Polydrug Use Typologies and Childhood Maltreatment in a Nationally Representative Survey of Danish Young Adults

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ABSTRACT. Objective: Substance use and childhood maltreatment experience are linked, but little is known about the association with polydrug use patterns. **Method:** Latent class analyses (LCA) were performed on eight illicit drugs in a random population sample of young Danes separated by sex (males: n = 1,555; females: n = 1,425). Logistic regressions explored associations of polydrug use patterns and childhood maltreatment. **Results:** A three-class solution best described patterns of polydrug use in both the male and female samples. Across all LCA models, Class 1 was characterized by individuals who represented wide-range polydrug users, endorsing many of the drug types (males = 8%; females = 2%). Class 2 was characterized by amphetamine, cannabis, cocaine, and amyl nitrate users (males = 18%; females = 7%). Class 3 was characterized by individuals who endorsed either low-level use of cannabis only or no drug use (males = 74%; females = 91%). For males, having been a child-protection case was associated with Classes 1 and 2 and for females with Class 2, compared with Class 3. Alcohol problems were associated with Classes 1 and 2 for both sexes. Sexual abuse was associated with Classes 1 and 2 for females but not males, whereas physical abuse was associated with Classes 1 and 2 for males but not females, as compared with Class 3. **Conclusions:** Separate sex analyses are important; although patterns of polydrug use are broadly similar, females are less frequently polydrug users. In addition, different relationships exist for the sexes, such that polydrug use patterns are associated with sexual abuse in females, whereas such patterns are associated with physical abuse in young males. (*J. Stud. Alcohol Drugs, 75,* 170–178, 2014)

BOTH CHILDHOOD MALTREATMENT AND substance use are associated with a wide range of negative outcomes including mental health issues, poor psychosocial functioning, poor academic performance, partaking in risky sexual activities, being the victim of dating violence, experiencing physical injury, and substance dependence (e.g., Bailey et al., 1998; Bendall et al., 2008; Cooper, 2002; Holt et al., 2007; Horwitz et al., 2001; Huang et al., 2011; Miller et al., 2007). Several studies have linked experience of childhood maltreatment with substance use and substance-related disorders (Huang et al., 2011; Millar and Stermac, 2000). However, this association differs between studies. For example, the association between sexual abuse and involvement in substance use has been confirmed in some (Fergusson et al., 2008; Shin et al., 2010), but not all (Hakansson et al., 2011; Singer et al., 2004), studies. This disparity in results may be attributable to studies focusing on varying types or combinations of child abuse experiences. Furthermore, Moran et al. (2004) assessed a range of maltreatment experiences and substance use practices in a sample of 10th- to 12th-grade adolescents (n = 2,187). Although sex, age, and family configuration were controlled for, illicit drug use was associated with physical (odds ratio [OR] = 2.9) and sexual abuse (OR = 3.9) but not with emotional maltreatment. The association was stronger for those experiencing both sexual and physical maltreatment (OR = 10.5). Different associations were found by sex; the strongest association with illicit drug use for females was found with physical maltreatment, whereas for males the strongest association with illicit drug use was found with the combination of physical and sexual abuse (Moran et al., 2004). The Moran study illustrated the importance of assessing a range of maltreatment types while also considering sex differences. The importance of assessing sex differences is further highlighted by reported differences in both childhood maltreatment and lifetime substance use. For example, a greater number of females experience sexual abuse and emotional maltreatment compared with males (May-Chahal and Cawson, 2005), and male drug use is more prevalent than female drug use, with 37.7% of males having tried marijuana compared with 28.4% of females (Danish Cancer Association and the National Board of Health, 2009).

Studies linking childhood experience and substance use may also be limited by focusing their analyses on a single type of substance, thus overlooking the potential confounding effect of other substances (Shin et al., 2010). A better examination of the independent effect of a particular drug involves the measurement and statistical control for a wide

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range of drugs (Smith et al., 2011; Topp et al., 1999), particularly because polydrug use is a common way in which substances are used (Earleywine and Newcomb, 1997). Martinotti et al. (2009) noted that self-reported childhood trauma was more common in polysubstance users than in monosubstance users. Hakansson et al. (2011) found an increased likelihood of the experience of sexual abuse and physical abuse in those who reported previous use of two and three substances compared with one, respectively. Thus, it is plausible that varying combinations of drug types may have differential associations with childhood maltreatment experience.

Detailed explanations of patterns of substance use, based on multiple types of illicit substances, may offer an important advance in understanding associations between substance use and childhood maltreatment. Latent class analysis (LCA) is a well-placed methodology to account for the varying patterns of polydrug use. LCA also allows for assessment of the relationship between drug use patterns and other variables of interest. Patterns of polydrug use have already been successfully derived using this method (Hedden et al., 2010; Ramo et al., 2010; Shin et al., 2010; Smith et al., 2011; Wu et al., 2009), resulting in a better understanding of the relationship between drug use patterns and multiple correlates.

To our knowledge, Shin et al. (2010) is the only study to assess typologies of polydrug use and childhood maltreatment. They assessed patterns of polydrug use in female (n = 346) and male (n = 673) adolescent subsamples. A three-class solution was deemed optimal in the male adolescent subsample, whereas a four-class solution was deemed optimal in the female adolescent subsample. In females, the experience of sexual abuse was associated with drug-using classes relative to a class of abstainers/low users. There were no significant associations found between patterns of polydrug use and childhood maltreatment indicators in males.

Given a growing interest in understanding long-term consequences of childhood maltreatment, identifying subgroups of young adults with distinct substance use patterns and comorbidity may help explain how maltreatment relates to substance use in young people. The application of existing polydrug use patterns to answer this question is difficult because prior polydrug use patterns have been generated based on respondent-driven samples of participants (Carlson et al., 2005), patterns incorporating a specific drug (Wu et al., 2009), or a random sample of a wide age range of individuals (Smith et al., 2011). Aside from Shin et al. (2010), there has been a paucity of research exploring patterns of polydrug use in relation to childhood maltreatment.

The current study is based on individuals randomly sampled from the Danish 1984 birth cohort. Respondents were age 24; thus, the current study captured those who had used substances until their mid-20s. The advantage of this is that drug use behaviors have been shown to peak in the early 20s (Kandel, 1980; Labouvie, 1996). Patterns of polydrug use have often been studied using samples in which the sexes were not differentiated; however, males are often seen as those more likely to use multiple drugs (Smith et al., 2011). Because female drug use had been underrepresented in this approach, the current analyses were performed on males and females separately. After the identification of patterns of polydrug use, we assessed how the patterns differentially associated with a range of childhood maltreatment variables (each of which independently indicated an individual's positive endorsement of [a] physical abuse, [b] sexual abuse, [c] emotional abuse, and [d] neglect). These associations were assessed while a range of sociodemographic variables (e.g., sex, living accommodation, child-protection case status, self-reported mental disorder, and current or past alcohol problems) were controlled for. We hypothesized that different patterns of polydrug use exist for each sex, and different polydrug use patterns will display differential relationships with the maltreatment domains of sexual, physical, and emotional abuse, and neglect. Based on prior literature, we expected that female victims of maltreatment would be at high risk of being polydrug users.

Method

Procedure

The Danish National Centre for Social Research conducted a stratified random probability survey of Danish young adults, age 24 years, in 2008 and 2009. Stratified sampling has several strengths over random sampling when conducting population-based research. Stratified sampling is conducted using the knowledge obtained on a population through prior research. It allows inferences to be made within strata and comparisons to be made across strata. Thus, it ensures a greater degree of representativeness of the sample and enhances the accuracy of population parameter estimates (Daniel, 2012). The current study implemented disproportionate stratified sampling, whereby individuals who had previously been assigned child-protection status by the Danish authorities (n = 850) were oversampled. As a result, sampling weights were created to compensate for the disproportionality. In total, Statistics Denmark randomly selected individuals (N = 4,718), age 24 at the time of assessment, from the total birth cohort of 1984. Trained interviewers conducted structured interviews with respondents at their home or via telephone. Ethical approval was granted by the Danish Protection Agency. For further procedural details, please see Christoffersen et al. (2013).

Participants

Data used in the current study came from a cross-sectional epidemiological survey of young Danes. The survey

response rate was 67% (n = 2,980; 52.2% male). Most respondents either owned or rented private accommodation (93.7%); the majority of the sample did not have children (91.2%), and there was roughly an equal split between being single (54%) or being either married or cohabitating (46%). Only 11.7% of the sample reported spending less than 11 years in formal education. As noted previously, the survey data and, thus, all analyses were weighted to account for the oversampling of individuals who had previously been assigned child-protection status by the Danish authorities (n = 850).

Measures

The survey contained numerous questions across sociodemographic, physical, and psychological domains. The sociodemographic variables used in the current study were sex, living accommodation (rents or owns home = 0; supported living, e.g., shelters = 1), identified child-protection case status (yes = 0; no = 1), self-reported mental disorder (absent = 0; present = 1), and current or past alcohol problems (none = 0; present = 1). There were eight questions pertaining to lifetime drug use, which had a yes/no (1/0) response format. For details of each question, please refer to Table 3. Childhood maltreatment was assessed across four domains: sexual abuse (four items), physical abuse (seven items), emotional abuse (six items), and neglect (seven items). All items described particular events that were indicative of the abuse type. Respondents answered either yes or no in relation to whether the events had ever occurred. An example of a question indicative of physical abuse is, "Have you ever been hit, kicked, or exposed to violence that has resulted in bruising, bleeding, or other physical injuries from your parents or guardians?" For the purpose of the current analyses, if individuals positively endorsed one or more sexual and physical abuse items, two or more neglect items, and three or more emotional abuse items, they were coded as having these experiences present. The classification of child maltreatment types and cutoff criteria used in the study followed procedures used in previously published works (Christoffersen et al., 2013; May-Chahal and Cawson, 2005). Further details pertaining to the measurement of childhood maltreatment experiences, including the specific questions comprising each domain, are available in Christoffersen et al. (2013).

Analysis

LCA was performed on male and female subsamples by identifying latent classes based on responses across eight binary illicit drug use variables. LCA estimates two sets of parameters termed *class probabilities* and *item probabilities* (Haagenars and McCutcheon, 2000). The former estimates the prevalence of each class, whereas the latter estimates specific item endorsement probabilities. LCA is an exploratory and iterative model-building technique in which the number of classes specified and estimated increases. In the current study, we specified and estimated latent class models comprising two to six classes. In addition to consideration for parsimony and substantive meaning, several indicators of model fit were used to assess optimal fit to the data. Statistical fit indices reported in the current study include the Akaike Information Criterion (AIC; Akaike, 1987), the Bayesian Information Criterion (BIC; Schwarz, 1978), and the sample size–adjusted BIC (SSABIC; Sclove, 1987). Lowest values of the AIC, BIC, and the SSABIC indicate best fit. Recent work using simulation data by Nylund et al. (2007) concluded that the BIC was the most reliable indicator of latent class enumeration. The entropy statistic, based on posterior probabilities, ranges from 0 to 1, with higher entropy values indicating clearer classification (Ramaswamy et al., 1993). In addition, the Lo–Mendell–Rubin adjusted likelihood ratio test (LRT; Lo et al., 2001) evaluated whether a class solution with one additional class was superior to a solution with one less class. A latent class model with a nonsignificant LRT indicated that the latent model with one less class was the more parsimonious option. Once the optimal class solution was established, the resultant classes were validated against a number of sociodemographic and health variables (sex, living arrangements, child-protection case status, self-reported mental disorder, or current or past alcohol-related problems) and four childhood maltreatment domains (sexual, physical, and emotional abuse, and neglect; note that categories were not mutually exclusive) using logistic regression. In line with other studies (e.g., Smith et al., 2011), the relationship of alcohol problems to polydrug use was used as a correlate rather than a component of the latent variable. All analyses were conducted using Mplus Version 6 (Muthén and Muthén, 1998–2010) incorporating the use of a weight variable to account for the oversampling of child-protection cases.

Results

The weighted frequencies of polydrug use and the experience of childhood maltreatment are reported in Table 1. Prevalence of childhood maltreatment ranged from 3% (neglect) to more than 5% (physical and emotional abuse). Sexual and emotional abuse rates were higher in females, whereas males had higher percentages of physical abuse. Lifetime polydrug use (the use of two or more drugs) was reported by 18.9% of the total sample; the rates were higher for males (27.6%) than females (9.4%).

Latent class analysis

Fit indices for LCAs with two to six classes were specified and estimated (fit indices are presented in Table 2) for

TABLE 1. Weighted prevalence of drug use, childhood maltreatment, and sociodemographic characteristics in the total sample, for the total sample and separated by sex

Variable	Total sample (n = 2,980) Weighted n (%)	Male sample (n = 1,555) Weighted n (%)	Female sample (n = 1,425) Weighted n (%)
Drug use			
1. Have you ever tried amphetamines (speed)?	443 (14.9)	352 (22.7)	90 (6.3)
2. Have you ever tried cannabis (pot/hash)?	1,453 (48.8)	910 (58.7)	543 (38.2)
3. Have you ever tried cocaine (coke/crack)?	399 (13.4)	315 (20.3)	84 (5.9)
4. Have you ever tried LSD (acid)?	106 (3.5)	87 (5.6)	19 (1.3)
5. Have you ever tried mushrooms with euphoric effect?	200 (6.7)	166 (10.7)	35 (2.4)
6. Have you ever tried heroin?	27 (0.9)	24 (1.6)	3 (0.2)
7. Have you ever tried amyl nitrate (sniff)?	338 (11.3)	263 (17.0)	75 (5.3)
8. Have you ever tried other drugs such as Ecstasy?	270 (9.1)	204 (13.2)	67 (4.7)
Childhood maltreatment			
1. Sexual abuse	102 (3.4)	11 (0.7)	91 (6.6)
2. Physical abuse	161 (5.4)	98 (6.1)	64 (4.1)
3. Emotional abuse	155 (5.2)	68 (4.2)	87 (6.1)
4. Neglect	89 (3.0)	40 (2.6)	49 (3.5)
Sociodemographics			
Identified as a child-protection case	186 (6.2)	103 (6.6)	83 (5.8)
Supported living/other	194 (6.5)	146 (9.4)	48 (3.4)
Current mental disorder (self-reported)	201 (6.8)	81 (5.2)	120 (8.5)
Alcohol problems (past and current)	128 (4.3)	95 (6.1)	33 (2.3)

Note: LSD = lysergic acid diethylamide.

males and females separately. For males, the AIC value gradually decreased through the two- to five-class solutions, then increased from the five- to six-class solution; for females, the AIC value decreased through two- to four-class and increased thereafter. The largest drop in the AIC value occurred from the two- to three-class solution in both samples. Subsequent drops in value were minimal, suggesting that subsequent decreases through to the five-class solution added little to the model (DiStefano and Kamphaus, 2006). The BIC value was lowest for the three-class solution in both models, whereas the SSABIC was lowest for the four-class solution in males, but lowest for the three-class solution in females. The LRT became nonsignificant for the four-class model in males and females, suggesting the three-class model may be more parsimonious for those classes. Taking all fit indices into consideration and based on Nylund et al.'s (2007) recommendation that the BIC was the superior indicator of latent class fit, the three-class solution was deemed the preferred model in both samples. Entropy values for the three-class solution were adequate across both samples.

Validation of polydrug use profiles

Several covariates that have been shown to associate with substance use were included in the model (Table 4). The majority of both male respondents (74.4%) and female respondents (90.6%) were classified into Class 3. Class 3 comprised individuals who endorsed cannabis only or no drugs. Class 2 (18.1% of males, 7.3% of females) was characterized by amphetamine, cannabis, cocaine, and amyl nitrate polydrug use. Class 1, the smallest class (7.5% of males, 2.2% of females), comprised individuals who had the highest likelihood of endorsement of all drug types and were termed *wide-range polydrug users.* The probability of endorsement of drug items in both latent class models is presented in Table 3. Note that there are few differences in prevalence between latent class models with and without covariates, indicating a stable solution.

Logistic regressions

In males, child-protection status, past and current alcohol problems, and physical abuse significantly increased the likelihood of membership in both Class 1 and Class 2 compared with Class 3. Self-reported current mental disorder was a significant predictor of membership in Class 1 only. In females, past and current alcohol problems and sexual abuse increased the likelihood of membership in Class 1 and Class 2. Child-protection status was associated with membership in Class 2 only compared with Class 3. Results are presented in Table 4.

Discussion

This study aimed to model patterns of polydrug use in males and females using LCAs across eight illicit substances in a sample of young Danish adults. Three heterogeneous classes were found to best represent patterns of lifetime polydrug use in the first 24 years of these young adults' lives, and these were similar for both sexes. Contrary to earlier predictions, differences in endorsement rates were largely quantitative rather than qualitative, with endorsement rates being increased in males. In addition, the prevalence of individuals across latent classes differed, with a higher prevalence of males in the polydrug-using Classes 1 and 2. The elevated level of substance use in males is unsurprising given a recent European Monitoring Centre for Drugs and Drug Addiction report (2011) that concluded rates of drug use were higher in males across several European countries, including Denmark.

The similarity between patterns may reflect the application of normalization theory for both males and females in that substance use initiation may be a component of maturing and growing up (Parker et al., 1998). The higher rate of drug use by young males compared with young females

TABLE 2. Fit indices for male and female latent class analysis models across eight drug use types

Variable	No. of classes	AIC	BIC	SSABIC	Entropy	LRT (*p*)
Males only						
	2	7,148.0	7,239.2	7,185.2	1.0	2,903.8 (.000)
	3	6,900.5	7,039.9	6,957.3	0.9	261.6 (.000)
	4	6,878.7	7,066.4	6,955.2	0.9	39.2 (.112)
	5	6,878.5	7,114.3	6,974.6	0.9	18.0 (.390)
	6	6,884.2	7,168.3	6,999.9	0.9	12.1 (.821)
Females only						
	2	3,726.1	3,815.2	3,761.2	1.0	1,107.2 (.000)
	3	3,676.9	3,813.2	3,730.6	1.0	66.1 (.001)
	4	3,668.8	3,852.3	3,741.1	0.9	25.4 (.082)
	5	3,675.4	3,906.2	3,766.4	0.9	11.2 (.312)
	6	3,685.4	3,963.3	3,794.9	0.9	10.2 (.827)

Notes: No. = number; AIC = Akaike Information Criterion; BIC = Bayesian Information Criterion; SSABIC = sample size adjusted Bayesian Information Criterion; LRT (*p*) = Lo–Mendell–Rubin adjusted likelihood ratio test value and associated significance level.

might be explained in light of Arnett's (1992) theory of socialization. Arnett's theory suggests that substance use may relate to tendencies (e.g., sensation seeking) considered endogenous in nature and often found in higher levels in young males. Cultural norms for males compared with females may also explain the differences. Females are considered to mature earlier than males, particularly in relation to adopting cultural roles (Measham and Shiner, 2009). Thus, the window in which drug use may be initiated is shorter, which may explain the lower percentage of drug-using females (i.e., females mature out of drug-using behavior or fewer initiate drug use as the period for doing so is shorter).

The classes found in the current study somewhat resemble those of Shin et al. (2010). In particular, the substance use class with the widest range found in both subsamples was very similar to the pattern found by Shin et al. (2010) for their widest range polydrug class in females. However, the widest polydrug use class in male adolescents found in the

TABLE 3. Probability of endorsement of drug items in latent class models for males and female latent class models both with and without covariates

	Latent Class 1 Wide ranging polydrug users				Latent Class 2 Amphetamine, cannabis, cocaine, and amyl nitrate polydrug users				Latent Class 3 Cannabis only, or no drug users			
	Males		Females		Males		Females		Males		Females	
Variable	w/o covar.	w/ covar.	w/o covar.	w/ covar.	w/o covar.	w/ covar.	w/o covar.	w/ covar.	w/o covar.	w/ covar.	w/o covar.	w/ covar.
Prevalence, %	7.4	7.5	2.2	2.2	18.5	18.1	6.8	7.3	74.1	74.4	91.0	90.6
Questionnaire items related to drug use[a]												
1. Have you ever tried amphetamines (speed)?	1.0 (0.0)	1.0 (0.0)	1.0 (0.0)	1.0 (0.0)	0.8 (0.0)	0.8 (0.0)	0.6 (0.1)	0.6 (0.2)	0.0 (0.0)	0.0 (0.0)	0.0 (0.0)	0.0 (0.0)
2. Have you ever tried cannabis (pot/hash)?	1.0 (0.0)	1.0 (0.0)	1.0 (0.0)	1.0 (0.0)	0.9 (0.0)	0.9 (0.0)	0.8 (0.1)	0.8 (0.1)	0.5 (0.0)	0.5 (0.0)	0.3 (0.0)	0.3 (0.0)
3. Have you ever tried cocaine (coke/crack)?	1.0 (0.0)	1.0 (0.0)	1.0 (0.1)	0.9 (0.1)	0.7 (0.0)	0.7 (0.0)	0.5 (0.1)	0.5 (0.0)	0.0 (0.0)	0.0 (0.0)	0.0 (0.0)	0.0 (0.0)
4. Have you ever tried LSD (acid)?	0.7 (0.1)	0.7 (0.1)	0.6 (0.1)	0.5 (0.2)	0.0 (0.0)	0.1 (0.0)	0.0 (0.0)	0.0 (0.0)	0.0 (0.0)	0.0 (0.0)	0.0 (0.0)	0.0 (0.0)
5. Have you ever tried mushrooms with euphoric effect?	0.9 (0.0)	0.9 (0.0)	0.6 (0.1)	0.6 (0.2)	0.2 (0.0)	0.2 (0.0)	0.1 (0.0)	0.1 (0.0)	0.0 (0.0)	0.0 (0.0)	0.0 (0.0)	0.0 (0.0)
6. Have you ever tried heroin?	0.2 (0.0)	0.2 (0.0)	0.1 (0.1)	0.1 (0.1)	0.0 (0.0)	0.0 (0.0)	0.0 (0.0)	0.0 (0.0)	0.0 (0.0)	0.0 (0.0)	0.0 (0.0)	0.0 (0.0)
7. Have you ever tried amyl nitrate (sniff)?	0.8 (0.0)	0.8 (0.1)	0.6 (0.1)	0.6 (0.1)	0.6 (0.0)	0.4 (0.0)	0.6 (0.1)	0.5 (0.2)	0.0 (0.0)	0.0 (0.0)	0.0 (0.0)	0.0 (0.0)
8. Have you ever tried other drugs such as ecstasy?	0.9 (0.0)	0.9 (0.0)	0.9 (0.1)	0.9 (0.1)	0.3 (0.0)	0.3 (0.0)	0.4 (0.1)	0.3 (0.1)	0.0 (0.0)	0.0 (0.0)	0.0 (0.0)	0.0 (0.0)

Notes: w/o = without; w/ = with; covar. = covariates. [a]Data are probability (*SE*).

TABLE 4. Odds ratios and 95% confidence intervals for the latent model with sociodemographic and childhood maltreatment variables for male and female polydrug use patterns

	Odds ratio [95% CI]			
	Female only		Male only	
Variable	Latent Class 1 Wide ranging polydrug users	Latent Class 2 Amphetamine, cannabis, cocaine and amyl nitrate polydrug users	Latent Class 1 Wide ranging polydrug users	Latent Class 2 Amphetamine, cannabis, cocaine and amyl nitrate polydrug users
Child care status				
Identified child-protection case (referent)	1	**1**	**1**	**1**
Not identified	2.3 [0.9, 5.9]	**2.5* [1.5, 4.2]**	**3.1* [2.0, 4.9]**	**1.5* [1.0, 2.1]**
Living accommodation				
Own or rent home (referent)	1	1	1	1
Supported living/other	2.2 [0.2, 20.5]	0.6 [0.1, 2.8]	1.1 [0.5, 2.5]	1.0 [0.5, 1.7]
Current mental disorder (self-reported)				
No (referent)	1	1	**1**	1
Yes	2.1 [0.5, 9.9]	1.4 [0.6, 3.5]	**3.9* [1.9, 8.0]**	1.2 [0.6, 2.6]
Alcohol problems (past and current)				
No (referent)	**1**	**1**	**1**	**1**
Yes	**36.3* [9.6, 137.4]**	**11.4* [2.6, 49.3]**	**8.9* [4.5, 17.5]**	**3.76* [2.0, 7.3]**
Experienced of sexual abuse				
No (referent)	**1**	**1**	1	1
Yes	**3.5* [1.3, 10.6]**	**3.4* [1.0, 11.2]**	0.8 [0.2, 3.1]	0.2 [0.0, 1.0]
Experienced of physical abuse				
No (referent)	1	1	**1**	**1**
Yes	2.3 [0.5, 10.5]	1.0 [0.2, 3.9]	**4.0* [1.7, 9.3]**	**2.1* [1.1, 4.1]**
Experienced of emotional abuse				
No (referent)	1	1	1	1
Yes	2.5 [0.4, 13.6]	2.5 [0.8, 8.0]	1.0 [0.3, 2.8]	1.2 [0.5, 2.9]
Experienced of neglect				
No (referent)	1	1	1	1
Yes	1.0 [0.3, 4.1]	1.0 [0.4, 2.6]	1.2 [0.4, 3.7]	1.6 [0.6, 4.2]

Notes: Statistically significant odds ratio are indicated by * and are in **bold.** Latent Classes 1 and 2 are compared with Latent Class 3 (cannabis only or no drug use). CI = confidence interval.

Shin et al. (2010) study differs from the widest range polydrug use class in the present study, with a higher endorsement here of cocaine use (approximately 40% higher in young males and 35% higher in young females). This higher level of cocaine use compared with the Shin et al. study might reflect a later initiation into cocaine use as reflected in the stage theory of substance use progression (Kandel, 2002; Kandel and Yamaguchi, 1993). This suggests substance use initiation commences with alcohol, tobacco, and cannabis before the use of "harder" drugs such as amphetamines, cocaine, Ecstasy, or heroin. Thus, the older age of our young Danish adults may allow for this sequence to progress to cocaine use, or the results may reflect prevalence differences of cocaine use between Denmark and the United States. The second polydrug use class (Class 2) reported amphetamine, cannabis, cocaine, and amyl nitrate use in both male and female samples. These were less likely to be equivalent to Shin and colleagues' classes given prevalence differences in key substances such as hallucinogens, which were higher in Shin et al. (2010).

Future research should consider separate sex analyses. The polydrug use patterns were similar between males and females, but the relationship of these patterns with covariates differed by sex. In addition, although females are less likely to be polydrug users, they do experience important consequences in terms of maltreatment. A total sample analysis may have found the same patterns, but the polydrug use classes would be likely to contain a higher proportion of males, and important differences in relation to childhood maltreatment may lie hidden. The association between child-protection status and latent Classes 1 and 2 existed in males, but associations were found only with Class 2 membership for females. Aarons et al. (2001) reported that rates of substance use disorders are significantly higher in males in child-protection care compared with females in care. It has been suggested that the "care home" may act as a special type of ready-made peer group that facilitates drug use through increased pressure from peers and the child's need to feel as though he or she belongs to a wider social circle (Ward, 1998).

There was a strong link between alcohol problems and polydrug use identified in latent Classes 1 and 2 compared with Class 3. In line with other studies (Shin et al., 2010; Smith et al., 2011), the widest range of polydrug use (Class 1) had the greatest association. Prior research would suggest that alcohol dependence was linked with wide-range polydrug use (Shin et al., 2010). Although Classes 1 and 2, compared with Class 3, were significantly associated with the reporting of alcohol problems for males and females, there was a considerably stronger association for females, particularly in relation to Class 1 compared with Class 3. Of note, Shin et al. (2010) included alcohol use in their LCA, and the additional class for female adolescents reflected cannabis and alcohol use only. Perhaps given the strong association with alcohol problems, inclusion of alcohol in the current LCA, particularly for females, would have resulted in an additional drug use pattern.

The association of polydrug use with self-reported mental disorder was found only in young males in Class 1 compared with Class 3. It is unclear why a similar finding was not found in the female sample given that there are typically higher prevalences of mood disorders in females and higher likelihood of disclosure of mental health issues in this group. Perhaps the difference between the sexes could be attributable to the self-reported nature of this diagnosis. Perhaps males are more likely to self-certify their problems, whereas females are more likely to wait to receive a diagnosis; however, this is entirely speculative, and future research could attempt to understand this finding. In addition, low mood is a well-known side effect of commonly used stimulant drugs, and it may be seen as a normal consequence of the use of the substance rather than a component of a pathological mental disorder requiring treatment; this perception may differ between the sexes. The difference may also be explained by the comparison group in the regression analyses, which contained some cannabis-only users. If Degenhardt et al. (2001) are correct in that female cannabis users were more likely to experience affective disorders than males and all three groups have some cannabis use, perhaps this may explain the lack of significant difference between Classes 1 and 2 compared with Class 3.

Different relationships were uncovered between latent classes and maltreatment variables for young males and females. For the male sample, only physical abuse was associated with patterns of polydrug use compared with Class 3 (the highest association was with Class 1). For females, the experience of sexual abuse was the only childhood maltreatment variable significantly associated with membership in the polydrug use Classes 1 and 2. However, unlike in the male sample, the magnitude of the association was broadly similar regardless of polydrug use pattern. The association of childhood sexual and physical abuse with polydrug use classes appears better defined when looking at sex-specific associations. The experience of emotional maltreatment was not associated with membership in any of the polydrug-using classes. This finding supports previous research by Moran et al. (2004), who reported that emotional maltreatment was not related to subsequent illicit drug use. Moran and colleagues did report a significant association between emotional maltreatment and alcohol and tobacco use; however, these items were not included within the current LCA model. Likewise, although we did not find any significant association between the experience of neglect and polydrug-using classes, Shin et al. (2010) reported an association between the experience of neglect and their latent class characterized by alcohol- and cannabis-only users. Again, we did not include alcohol as an item in our LCA. This illustrates an important concept, that comparison between studies is difficult because of inconsistencies in the items used to create polydrug use patterns. One possible explanation for the association between childhood maltreatment in the form of sexual and physical abuse and substance use classes is the self-medication hypothesis (Khantzian, 1985). It is proposed that victims of maltreatment may mitigate the distress caused by maltreatment by self-medicating with illegal substances (White and Widom, 2008; Widom and Hiller-Sturmhöfel, 2001).

Several studies have reported the co-occurrence of abuse types (Armour et al., 2014; Higgins and McCabe, 2001) Of note, a child who experiences one type of maltreatment is highly likely to be experiencing alternative types of maltreatment (Higgins and McCabe, 2001; Litrownik et al., 2005; Saunders, 2003). Diaz et al. (2002) recommend including a wider repertoire of maltreatment domains in analyses. A strength of the current study is that we used a range of drug types in the LCA and assessed the resultant polydrug patterns associated with childhood maltreatment across four maltreatment domains. Although a retrospective account is known to reduce recall (Fergusson et al., 2008), the use of young adults reduces the reference period and thus minimizes recall bias by minimizing time to forget (Diaz et al., 2002). However, the current study is reliant on individuals' willingness and ability to recall and report events (Fergusson and Mullen, 1999). Furthermore, maltreatment research is always conducted under the caveat that reported rates of maltreatment are underestimations (Shin et al., 2010).

A limitation of the study relates to sequence of initiation of drug use (i.e., prior or post substance use disorders). Furthermore, given the complex interplay between different factors of substance use, childhood maltreatment, sex, and other correlates given here, further research might wish to explore the mechanisms underlying these links. There are many developmental challenges experienced in the transition to early adulthood, and the experience of maltreatment can increase the difficulty in resolving issues of identity (Berk, 2007). Several reasons have been put forward to explain why childhood maltreatment might lead to substance use (Widom and White, 1997).These include self-medication in an attempt to gain control over life experiences (Khantzian,

1985), self-enhancement and reduction of loneliness through improving self-esteem, or internalizing/externalizing behavior paradigms (Shin et al., 2010). Although a range of correlates was controlled for in this analysis, in acknowledging the above potential explanations, there may be correlates/risk factors that play a role other than those included (e.g., parental and peer substance use). A further limitation of the current study is that the indicators of childhood maltreatment reflected the occurrence of a type of maltreatment rather than a standardized measure that might assess, for example, the extent of events experienced or typologies of events in a particular category.

In conclusion, there were three types of lifetime polydrug use patterns found in Danish young adults. The results, unlike those of prior research (e.g., Shin et al., 2010), suggested that male and female experience does not differ qualitatively (i.e., by pattern) but does differ quantitatively (i.e., by the frequency of engagement). Although it may not be immediately apparent that this conveys a rationale to study polydrug use separately, a total sample analysis would have overemphasized the role of males, negating important differences between the sexes. A strong rationale for separation by sex was given in the regression models, in which male polydrug use was associated with physical abuse (with higher associations in Class 1), and female polydrug use was associated with the experience of sexual abuse.

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