (absence) or 1 (presence) due to a floor effect resulting in a lack of variance: usual pain during tampon insertion, pain during the last pelvic exam, number of vaginal infections, number of days having applied a vaginal treatment cream (with/without prescription), number of urinary tract infections, number of times having used emergency contraceptives, number of sexually transmitted infections, lifetime frequency of sexual abuse, and lifetime frequency of fearing sexual abuse.

Possible sociodemographic confounding factors were examined with Pearson correlations. Painful intercourse correlates were identified by comparing the chronic painful intercourse group's mean to the one of the pain-free comparison group with one of three statistical tests depending on the nature of the variable. More precisely, chi-square tests were used for dichotomous variables, MANOVAS with the Wilk's criterion were used for continuous variables that were significantly correlated (≥ 0.3 correlation), and two-tailed t-tests were used for the remaining continuous variables that were not correlated. The risk ratio was derived from significant chi-square tests to estimate the likelihood of reporting chronic painful intercourse when considering each variable in an isolated way. Following these analyses, a logistic regression was used to identify the statistical predictors of painful intercourse in addition to their given odds ratio. Only variables that were identified as being significant correlates of painful intercourse were entered in this analysis. Considering the exploratory nature of this study and the need to control for a significant association between two correlates (i.e., the pain during usual tampon insertion variable was nested in the pain during first tampon insertion variable, $r = .45$, $p < .001$), the forward stepwise method was chosen. Three correlates in the logistic regression had missing values and were replaced using the dummy variable adjustment method to conserve the original sample's statistical power (Allison, 2001). The level of significance was set at $p < .05$ for all analyses and the SPSS Statistics pack for Windows, version 17.0, was used.

Results

Biomedical Correlates

The chronic painful intercourse and comparison groups were first compared on their vulvo-vaginal insertion pain in non-sexual contexts. A two-tailed t-test revealed that the chronic painful intercourse cases reported significantly more pain during their first tampon insertion (M on visual analogue scale = 4.7) than the comparison group (M on visual analogue

scale = 3.0), $t(190) = -3.06$, $p = .003$ (see Table 2 for all univariate results on continuous variables). Using the mean (3.4/10) and SD (3.2/10), pain during first tampon insertion was further divided into three pain intensity categories: no pain (0/10), mild/moderate pain (1–6/10), or severe pain (7–10/10). Hence, significantly more girls with chronic painful intercourse reported severe pain during their first tampon insertion (42.2%) than pain-free girls (16.3%), $\chi^2(2, N = 192) = 13.42$, $p = .001$ ($OR = 4.30$, $CI_{95\%} = 1.57–11.75$), when compared to girls with no pain during first tampon insertion). Concerning pain during usual tampon insertion, a chi-square test showed a significant difference between chronic painful intercourse cases and pain-free girls, $\chi^2(1, N = 158) = 6.60$, $p = .01$, with 56.3% of cases reporting pain in this non-sexual context compared to 31.7% of pain-free girls (see Table 3 for all chi-square results on dichotomous variables). The risk ratio obtained from this chi-square analysis revealed that girls who reported pain during usual tampon insertion were 2.8 times more likely to report chronic painful intercourse than girls who did not experience pain during tampon insertion ($CI_{95\%} = 1.25–6.11$). However, the chi-square test conducted on pain during the last pelvic exam showed a non-significant difference between groups (Table 3).

Chi-square tests did not reveal any significant differences between chronic painful intercourse cases and pain-free girls on occurrence (yes vs. no) of vaginal infections, of urinary tract infections, nor of sexually transmitted infections in the last year. Likewise, groups did not significantly differ on lifetime use (ever vs. never) of oral contraceptive pills, nor on emergency contraceptive use in the last year (Table 3).

A between-group multivariate analysis of variance (MANOVA) was performed on four significantly correlated biomedical variables concerning age of occurrence: age at first tampon insertion, age at first oral contraceptive pill use, age at first menstruation, and age at first sexual intercourse experience. No significant multivariate effect for group was obtained, $F(4, 120) = 1.25$. Finally, no significant differences were observed between groups for dysmenorrhea nor for the total number of months having used oral contraceptive pills (Table 2).

Behavioral and Psychosocial Correlates

Concerning behavioral variables, a chi-square test revealed that groups did not differ significantly with regards to vaginal treatment cream use (yes vs. no) in the last year either with or without a prescription (Table 3). In addition, a two-tailed t-test showed that the number of lifetime intercourse experiences did not significantly differ between groups. However, another two-tailed t-test indicated that chronic painful intercourse cases engaged in significantly more potentially detrimental vulvar hygiene habits than pain-free girls, $t(216) = -2.08$, $p = .039$

Table 2 Mean and SD of adolescents with chronic painful intercourse versus pain-free girls on biomedical, behavioral, and psychological variables

	Painful intercourse cases ($n = 51$)		Pain-free girls ($n = 167$)		p value
	Mean	SD	Mean	SD	
Biomedical variables					
Age at first tampon use	13.08	1.13	13.75	1.53	.039[a]
Age at first menstruation	11.77	1.42	11.97	1.36	ns
Age at first oral contraceptive pill use	14.50	1.30	14.95	1.23	ns
Age at first sexual intercourse experience	14.23	1.31	14.47	1.43	ns
Pain during first tampon insertion	4.71	3.42	3.03	2.98	.003
Dysmenorrhea	4.53	2.56	4.85	2.80	ns
Months having used oral contraceptive pill	14.11	10.04	14.09	11.53	ns
Behavioral and psychosocial variables					
Potentially detrimental vulvar hygiene habits	3.67	1.23	3.21	1.41	.039
Number of sexual intercourse experiences	79.84	132.63	105.18	142.70	ns
Physical abuse	4.63	4.51	4.08	3.78	ns
Fear of physical abuse	5.37	4.58	3.90	4.01	.028
Psychological abuse	2.71	1.93	2.21	1.86	ns
Fear of psychological abuse	1.98	1.75	1.76	1.91	ns
State anxiety	39.74	11.26	36.42	10.59	.055
Trait anxiety	47.80	11.37	43.36	10.96	.013
Depressive symptoms	13.94	10.17	13.56	10.22	ns
Parental emotional support perception	22.92	5.59	23.61	5.19	ns
Parental unconditional support perception	17.75	5.16	18.88	4.90	ns
General support from friends perception	34.31	4.73	34.06	5.53	ns
Attitudes towards sexuality	53.18	6.02	53.06	6.78	ns

[a] Although age at first tampon use was significant in univariate analysis, it was entered in a MANOVA which did not show any group effect

Table 3 Reported lifetime use or occurrence of biomedical, behavioral, and psychosocial variables in 218 sexually active adolescent girls

	Painful intercourse cases ($n = 51$)		Pain-free girls ($n = 167$)		Chi-square value	Group differences
	(%)	n	(%)	n	$\chi^2(1)$	p
Biomedical variables						
Pain during usual tampon insertion[a]	56.3	18	31.7	40	6.60	.010
Pain during last pelvic exam[b]	85.2	23	69.5	66	2.63	ns
Oral contraceptive pill use	27.5	14	28.1	47	0.01	ns
Vaginal infections	17.6	9	19.2	32	0.06	ns
Urinary tract infections	9.8	5	18.6	31	2.17	ns
Emergency contraceptive use	31.4	16	32.9	55	0.04	ns
Sexually transmitted infections	5.9	3	3.0	5	0.92	ns
Behavioral and psychosocial variables						
Vaginal cream with prescription	11.8	6	9.0	15	0.35	ns
Vaginal cream without prescription	13.7	7	10.8	18	0.33	ns
Avoidance of tampon use[c]	28.9	13	14.3	21	5.04	.025
Sexual abuse	43.1	22	28.1	47	4.06	.044
Fear of sexual abuse	52.9	27	47.3	79	0.50	ns

[a] Of the 218 sexually active adolescents, only 158 (32 painful intercourse cases vs. 126 pain-free girls) regularly used tampons during menstruation

[b] Of the 218 sexually active adolescents, only 122 (27 painful intercourse cases vs. 95 pain-free girls) had had a pelvic exam

[c] Of the 218 sexually active adolescents, only 192 (45 painful intercourse cases vs. 147 pain-free girls) had already inserted their first tampon and were thus asked this question

(Table 2). Furthermore, following a first tampon insertion experience, significantly more girls with chronic painful intercourse avoided using tampons regularly (28.9%) compared to pain-free girls (14.3%), $\chi^2(1, N = 192) = 5.04$, $p = .025$ (Table 3), with avoiders having significantly more pain during first tampon insertion (M on visual analogue scale $= 4.6$) than girls using them regularly (M on visual analogue scale $= 3.2$), $t(190) = -2.34$, $p = .02$. Moreover, the risk ratio showed that adolescents avoiding tampons were 3.8 times more likely to report chronic painful intercourse than girls using them regularly without any insertion pain whatsoever ($CI_{95\%} = 1.56$–9.29).

A chi-square test revealed that chronic painful intercourse cases reported more lifetime occurrence (i.e., presence vs. absence) of sexual abuse than pain-free girls, $\chi^2(1, N = 218) = 4.06$, $p = .044$, with 43.1% of cases reporting having been sexually abused at least once in the past compared to 28.1% of pain-free girls. The risk ratio derived from this chi-square analysis revealed that girls who reported having been sexually abused were 1.9 times more likely to report chronic painful intercourse than girls who did not experience such abuse ($CI_{95\%} = 1.01$–3.71). On the other hand, no significant differences between groups were noted on lifetime occurrence (presence vs. absence) of fearing sexual abuse (Table 3). In addition, a two-tailed t-test indicated that chronic painful intercourse cases and pain-free girls did not significantly differ with regards to attitudes towards sexuality (Table 2).

A between-group MANOVA was performed on the ten remaining correlated psychosocial variables: lifetime frequency of physical abuse, lifetime frequency of fearing physical abuse, lifetime frequency of psychological abuse, lifetime frequency of fearing psychological abuse, state anxiety, trait anxiety, depressive symptoms, parental emotional support perception, parental unconditional support perception, and general support from friends perception. A significant multivariate effect for group was obtained, $F(10, 207) = 2.30$, $p = .014$. Subsequent univariate analyses indicated that chronic painful intercourse cases had significantly more trait anxiety than pain-free girls, $F(1, 216) = 6.30$, $p = .013$, while state anxiety showed a non significant effect. Adolescents suffering from chronic painful intercourse also reported fearing physical abuse more frequently in their lifetime than pain-free adolescents, $F(1, 216) = 4.89$, $p = .028$ (Table 2).

Logistic Regression

The following seven significant correlates were included in the logistic regression analysis: pain during first tampon insertion (no pain; mild/moderate pain; severe pain), pain during usual tampon insertion (dichotomous variable), avoidance of tampon use (dichotomous variable), total number of potentially detrimental vulvar hygiene habits, lifetime occurrence of sexual abuse (dichotomous variable), lifetime frequency of fearing physical abuse, and trait anxiety.

In the final model, only pain during first tampon insertion ($p = .003$) and trait anxiety ($p = .026$) significantly predicted chronic painful intercourse among adolescent girls, which explained 14% of the total variance ($N = 218$; 51 cases vs. 167

pain-free girls). More specifically, girls experiencing severe pain during their first tampon insertion increased their likelihood of reporting chronic painful intercourse by 4.4 times ($OR = 4.38$, $CI_{95\%} = 1.55–12.34$) compared to girls with no insertion pain in this non-sexual context. For trait anxiety, the odds ratio was interpreted in terms of SD. Hence, for every SD increase of trait anxiety in the Spielberger questionnaire, adolescents increased their likelihood of reporting chronic painful intercourse by 1.4 times ($OR = 1.43$, $CI_{95\%} = 1.04–1.97$).

Discussion

This study was the first to present an integrated biopsychosocial portrait of painful intercourse in sexually active adolescent girls from a community-based sample. Main findings showed that biomedical variables did not appear to be associated with chronic pain during intercourse in adolescents. However, seven significant behavioral and psychosocial correlates of chronic painful intercourse were identified: pain during first tampon insertion, pain during usual tampon insertion, avoidance of tampon use, total number of potentially detrimental vulvar hygiene habits, lifetime occurrence of sexual abuse, lifetime frequency of fearing physical abuse, and trait anxiety. Finally, when entered in a logistic regression, pain during first tampon insertion and trait anxiety were significant statistical predictors of chronic painful intercourse in our adolescent sample.

Refuting our most empirically supported biomedical hypothesis, cases did not report having had more vaginal infections than pain-free girls. This result was especially surprising in light of the earlier clinical description of painful intercourse in teenagers indicating an association with vaginal infections (Berglund et al., 2002) in addition to the first mouse model recently showing increased vulvar mechanical sensitivity following recurrent candida inoculations (Farmer et al., 2009). A simple interpretation may be that our sample was community-based and much younger than prior samples, so only a small minority of participants reported such infections thereby limiting statistical power. Furthermore, since only 6% of adolescents had developed *recurrent* vaginal infections, most would not fit the etiology hypothesis supported by the mouse model, which suggests that *prolonged* vulvar inflammation may decrease pain thresholds. Finally, vaginal infections might play a mediating role by being associated with other factors leading to painful intercourse, such as OC use (Berglund et al., 2002). However, OC variables were not shown to differentiate our adolescent groups, which might be explained by recent findings specifying that this link predominantly varies according to the hormonal composition of the pill, a variable that was not examined in the present study (e.g., Greenstein et al., 2007).

Behavioral findings confirmed part of our hypothesis with avoidance of tampon use being linked to a fourfold risk of reporting chronic painful intercourse, while cases were not found to be reducing their intercourse frequency. Interestingly, whereas some adult women with dyspareunia report restricting intercourse (e.g., White & Jantos, 1998), others reveal that they force themselves to engage in painful intercourse without truly wanting to (e.g., Gordon, Panahian-Jand, McComb, Melegari, & Sharp, 2003). The possibility that adolescents with chronic painful intercourse might already be caught in this vicious cycle of repeated exposure to painful intercourse, perhaps without any desire or arousal, certainly merits a more detailed assessment (Brauer, ter Kuile, & Laan, 2009). Unexpectedly, cases reported engaging in significantly more potentially detrimental vulvar hygiene habits than pain-free girls. This finding was quite unsettling considering the sensitive nature of the vulvar epithelium and its potential for irritation and inflammation. Through such adverse behaviors (e.g., washing the genitalia with antibacterial soap, vaginal douching), girls might be attempting to self-treat their persistent vulvo-vaginal symptom as adult women have been shown to do (Marin, King, Sfameni, & Dennerstein, 2000). However, cases did not differ from pain-free girls regarding self-treatment with vaginal creams, which could be explained by a lack of statistical power (only 12% had applied such creams). Nonetheless, by practicing more hygiene habits that could damage the vulvar epithelium, adolescents with chronic painful intercourse might unfortunately be exacerbating their pain and/or contributing to its chronicity (Nyirjesy, Weitz, Grody, & Lorber, 1997). Moreover, a prospective study has recently revealed a causal link between vaginal douching and STIs among adolescents, suggesting that some hygiene habits might be contributing to the development of gynecologic health problems in girls (Tsai, Shepherd, & Vermund, 2009).

In line with one of our main psychosocial hypothesis, adolescents suffering from chronic pain during intercourse revealed almost twice the lifetime occurrence of sexual abuse than pain-free girls. These results add support to the possible bias introduced by clinic-based samples where distinct treatment-seeking behavior in cases and controls might account for null associations (Harlow & Stewart, 2005). Findings also indicate that the role of sexuality-related developmental events should not be readily discarded in our hypotheses concerning dyspareunia's etiology. In fact, numerous biopsychosocial mediating mechanisms could explain how sexual abuse may increase the risk of experiencing chronic dyspareunia, such as suppression of optimal biochemical functioning (e.g., HPA axis, wound healing, immune response), high-risk sexual behaviors, and/or long-term emotional and social consequences (e.g., anxiety, depression, weak social support)(Fergusson, Horwood, & Lynskey, 1997; Finestone, Alfeeli, & Fisher, 2008; Heim, Ehlert, Hanker, & Hellhammer 1998; Kendall-Tackett, 2002). Nevertheless, in our adolescent sample, depression and social support were not significantly correlated with chronic painful intercourse. Whereas the association with depression could be limited to

adult women in clinical samples (Desrochers et al., 2008), social support merits further investigation within a larger sample using a questionnaire focusing specifically on painful intercourse-related support. Lastly, victimized adolescents could be experiencing PTSD symptoms, such as flashback-induced fear during sexual activity, which could hinder sexual arousal and/or create pelvic floor muscle hypertonicity, thereby contributing to painful intercourse (Brauer et al., 2009; Reissing, Brown, Lord, Binik, & Khalifé, 2005; Rellini & Meston, 2006).

As predicted, trait anxiety was significantly correlated with chronic pain during intercourse, this variable also being identified as a statistical predictor. While the relationship between anxiety and chronic pain problems is well-known (Dersh, Polatin, & Gatchel, 2002), anxiety has also been shown to increase experimental pain perception (Tsao, Lu, Kim, & Zeltzer, 2006), predict hypervigilance to coital pain (Payne, Binik, Amsel, & Khalifé, 2005), and reduce physiological sexual arousal (Payne et al., 2007). In addition, the fear-avoidance model posits that pain catastrophizing, fear of pain, and escape/avoidance, may partly explain the transition from acute to chronic pain (Leeuw et al., 2007; Vlaeyen & Linton, 2000). Interestingly, a fundamental personality trait that encompasses anxiety (neuroticism) has recently been proposed as a vulnerability factor by predicting key variables in this model (Goubert, Crombez, & Van Damme, 2004). In sum, while the explanations linking trait anxiety to chronic painful intercourse remain speculative, investigation of the fear-avoidance model may contribute to our understanding of dyspareunia's development, maintenance, and exacerbation.

From a theoretical perspective, with cases reporting more pain during first and usual tampon insertion, results hint towards the implication of a generalized sensory dysfunction in dyspareunia's pathogenesis. In fact, these findings suggest the possibility of virgin girls having lower vulvar pain thresholds in insertion contexts unrelated to sexuality, similarly to women with provoked vestibulodynia (Pukall, Binik, Khalifé, Amsel, & Abbott, 2002). Furthermore, primary dyspareunia has been shown to be associated with an enhanced systemic pain perception and more trait anxiety compared to secondary dyspareunia in adult women (Granot, Friedman, Yarnitsky, Tamir, & Zimmer, 2004). Interestingly, two-thirds of our adolescent cases reported a primary form of painful intercourse in addition to trait anxiety being the strongest psychosocial correlate. Taken together, these findings point towards the possibility of different etiologies for primary and secondary dyspareunia (Sutton, Pukall, & Chamberlain, 2009). On the one hand, primary dyspareunia could mainly be the result of inherent pathophysiological abnormalities (e.g., congenital defect of urogenital sinus-derived epithelium, genetic variants reducing the ability to fight pathogens/increasing the proinflammatory response, impairment in pain-regulatory mechanisms) combined with psychosocial characteristics like trait anxiety (Babula, Linhares, Bongiovanni, Ledger, & Witkin, 2008; Burrows, Klingman,

Pukall, & Goldstein, 2008; Granot et al., 2004). Conversely, biomedical and behavioral factors (e.g., OC, infections, non-indicated self-treatment) may mostly explain secondary dyspareunia by creating prolonged inflammation of the vulvar mucosa and peripheral sensitization (Bohm-Starke, Hilliges, Falconer, & Rylander, 1998; Foster et al., 2007).

Limitations of the present study include the use of a small number of questions to investigate victimization variables, such as sexual abuse, which we know to be a complex phenomenon. The self-report nature of all measures included in the study should also be mentioned. Considering the growing absence of sexual education classes in high schools in North America, lack of knowledge could have biased data collection by limiting understanding of the biomedical questionnaire's terminology. Furthermore, while chronic painful intercourse was detected in 20% of adolescent girls, no gynecological examination was undertaken to determine the diagnosis underlying their symptom. In addition, specific circumstances surrounding intercourse were not investigated (e.g., arousal, emotions, relationship quality, partner behaviors) and thus cannot be ruled out as a contributor to pain during intercourse in our adolescent sample. Lastly, this being a cross-sectional study, the direction of the relationship between biopsychosocial correlates and chronic painful intercourse remains unknown. Hence, although a logistic regression indicates statistical prediction, causality should not be inferred from results. Despite these limitations, this study sheds new light on the factors associated with painful intercourse during its earliest manifestations in adolescence. Findings suggest that, in addition to a possible innate vulnerability to chronic vulvo-vaginal pain, psychosocial factors should not be overlooked in our understanding of dyspareunia's onset. Clinically, results support a biopsychosocial evaluation and multidisciplinary approach to the treatment of this complex women's sexual health problem.

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