A latent class analysis of changes in adolescent substance use between 1988 and 2011 in Sweden: associations with sex and psychosomatic problems

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Aims   To characterize changes in patterns of adolescent substance use in Sweden between 1988 and 2011, and to assess whether sex and psychosomatic problems were associated with substance use and whether these associations changed over time. **Design**   Secondary analysis of repeated cross-sectional survey data. Survey data were collected eight times and analyzed as four cohorts (1988–91, 1995–98, 2002–05 and 2008–11). **Setting and participants**   The sample included all 15–16-year-olds in Värmland County, Sweden ($n = 20\,057$). **Measurements**   Binary-coded substance use measures included life-time use of alcohol and tobacco, getting drunk and past school year use of inhalants. An eight-item scale was used to assess psychosomatic problems. **Findings**   A three-class model fitted the data best (i.e. non/low use, mainly alcohol use and polysubstance use). The patterns of substance use were different among cohorts; most notably, adolescents in the last cohort had lower odds of being included in the alcohol and polysubstance use classes rather than the non/low use class than in the earlier cohorts (all $Ps < 0.001$). Males had higher odds than females of being in the polysubstance use class rather than the non/low use class among the first three cohorts (all $Ps < 0.001$) but not the last. Sex was not associated with inclusion in the alcohol use class rather than the non/low use class. Adolescents who reported more psychosomatic problems had higher odds of being included in the alcohol and polysubstance use classes rather than the non/low use class (all $Ps < 0.001$). The associations of sex and psychosomatic problems with class inclusion did not change during the study period. **Conclusions**   Between 1988 and 2011, patterns of substance use among adolescents in Sweden shifted away from polysubstance use and alcohol use to non-use or low use. Associations between patterns of substance use and sex and psychosomatic problems remained largely consistent across the study period.

Keywords   Adolescence, internalizing problems, latent class analysis, psychosomatic problems, sex, substance use, time trends.

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INTRODUCTION

Adolescence is a critical developmental phase, when individuals transition from parent-protected environments to social independence. This transition is characterized by major biological and psychological changes and shifting social roles [1,2]. It is facilitated by an increase in exploratory and sensation-seeking behavior [3], allowing adolescents to gain the experiences and competencies they need to navigate the adult world. Consequently, experimental substance use is common during adolescence [4–7], and may be considered normative to some extent [8–10].

In the past few decades, rates of adolescent substance use have changed. Alcohol and tobacco use, particularly, rose in many western countries between the 1980s and into the mid-1990s [5,11,12]. Since then, substance use has decreased substantially [13–16]. As the rates of adolescent substance use have shifted over time, it is possible that the extent of substance use that is considered 'normative' has also shifted.

In a diverse group of individuals, subgroups will show varying degrees of normative and non-normative substance use behavior [17]. Latent class analysis (LCA) is an optimal way to understand nuanced patterns of behavior by identifying mutually exclusive and homogeneous subgroups within a heterogeneous population [18,19]. Several studies have been published using LCA to investigate patterns of adolescent substance use [9,18,20–29]. Most studies identified three to four classes, including non/low use, mainly alcohol, and polysubstance use

classes [30]. None of these studies examined changes in patterns of substance use at the societal level over a longer period of time. One study among high school seniors examined patterns of cannabis use and attitudes toward cannabis use. They examined changes in these patterns between 1977 and 2001 by using year to predict class inclusion [31], but did not test whether the patterns of substance use were different between the years.

Sex

Patterns of substance use may differ by sex. Most previous research showed that adolescent males had a greater tendency towards risky and experimental substance use than females [32], although this gap may be narrowing [33]. One LCA study revealed that females were more likely to use different types of substances [9], whereas others found that class probabilities for substance use classes did not differ between males and females [23]. Similarly, some studies found that females were more likely to be included in tobacco and polysubstance use classes [21], but others found that males were more likely to be included in a polysubstance use class or typology [23,34]. Other studies did not observe sex differences [22,25,26]. Thus, the findings for sex differences in patterns of substance use seem to be mixed [30].

Internalizing problems

Substance use and internalizing problems such as anxiety, depression and psychosomatic problems are highly comorbid [35]. Among adolescents in particular, internalizing problems are common among those with substance use problems and may precede initiation of substance use [36]. In Sweden, internalizing problems have increased since the 1980s, particularly among females [37]. In LCAs of adolescent substance use, more severe internalizing problems predicted inclusion in substance use classes [21], in a tobacco use class among females only [38] and in a polysubstance use class among urban cigarette smokers [22]. Given the decrease in rates of substance use among adolescents in the previous decades, it seems possible that the association between patterns of substance use and internalizing problems has also changed.

Current study

In the current study, our aim was to employ an LCA in order to describe patterns of substance use among adolescents in Sweden between 1988 and 2011. We were particularly interested in possible changes in patterns of substance use, therefore we investigated whether the patterns of substance use differed among four cross-sectional cohorts (1988–91, 1995–98, 2002–05 and 2008–11). Finally, we examined whether sex and psychosomatic

problems predicted class inclusion. We hypothesized that sex would be more strongly predictive of class inclusion during the earlier years of the study period compared to the later years, as the gap in substance use between sexes seems to be narrowing [33]. Given that the rates of substance use rates have decreased, we hypothesized that psychosomatic problems would be more predictive of class inclusion during the later years of the study period compared to the earlier years. With higher rates of alcohol and tobacco use in particular in the 1990s [5], we reasoned that substance use may have been considered more normative and not necessarily associated with psychosomatic problems. In the 2000s, substance use became less common among adolescents, and therefore using substances may have become more strongly associated with psychosomatic problems.

METHODS

Participants

Participants were adolescents who took part in the Young in Värmland (YiV) study [39,40], a repeated cross-sectional survey study that took place eight times between 1988 and 2011 in Värmland County, Sweden. During the spring semester of each year of investigation, a questionnaire was given to all students in the ninth grade of compulsory education (aged 15–16 years). Throughout all years, 23 167 adolescents from 42 schools in 16 municipalities participated in the study. In 1995 two of the municipalities did not participate, therefore data from these municipalities were excluded from the entire analysis (the remaining sample consisted of 20 115 adolescents). The final sample consisted of 20 057 adolescents for the LCA (3% of adolescents had missing data on all substance use indicators) and 19 828 adolescents for the analysis predicting class inclusion (1% of data on psychosomatic problems and sex were missing and therefore deleted [41]).

Procedure

The data collection procedure followed the research ethics principles in humanistic–social science research stipulated by the Swedish Research Council. The questionnaire and the principles guiding the data collections from 2005 onwards were reviewed by the Ethics Committee at Karlstad University, Sweden. School personnel handed paper-and-pencil questionnaires to the students. Before the data collection, parents of all eligible participants were informed of the study. Participation was voluntary. Students completed the questionnaire anonymously in the classroom and returned it to the school personnel in a sealed envelope.

Measures

Substance use

We used four indicators of substance use in the LCA that were available for all data collection years. Adolescents reported life-time use of alcohol and tobacco (smoking and use of snus, a moist powder tobacco product typical in Sweden, which were combined into any tobacco use), having ever been drunk and inhalant use during the past school year. Each question had between two and eight answer categories, which were collapsed into two in order to meet the assumption of local independence (no use versus use; see Supporting information, Table S1 for details on how indicators were recoded).

Psychosomatic problems

The psychosomatic problems scale was administered to adolescents. They were asked how frequently during the school year they experienced eight symptoms (difficulty concentrating, difficulty sleeping, headaches, stomachaches, feeling tense, little appetite, feeling sad, feeling giddy). Answers were given on a five-point Likert scale (never to always) and summed. Some items were resolved for differential item functioning across sexes following Rasch psychometric analyses [42]. The non-linear raw scores were transformed to a linear scale on which each person had a location (logit) value. Higher values on the logit scale indicated a greater degree of psychosomatic problems. The scale has previously been examined in the YiV sample, and has shown to be reliable and to work invariantly across the years of investigation [42] (see Supporting information, Table S2).

Data analysis

LCA

First, we ran a series of models of up to four classes to determine the appropriate number of latent classes. The most appropriate model was determined based on low adjusted Bayesian information criterion (BIC), low Aikaike information criterion (AIC), a significant Lo–Mendell–Rubin likelihood ratio test (LMR LRT), visual inspection of plots of the log-likelihood values, meaningfully interpretable classification and parsimony [43,44]. Subsequently, we examined entropy to determine how well the classes delineated individuals and bivariate correlations to determine whether the assumption of local independence had been met [45].

Multiple group LVA

Secondly, we included cohort as a grouping factor in the LCA in order to examine whether the patterns of substance use differed throughout the study years. In order to reduce the number of comparisons in testing differences between cohorts, and because the patterns of substance use were similar for the pairs of proximal cohorts (see Supporting information, Fig. S1), we collapsed the eight waves of data into four cohorts: cohort 1: 1988 and 1991 ($n = 5299$), cohort 2: 1995 and 1998 ($n = 4761$), cohort 3: 2002 and 2005 ($n = 5116$) and cohort 4: 2008 and 2011 ($n = 4881$). We compared restricted, semi-restricted and unrestricted models. In the restricted model, the probability of class membership and the probabilities of item responses were constrained to be equal throughout cohorts. In the semi-restricted models, class probabilities were allowed to vary by cohort and the item response probabilities of pairs of cohorts were held equal. In the unrestricted model, class and item response probabilities were allowed to vary by cohort. The best model fit was determined by significance of the χ^2 difference test based on the log-likelihood [46,47]. If entropy was high (> 0.80 [48]), we used the most likely class membership in the subsequent steps. Thirdly, to determine how probabilities of class membership differed per cohort, we performed a multinomial logistic regression with class as the outcome and cohort as the predictor.

Multinomial logistic regression

Fourthly, we predicted most likely class membership using sex and psychosomatic problems by conducting multinomial logistic regression (two-step method [48]; see Supporting information, Fig. S2). If the classes differed by cohort, we added cohort as a grouping factor to the logistic regression (mixture model); effects of sex and psychosomatic problems were considered significant at an adjusted $P < 0.003$ in that case (Bonferroni correction for 16 tests). Fifthly, we tested differences between specific parameters (i.e. the association between psychosomatic problems and probability of inclusion in class 1 versus 2 in the 1988–91 cohort compared to the 1995–98 cohort) using Wald tests (significant at Bonferroni-corrected $P < 0.002$). All analyses were performed using the type = Complex option in Mplus, which corrects the standard errors for non-independence of observations, as participants were clustered in schools. All analyses were conducted using the MLR estimator in Mplus version 8.3 [49]. They were not pre-registered and are thus exploratory.

RESULTS

Table 1 shows the descriptive statistics for the substance use items, sex and psychosomatic problems for each of the cohorts.

LCA

First, we determined which number of classes fitted the data best in the entire sample (see Table 2). The

Table 1 Descriptive statistics for indicators of substance use, sex and psychosomatic problems for all cohorts.

	Cohort 1 (1988–91)		Cohort 2 (1995–98)		Cohort 3 (2002–05)		Cohort 4 (2008–11)		Total	
	n	% or mean (SD)	n	% or mean (SD)	n	% or mean (SD)	n	% or mean (SD)	n	% or mean (SD)
Alcohol use (no use/use)	5291	17/83	4751	14/86	5106	21/79	4868	32/68	20016	21/79
Ever drunk (no/yes)	5276	39/61	4743	32/68	5079	40/60	4836	53/47	19934	41/59
Tobacco use (no use/use)	5290	73/27	4748	72/28	5104	71/29	4863	79/21	20005	74/26
Inhalant use (no use/use)	5277	97/3	4734	95/5	5087	95/5	4822	95/5	19920	96/4
Sex (male/female)	5199	52/48	4757	50/50	5121	50/50	4881	51/49	19958	51/49
Psychosomatic problems	5293	−0.94 (1.02)	4744	−0.88 (1.10)	5098	−0.80 (1.28)	4853	−0.79 (1.26)	19988	−0.85 (1.17)

Complete data were available for 20 057 adolescents for the latent class analysis (cohort 1: 5299, cohort 2: 4761, cohort 3: 5116, cohort 4: 4881) and for 19 828 adolescents for the multinomial logistic regression analysis (cohort 1: 5181, cohort 2: 4731, cohort 3: 5079, cohort 4: 4837). SD = standard deviation.

Table 2 Model fit statistics for models with one to four classes.

Number of classes	LL	Adjusted BIC	AIC	LMR–LRT	Interpretability	Entropy	Bivariate correlations > 0.30
1	−38 674.57	77 376.05	77 357.13	–		–	6
2	−32 241.63	64 543.82	64 501.27	P < 0.001	Acceptable	0.90	1
3	−32 054.52	64 203.23	64 137.04	P = 0.005	Acceptable	0.79	0
4	−32 024.61	64 177.06	64 087.22	P = 0.176	Acceptable	0.79	0

LL = log-likelihood; BIC = Bayesian information criterion; AIC = Akaike information criterion; LMR–LRT = Lo–Mendell–Rubin likelihood ratio test.

log-likelihood increased and the adjusted BIC and AIC decreased with each additional class; however, the LMR LRT was not significant after adding the fourth class. Plotting the log-likelihood, BIC and AIC values showed a leveling off after the two-class model (see Supporting information, Fig. S3); however, the three-class model added an important nuance to substance use patterns beyond the use versus non/low use classes in the two-class model. We termed the classes: non/low use (40%; no substance use or life-time alcohol use only), mainly alcohol use (56%; life-time alcohol use and some life-time drunkenness, very little tobacco and inhalant use) and polysubstance use (4%; life-time alcohol and tobacco use, drunkenness and some inhalant use).

Multiple group LCA

Secondly, we added a grouping variable to the LCA to examine whether the patterns of substance use differed among the four cohorts. Comparison of a restricted, a series of semi-restricted and an unrestricted model showed that the unrestricted model was significantly improved compared to the other models (see Supporting information, Table S3), indicating that the patterns of substance use

differed between cohorts. Figure 1 shows the class probabilities for each cohort. The entropy for the unrestricted model was 0.92; therefore, we used most likely class membership in the next steps.

Thirdly, we predicted class inclusion by cohort in order to determine how class proportions differed between cohorts (see Table 3). The likelihood of inclusion in the alcohol use compared to the non/low use class was greater in the 1995–98 and 2002–05 cohorts compared to the 1988–91 cohort, greater in the 2002–05 cohort compared to the 1995–98 cohort and smaller in the 2008–11 cohort compared to the 1995–98 and 2002–05 cohorts. The first and last cohorts did not differ regarding inclusion in the alcohol use class compared to the non/low use class. Inclusion in the polysubstance use class compared to the non/low use class was more likely in the 2002–05 cohort compared to the first two cohorts, and less likely in the last cohort compared to all others. The first two cohorts did not differ regarding inclusion in the polysubstance use class compared to the non/low use class.

Figure 2 shows the item response probabilities on the four substance use items for each class per cohort. In the non/low use class, item response probabilities were not significantly different between cohorts. In the alcohol use
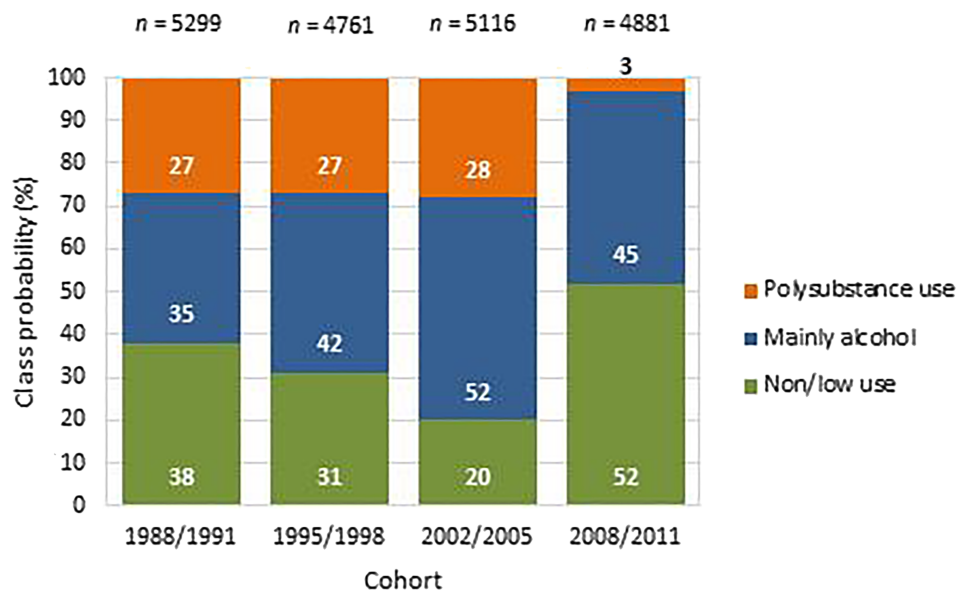

Figure 1 Probability of inclusion in latent classes for each cohort [Colour figure can be viewed at wileyonlinelibrary.com]

Table 3 Statistics of multinomial logistic regression predicting most likely class membership with cohort.

	Mainly alcohol use versus non/low use			Polysubstance use versus non/low use		
Cohort	OR	95% CI	P	OR	95% CI	P
2 versus 1	**1.52**	**1.36–1.69**	**< 0.001**	1.24	1.10–1.40	0.008
3 versus 1	**2.84**	**2.55–3.16**	**< 0.001**	**1.95**	**1.69–2.26**	**< 0.001**
4 versus 1	0.97	0.85–1.09	0.633	**0.08**	**0.07–0.10**	**< 0.001**
3 versus 2	**1.88**	**1.66–2.12**	**< 0.001**	**1.57**	**1.36–1.82**	**< 0.001**
4 versus 2	**0.64**	**0.58–0.70**	**< 0.001**	**0.07**	**0.05–0.08**	**< 0.001**
4 versus 3	**0.34**	**0.30–0.38**	**< 0.001**	**0.04**	**0.04–0.05**	**< 0.001**

Statistically significant (P < 0.004, Bonferroni-corrected) statistics are shown in bold type. OR = odds ratio; CI = confidence interval. Cohort 1 = 1988–91; cohort 2 = 1995–98; cohort 3 = 2002–05; cohort 4 = 2008–11.
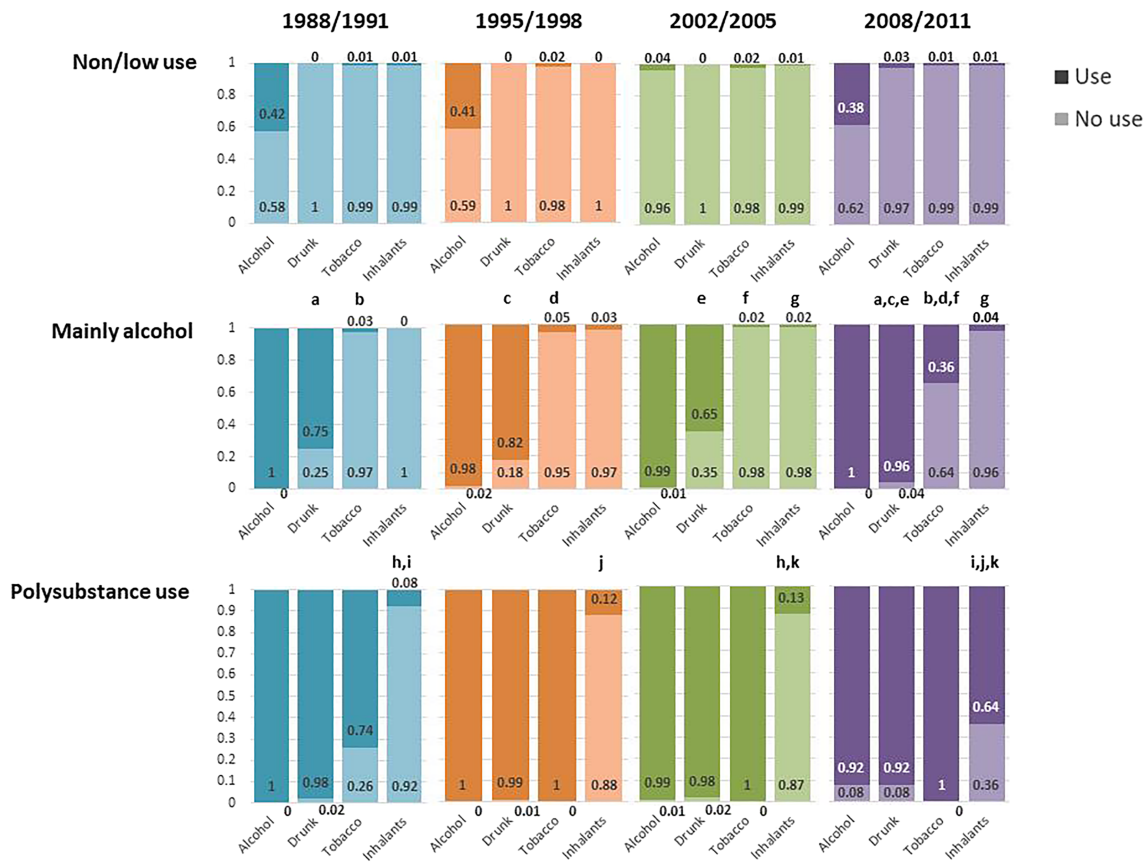
Figure 2 Item response probabilities for each substance use class per cohort. Statistically significant differences (P < 0.001) between cohorts on specific items are given by pairs of small letters (i.e. among those in the alcohol use class, the proportion of those who had ever been drunk versus never been drunk was significantly smaller in the first compared to the fourth cohort ('a') [Colour figure can be viewed at wileyonlinelibrary.com]

class, the proportions of adolescents who had been drunk versus not been drunk were smaller in the first three cohorts compared to the last [odds ratio (OR), cohort 1988–91 = 0.14, marked 'a' in Fig. 2; OR cohort 1995–98 = 0.21, 'c'; OR cohort 2002–05 = 0.09, 'e']. Similarly, the proportions of adolescents who used tobacco were smaller in the first three cohorts compared to the last (OR cohort 1988–91 = 0.06, 'b'; OR cohort 1995–98 = 0.08, 'd'; OR cohort 2002–05 = 0.04, 'f'). Also, the proportion of adolescents who used inhalants in the past

school year was smaller in cohort 2002–05 compared to cohort 2008–11 (OR = 0.46, 'g'). In the polysubstance use class, the proportion of adolescents who reported using inhalants in the past school year was smaller in the first cohort compared to the third and fourth (OR cohort 2002–05 = 0.60, 'h'; OR cohort 2008–11 = 0.05, 'i'), and smaller in the second and third cohorts compared to the last (OR cohort 1995–98 = 0.08, 'j'; OR cohort 2002–05 = 0.08, 'k'). These differences were significant at P <0.001.

Multinomial logistic regression

Fourthly, we predicted class inclusion based on sex and psychosomatic problems. A multinomial regression model with cohort as a grouping factor showed that psychosomatic problems were significantly associated with substance use class for all cohorts, and males were more likely than females to be included in the polysubstance use class compared to the non/low use class for the first three cohorts, but not the 2008–11 cohort (see Table 4). Sex was not associated with inclusion in the alcohol use versus non/low use class. Fifthly, Wald tests showed that none of the effects of sex and psychosomatic problems differed significantly for the four cohorts (see Supporting information, Table S4).

DISCUSSION

We employed an LCA to determine patterns of substance use among adolescents in Sweden and whether these patterns changed between 1988 and 2011. A three-class model fitted the data best, with non/low use, mainly alcohol use, and polysubstance use classes. Analyses showed that both class and item response probabilities varied by cohort. Sex was associated with inclusion in the polysubstance use class and psychosomatic symptoms were associated with inclusion in the alcohol and polysubstance use classes, and these associations were not different between the cohorts.

The three-class structure of non/low, alcohol and polysubstance use classes that fitted our data best is consistent with most previous LCAs of adolescent substance use [23,30]. Our study contributes to this literature by demonstrating that these patterns of adolescent substance use changed between 1988 and 2011. The majority in our sample showed alcohol or polysubstance use patterns of behavior between 1988 and 2005, and the probability of inclusion in these classes compared to the non/low use class increased during each of the first three cohorts. In the last cohort (2008–11) the probability of inclusion in these classes decreased, and the polysubstance use class, in particular, became smaller. This is in line with reports that rates of substance use, most notably alcohol and tobacco use, have been decreasing [14], and disapproval of these substances among adolescents has been increasing [11] since the 2000s.

Disapproval of other drugs such as cannabis and inhalants among adolescents, however, seems to be declining [11]. In our study, inhalant use increased among adolescents in the alcohol and polysubstance use classes during the last cohort (2008–11), and was particularly high among polysubstance users in the last cohort (64%). Overall rates remain low, and reports suggest that inhalant use may be decreasing since 2011 [14]; however, the high rate of use among polysubstance users may indicate a potential target for substance use prevention efforts. A recent latent transition analysis showed that adolescents were likely to remain in the same substance use class over time [23]. Given the robust association between risky substance use

Table 4 Results of multiple group multinomial logistic regression analysis predicting class inclusion.

	Mainly alcohol use versus non/low use			Polysubstance use versus non/low use		
Cohort 1 (1988–91)	*Odds ratio*	*95% CI*	*P*	*Odds ratio*	*95% CI*	*P*
Sex	0.98	0.85–1.12	0.788	**0.63**	**0.54–0.75**	**< 0.001**
PSP	**1.32**	**1.24–1.40**	**< 0.001**	1.79	1.65–1.94	< 0.001
Cohort 2 (1995–98)						
Sex	1.24	1.09–1.42	0.018	**0.66**	**0.57–0.76**	**< 0.001**
PSP	**1.35**	**1.26–1.44**	**< 0.001**	1.75	1.63–1.86	< 0.001
Cohort 3 (2002–05)						
Sex	0.92	0.78–1.09	0.383	**0.56**	**0.47–0.66**	**< 0.001**
PSP	**1.34**	**1.26–1.42**	**< 0.001**	1.93	1.77–2.12	< 0.001
Cohort 4 (2008–11)						
Sex	1.26	1.08–1.46	0.024	0.75	0.54–1.04	0.093
PSP	**1.40**	**1.32–1.49**	**< 0.001**	1.93	1.65–2.25	< 0.001

Significant odds ratios ($P < 0.003$, Bonferroni-corrected) are shown in bold type. PSP = psychosomatic problems; CI = confidence interval.

during adolescence and later substance use disorders [50,51], the high rates of substance use among the polysubstance users indicate a risk for later substance use problems.

We included substance use indicators in our study that were available for all cohorts and therefore were not able to examine use of other substances. An LCA of illicit drug use among Swedish adolescents demonstrated that cannabis use may be somewhat 'normalized' among youth, although rates of experimentation were low [29]. Similarly, low rates of illicit drug use were evident between 1989 and 2011 in Sweden. Among 15–16-year-olds, 0–1% reported life-time use of amphetamines, lysergic acid diethylamide (LSD) and cocaine [52]. Rates of life-time cannabis use were also low, although they increased from 2% in 1989 to 7% in 2011 [52], which is similar to our finding of increasing inhalant use among polysubstance users. A study among Spanish adolescents showed that use of tranquilizers, sedatives and sleeping pills increased between 2004 and 2014 [53]. Thus, while alcohol and tobacco use seem to be declining, some evidence from other countries suggests that illicit drug use may be increasing among adolescents, and warrants further investigation.

We observed that sex was associated with class inclusion, such that males were more likely than females to be included in the polysubstance use class among the first three cohorts. This is in line with previous latent class/typology analyses [23,34], as well as previous research showing that adolescent males were more likely to engage in risky substance use [32]. Consistent with a large-scale study that showed that the gap in substance use between sexes has been narrowing [33], sex was not associated with inclusion in the polysubstance use class during the last cohort. Furthermore, sex was not associated with inclusion in the alcohol use class. The association between sex and class inclusion was not significantly different between cohorts. Previous LCAs have presented mixed evidence regarding sex differences in patterns of adolescent substance use [30]. Our study suggests that sex differences in polysubstance use were evident between 1988 and 2005, but not later, whereas sex differences in alcohol use were not evident between 1988 and 2011. This implies that substance use prevention efforts should target adolescents regardless of sex.

Throughout all four cohorts, adolescents who reported more psychosomatic problems were more likely to be in the alcohol and polysubstance use classes rather than the non/low use class, in line with other LCA studies [21]. We hypothesized that psychosomatic problems would be less strongly associated with patterns of substance use in the earlier cohorts, when substance use was more common, compared to the later cohorts when it was less common. The results from our analyses did not support this hypothesis, showing rather that psychosomatic problems

were associated with substance use patterns across all cohorts. Possibly, the increase in rates of psychosomatic problems during our study period, particularly among females [37,54], affected this association. Thus, despite changing rates in both psychosomatic problems and substance use, our study suggests that the strong comorbidity between these constructs [35] has remained consistent. Prevention/intervention efforts that address both may therefore be appropriate.

Some limitations to our study should be noted. First, we gathered data among all 15–16-year-olds in one county in Sweden, therefore caution is needed in generalizing our findings to the whole of Sweden or to other countries. Secondly, adolescents in our study reported very low rates of inhalant use (2.9–4.6% reported life-time use). Thirdly, as our data were cross-sectional in nature, we could not determine the direction of effects between patterns of substance use and psychosomatic problems. Fourthly, data after 2011 were unavailable. Fifthly, we included both life-time and past-year substance use, which may have affected our results.

To conclude, we utilized an LCA to examine patterns of substance use among Swedish adolescents and changes in these patterns between 1988 and 2011. Our findings provide a unique contribution to the literature, as LCA studies investigating changes in patterns of substance use over time are scarce. Thus, we provided a nuanced depiction of how patterns of substance use have changed, extending the research on trends in rates of substance use. In addition, we observed that the associations with sex and psychosomatic problems and substance use patterns were consistent across the study period.

Declaration of interests

None.

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Supporting Information

Additional supporting information may be found online in the Supporting Information section at the end of the article.

Figure S1 Responses to each substance use indicator per unpaired cohort.

Figure S2 Depiction of multi-group multinomial logistic regression (step 4 of the analyses).

Figure S3 Scree plot of AIC, Adjusted BIC and Loglikelihood values for the 1-, 2-, 3-, and 4-latent class models.

Table S1 Original items on substance use and recoded indicators used in the analyses.

Table S2 Person Separation Index values for the psychosomatic symptoms measure per cohort.

Table S3 Loglikelihood and p values for the Chi-square difference tests comparing restricted, semi-restricted and unrestricted latent class models with cohort as a grouping factor (knownclass in Mplus).

Table S4 Results from Wald tests comparing multinomial regression parameters between cohorts.