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ORIGINAL CONTRIBUTION

A 5-year follow-up study of adolescents who sought treatment for substance misuse in Sweden

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Abstract Previous studies have shown that substance misuse in adolescence is associated with increased risks of hospitalizations for mental and physical disorders, convictions for crimes, poverty, and premature death from age 21 to 50. The present study examined 180 adolescent boys and girls who sought treatment for substance misuse in Sweden. The adolescents and their parents were assessed independently when the adolescents first contacted the clinic to diagnose mental disorders and collect information on maltreatment and antisocial behavior. Official criminal files were obtained. Five years later, 147 of the ex-clients again completed similar assessments. The objectives were (1) to document the prevalence of alcohol use disorders (AUD) and drug use disorders (DUD) in early adulthood; and (2) to identify family and individual factors measured in adolescence that predicted these disorders, after taking account of AUD and DUD in adolescence and treatment. Results showed that AUD, DUD, and AUD + DUD present in mid-adolescence were in most cases also present in early adulthood. Prediction models detected no positive effect of treatment in limiting persistence of these disorders. Thus, treatment-as-usual provided by the only psychiatric service for adolescents with substance misuse in a large urban center in Sweden failed to prevent the persistence of substance misuse. Despite extensive clinical assessments of the ex-clients and their parents, few factors assessed in mid-adolescence were associated with substance misuse disorders 5 years later. It may be that family and individual factors in early life promote the mental disorders that precede adolescent substance misuse.

Keywords Substance misuse · Adolescence · Outcomes

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Introduction

Substance use disorders (SUDs) account for a large part of the disease burden and deaths among young people in industrialized countries parts of the world. As these disorders often onset in adolescence, much effort is expended to prevent and to treat SUDs prior to adulthood [1]. We recently conducted one of the first long-term studies of multiple outcomes of individuals who as adolescents had sought treatment for substance misuse. We compared a cohort of the 1,992 individuals who were seen at the only clinic for adolescents presenting substance misuse in the greater Stockholm area from January 1, 1968 to December 31, 1971 and a randomly selected general population sample of 1,992 individuals matched for sex, birthdate, and birth place. We collected information for both the clinic and the general population sample from six national registers to document death, hospitalizations for physical illness and mental disorders, SUDs, criminal convictions, and poverty from age 21 to 50. Among both women and men in the clinic sample, the relative risks of all six adverse outcomes were significantly elevated as compared with the

general population sample [2, 3]. The elevations in risk were present throughout the entire 25-year follow-up period. While these findings covered a longer follow-up period, including a broader array of outcomes and a larger cohort than previous studies, results were similar in showing that adolescent substance misuse is associated with long-term adverse outcomes [4–8]. Eighty percent of the clinic sample presented adverse outcomes through adulthood, and 39.8 % of women and men in the clinic sample experienced three or more adverse outcomes, while this was true of only 3.4 % of the women and 9.8 % of the men in the general population sample. In the general population sample, many individuals presented one adverse outcome. This was almost non-existent in the clinical sample where co-morbidity of adverse outcomes was common. In fact, not one of almost 2,000 clinic ex-clients presented only SUD during the three decades of follow-up.

When estimating the relative risks of each adverse outcome, we statistically controlled for the other co-morbid adverse outcomes in adulthood. Thus, the results suggested that the elevations in risk for the adverse outcomes were not due to continued SUDs, nor to any of the other adult outcomes. Rather, the results suggested that the adult outcomes were driven by factors present earlier in these individuals' lives. Further analyses confirmed that antisocial behaviour (ASB) before age 15 was associated with increased risks of all outcomes in adulthood, except hospitalization for mental illness, after adjusting for low family socioeconomic status, sex, the interaction of sex and ASB, and SUDs in adulthood, and with an increased number of adverse outcomes up to age 50 [9]. These results are consistent with much evidence showing that ASB is common among adolescents engaging in substance misuse [10] and that the co-occurrence of ASB and substance misuse is associated with persistence of both conditions in adulthood [8]. Overall, these studies showed that a small number of individuals who engaged in substance misuse as adolescents imposed a large burden on the health, criminal justice, and social system, not only in adolescence, but also through the subsequent three decades of their lives.

While these large cohorts provided reliable estimates of outcomes measured using data from national Swedish registers, the information on the participants as children/adolescents and their families was limited. Therefore, we recruited a representative sample of clients at this same clinic in 2004 and intensively studied them and their families using gold-standard clinical instruments [10]. The sample included 99 female and 81 male clients/ex-clients, 168 mothers and 106 fathers, and 97 siblings. At baseline, the clients were aged, on average, 16.7 years (SD = 1.8), and they presented high rates of SUDs, other mental disorders, ASB, and violence. Among the 99 girls, 44.6 % received a diagnosis of alcohol use disorder (AUD) and the other 36.4 % a drug use disorder (DUD). Among the boys, 48.1 % received a diagnosis of AUD, 37.0 % of DUD. Ninety percent of the girls and 81 % of the boys presented at least one mental disorder, and on average, they suffered from three mental disorders. Importantly, most of these disorders had onset prior to substance misuse. The most common disorder was conduct disorder (CD) presented by 67.9 % of the boys and 56.6 % of the girls. Additionally, the prevalence of anxiety and depression was high. Thus, the sample was similar to both treatment [11–14] and community samples of adolescents engaging in substance misuse that have been studied in other countries, particularly with respect to the elevated levels of CD and other disorders that had onset prior to SUDs [11, 15, 16]. The gender differences in the prevalence of AUD, DUD, CD, and anxiety disorders were also consistent with results from previous studies [17, 18].

In this clinic sample recruited in 2004, 52 % of the girls and 35 % of the boys experienced physical abuse by parents and almost one-quarter reported experiencing sexual abuse, more than double the number reported in a Swedish general population sample of the same age. These findings are consistent with those from many studies showing an association between childhood maltreatment and subsequent SUDs [19–21]. Almost half, 45 %, of the adolescents reported engaging in violence towards another person in the past year, 39 % reported bullying others, 4 % reported sexually abusing others, and 76 % reported that they had committed a non-violent offence.

Almost 80 % of the mothers and 67 % of the fathers met criteria for at least one mental disorder. Thirty per cent of the mothers and 77.5 % of the fathers presented either a SUDs or a personality disorder, or both. Official records indicated that 45.5 % of the fathers and 19.3 % of the mothers had at least one conviction for a criminal offence. High levels of SUDs and ASB among parents of offspring with similar problems have often been reported [22–29].

Six and 12 months after their original contact with the clinic, we re-interviewed the former clients. Surprisingly, given the nature, the number, and the severity of problems presented by the adolescents, only 55 % received health or social services in the year following the initial assessments. The only factor to distinguish between those receiving and not receiving treatment was the presence of major depression that was elevated among those in treatment. However, as we found in the study of the cohort treated from 1968 to 1971, the greater the number of problematic domains (mental disorders, substance misuse, victimization, violent and non-violent criminality) presented by the adolescent, the more likely he/she was to receive treatment. At the 12-month follow-up, most of the adolescents continued to present the same problems that they had shown at baseline. Importantly, however, some of the adolescents who did not

have one or other of these problems at baseline had developed the problem by the 12-month follow-up [10, 30].

Follow-up studies of clinical samples provide valuable information to clinics about outcomes, and characteristics of clients who benefit and who do not benefit from their services. Further, such studies provide information useful for modifying social and health policies, for example, with regard to the prevention of maltreatment, and the provision of mental health care to children presenting mental disorders that put them at risk for substance misuse in adolescence, and for their parents who present mental disorders and substance misuse. Further, since this sample was similar to adolescents with SUDs described in the literature as to the presence of co-morbid disorders that had onset prior to SUDs, ASB, physical abuse, and parents' characteristics, the results of the follow-up study would extend knowledge of the transition to adulthood of this clinical population. Consequently, we conducted another follow-up of this sample in early adulthood.

The present study

The present study investigated the prevalence of AUD, DUD, and AUD + DUD in early adulthood among individuals who as adolescents had consulted a clinic for substance misuse in a large urban center in Sweden. Further, the study examined family and individual factors predictive of these disorders in early adulthood. Parents' AUD [10, 27] and DUD, criminality, and physical maltreatment of their offspring [31, 32] have been associated with SUDs among their offspring. Among adolescents, the presence of mental disorders [31–35], ASB, and victimization by peers have been associated with SUDs. Consequently, the study estimated the strength of associations of these factors assessed in mid-adolescence with outcomes measured 5 years later.

The study also investigated sex differences in outcomes and predictors of outcomes. Only 16.6 % of the cohort treated from 1968 to 1971 were females [3], while in 2004 more than half the clients of the clinic were females, consistent with findings from current samples in the US [36]. In the follow-up study of the old cohort, differences through adulthood between those who had presented SUDs as adolescents and those who had not were greater among women than men for death, SUDs, and criminality. These findings concurred with some previous studies [37, 38], while other studies reported similar outcomes for women and men [39]. Further, in the study of the old cohort, the associations between ASB in adolescence and adverse outcomes through adulthood were similar in females and males [8]. However, some studies have reported sex differences in factors associated with SUDs in adolescents, for example, anxiety in girls [31].

Method

Participants

At first contact with the clinic (baseline)

During a 19-week period in 2004, 742 adolescents consulted the clinic for adolescents with substance misuse in a large urban center in Sweden. A random sample of 373 (50.3 %) of these adolescents and their parents were invited to participate in the study. Of these, 180 clients, their mothers and fathers agreed. Given the high rate of refusal, 61 clients who agreed to participate in the study were compared with 61 clients who refused. Results indicated that the sample was representative of the clinic population [10].

Five years after first contact with the clinic

Of the 180 adolescents who participated at baseline, 147 (81.7 %) completed interviews 5 years later, 61 males and 86 females. The mean age of the ex-clients at follow-up was 22.2 years (SD = 1.84) with no difference between males and females. The mean follow-up time was 67.2 months (SD = 10.2). There were no significant differences between those who completed the 5-year follow-up and those who did not on baseline characteristics: parents' SUDs, criminality, maltreatment by parents, family poverty, and ex-clients' mental disorders, experience of victimization by peers, experience of sexual abuse, treatment and age at first contact with the clinic. The adolescents who declined to participate in the follow-up were, however, more likely to be males, to have one or both parents born abroad, to have official and/or self-reports of non-violent and violent crime at baseline and during the follow-up.

The characteristics of the 147 ex-client adolescents at first contact with the clinic are presented in Table 1. Few differences were detected between the girls and boys. Proportionately more girls, than boys, experienced neglect by parents, sexual abuse, and presented anxiety disorders. Proportionately more boys than girls presented CD, and committed non-violent and violent crimes.

Procedure

Baseline

The adolescents and their parents were invited to participate in the study at first contact with the clinic in 2004. The adolescent and each parent signed consent forms agreeing to complete questionnaires and interviews, authorizing the research team to retrieve information from medical, criminal, and social insurance records. Interviews were

Table 1 Characteristics of adolescent girls and boys at first contact with substance misuse clinic

	Males *n* (%)	Females *n* (%)	Males as compared to females Statistical comparison χ^2 (*p*)
Family factors			
Fathers AUD	27 (35.5)	35 (38.0)	$\chi^2(N = 137) = 0.441$, $p = 0.507$
Mothers AUD	13 (16.3)	17 (17.5)	$\chi^2(N = 144) = 0.035$, $p = 0.852$
Fathers DUD	18 (23.7)	18 (19.6)	$\chi^2(N = 137) = 0.004$, $p = 0.950$
Mothers DUD	5 (6.3)	11 (11.3)	$\chi^2(N = 144) = 0.478$, $p = 0.489$
Father non-violent crime	22 (27.2)	29 (29.3)	$\chi^2(N = 147) = 0.096$, $p = 0.756$
Mother non-violent crime	16 (19.8)	16 (16.2)	$\chi^2(N = 147) = 0.222$, $p = 0.637$
Fathers violent crime	7 (8.6)	7 (8.6)	$\chi^2(N = 147) = 0.461$, $p = 0.497$
Mother violent crime	0 (0.00)	4 (4.0)	$\chi^2(N = 147) = 2.917$, $p = 0.088$
Physical abuse of participant	38 (46.9)	50 (50.5)	$\chi^2(N = 147) = 0.327$, $p = 0.568$
Neglect of participant	60 (75.9)	87 (87.9)	$\chi^2(N = 146) = 4.515$, $p = 0.034$
Family poverty	20 (24.7)	23 (23.2)	$\chi^2(N = 147) = 0.008$, $p = 0.930$
A parent born outside of Sweden	26 (32.1)	26 (26.3)	$\chi^2(N = 147) = 0.062$, $p = 0.803$
Individual factors			
Mean age (in years)	16.7 SD = 1.82	16.6 SD = 1.76	$t(df = 145) = 0.437$ $p = 0.663$
Mood disorder	9 (11.1)	16 (16.2)	$\chi^2(N = 147) = 0.787$, $p = 0.375$
Anxiety disorder	9 (11.1)	42 (42.4)	$\chi^2(N = 147) = 17.934$, $p = 0.000$
Conduct disorder	30 (49.2)	26 (30.2)	$\chi^2(N = 147) = 5.433$, $p = 0.020$
Conviction/self-report non-violent crime	70 (87.5)	75 (75.8)	$\chi^2(N = 144) = 6.571$, $p = 0.010$
Conviction/self-report violent crime	52 (65.8)	42 (42.9)	$\chi^2(N = 144) = 7.479$, $p = 0.006$
Sexual abuse	7 (8.6)	45 (45.5)	$\chi^2(N = 147) = 21.189$, $p = 0.000$
Victimization by peers	32 (39.5)	47 (47.5)	$\chi^2(N = 147) = 2.862$, $p = 0.091$
SUDs			
AUD	37 (45.7)	42 (42.4)	$\chi^2(N = 147) = 0.467$, $p = 0.494$
DUD	27 (33.3)	27 (27.3)	$\chi^2(N = 147) = 0.045$, $p = 0.832$
AUD + DUD	20 (24.7)	14 (14.1)	$\chi^2(N = 147) = 1.461$, $p = 0.227$
Treatment during the follow-up period			
Treatment SUDs	33 (44.6)	50 (53.8)	$\chi^2(N = 146) = 0.175$, $p = 0.675$
Treatment other mental problems	47 (63.5)	76 (80.9)	$\chi^2(N = 146) = 0.145$, $p = 0.703$

Statistical abbreviation is normally reported in italic

conducted separately with adolescents and each parent, and all participants were guaranteed confidentiality of the information that they provided, with the exception of current maltreatment towards the adolescent, and intentions to hurt specific others or self. The adolescents received a gift certificate worth 500 SEK, and their parents a gift certificate for 300 SEK for a department store as compensation for their time and inconvenience.

Five-year follow-up

In 2009 and 2010 the ex-clients were contacted by telephone asking them to participate in the follow-up study. Those who accepted signed consent forms agreeing to complete questionnaires and interviews and authorizing the research team to retrieve information from national registers of health care, criminal convictions, and social insurance. The ex-clients were given a gift certificate worth 500 SEK at a department store as compensation for their participation.

Each wave of data collection was approved by the Karolinska Institute Research Ethics Committee Nord and/or the Regional Board for Research Ethics in Stockholm.

Measures at baseline

Parents' substance use disorders

Ninety fathers and 163 mothers completed interviews with a clinical psychologist using the Structured Clinical Interview for DSM-IV axis I disorders [40, 41]. Additionally, 78 mothers reported on fathers' SUDs, and 14 fathers reported on mothers' SUDs using the Family Interview for Genetic Studies (FIGs) [42].

Parents' criminality

Information on criminal convictions was extracted from official records (Lagfördaregistret). Violent crime was defined as having a conviction for any of the following crimes: attempted or completed homicide or manslaughter; criminal negligence causing death; assault and aggravated assault; arson and aggravated arson; robbery and aggravated robbery; kidnapping, stalking; harassment; unlawful threats; rape and aggravated rape; sexual assault; sexual molestation, sexual abuse of minors; incest; and procuring and child pornography crimes during the past year or earlier. Non-violent crime was defined as having a conviction for any other offence in the Swedish penal code.

Parents' maltreatment of the adolescents

The adolescents and each parent independently completed the Conflict Tactic Scale: Parent–Children Version (CTSPC), [43, 44]. If one of the parents did not participate in the study, the other parent reported on the absent parent's behavior. Based on reports of both parents and the adolescent, physical abuse was defined as present if any of the following were reported: hit with a fist or kicked hard; hit on a part of the body other than the bottom with a hard object; thrown or knocked down; grabbed around the neck and choked; beaten up; hit repeatedly very hard; burned; threatened with a gun or knife. Neglect was defined as present if any of the following were reported: left at home alone when inappropriate; not provided with adequate emotional support; not provided with food or medical assistance when needed; parent being too drunk or high to provide supervision or assistance.

Family poverty

Poverty was defined as the family having received social welfare payments due to low income during at least 3 months in the period of 1990–2004. Twenty-four percent of the families received social welfare payments, considerably higher than the 8 % reported for the general population age 20–64 years. This information was extracted from the Swedish Social Insurance Administration.

Adolescents' mental disorders

The participants 17 years or younger completed the Kiddie-Schedule for Affective Disorders and Schizophrenia for School-Aged Children-Present and Lifetime Version (K-SADS-PL) [45] [56]. Fifteen cases were rated independently by a second clinician and inter-rater reliability was high with kappa statistics (κ) ranging from 0.76 to 0.92. (e.g. for conduct disorder/oppositional defiant disorder, $\kappa = 0.82$). Participants 18 years or older were interviewed using the SCID I and II. Inter rater reliability, calculated on 12 cases of participants, was high, (e.g. conduct disorder/oppositional defiant disorder, and major depression with $\kappa = 0.82$ and 1.0, respectively).

Adolescents' criminality

Information on criminal convictions was extracted from official records (Lagfördaregistret). The youngest age for conviction in Sweden is 15 years. Violent and non-violent crimes were defined as for the parents. Additionally, adolescents reported on non-violent and violent crimes that they had committed during the past year [46].

Adolescents' experience of victimization by peers

Experience of victimization by peers during the past 6 months was measured by a self-report questionnaire and

defined as present if any of the following was reported: attacked unprovoked, kicked in the head while lying on the ground, threatened with weapons, forced to hand over money, cell phone, cigarettes or other things [46], told bad things, made fun of or teased, kicked assaulted, ostracized by peers [47].

Adolescents' experience of sexual abuse

Sexual abuse was defined as reports by either a parent or the participant in the questionnaire Sexual Experience Survey (SES) [48, 49] that any of the following had occurred: forcing the adolescent to have sex against her/his will by a person in position of authority, by offering alcohol or drugs, or by physical violence.

Measures at 5-year follow-up

Ex-clients' SUDs

Ex-clients completed the SCID I and II. Videos of 12 SCID interviews were rated independently by a second clinician. Inter-rater reliability was high; for AUD, $\kappa = 0.832$ and for different DUDs $\kappa = 1$.

Ex-clients' treatment

Participants reported on treatment received since baseline, during the SCID interview and during a semi structured interview using the Life History Calendar [50]. Two types of treatment were defined: treatment for SUDs and treatment for other mental disorder.

Statistical analyses

Based on previous studies, we expected that the presence of SUDs in mid-adolescence would be associated with similar disorders 5 years later. We also expected treatment to be associated with the outcomes AUD, DUD, and AUD + DUD. Consequently, analyses were completed in three steps.

In a first step, we identified baseline factors, other than SUDs and treatments, that independently predicted AUD, DUD, and AUD + DUD 5 years later. Family factors included father AUD, mother AUD, father DUD, mother DUD, father conviction for a violent crime, mother conviction for a violent crime, father conviction for a non-violent crime, mother conviction for a non-violent crime, parent physical abuse, parent neglect, family poverty; individual factors included mood disorder, anxiety disorder, conduct disorder, self-report or conviction for a violent crime, self-report or conviction for a non-violent crime, experience of victimization by peers, experience of sexual abuse. Based on evidence of sex differences in many of the predictors, the interaction of each factor with sex was tested. Initially, univariate logistic regressions were calculated to identify associations between predictors assessed at baseline and AUD, DUD, and AUD + DUD at follow-up. Predictors with significant associations were entered into a multivariate logistic regression model. One model included family factors, another model the individual factors, and a final model included the significant variables from the two preceding models thereby identifying baseline factors that were independently associated with outcomes.

In the second step, we attempted to determine whether these characteristics that had been assessed at first contact with the clinic would continue to predict AUD and DUD, and AUD + DUD 5 years later, when we took account of the SUDs that had been present at baseline.

In the third step, we aimed to determine whether any factors would continue to predict AUD, DUD, and AUD + DUD at follow-up, after the final models were adjusted for treatment for SUDs and treatment for other mental disorders during follow-up.

In all analyses, males were coded one and females zero. Results of regression models are presented as odds ratios (ORs) with 95 % confidence intervals (CI). All analyses were conducted in Statistical Package for the Social Sciences Version 20. A p value less than $p < 0.05$ for main effects and $p < 0.10$ for interaction effects were considered significant as suggested by Fleiss [51].

Results

Outcomes at 5-year follow-up

Five years after consulting for substance misuse, 28 (45.9 %) of the males and 35 (40.7 %) of the females presented AUD, 29 (47.5 %) of the males and 21 (24.4 %) of the females presented DUD, and 19 (31.1 %) of the males and 15 (17.4 %) of the females presented AUD + DUD. Figure 1 presents the numbers of participants with each disorder at follow-up as a function of disorders present at baseline.

Having an AUD in mid adolescence was associated with a ninefold increase in risk of AUD 5 years later among males (OR = 9.37, 2.91–30.16) but not among females (OR = 2.38, 0.98–5.75). Having a DUD in mid-adolescence was associated with increased risk of DUD 5 years later, 4 times among males (OR = 4.39, 1.32–14.60) and almost 6 times among females (OR = 5.89, 2.02–17.13). Having AUD + DUD in mid-adolescence was associated with a fourfold increase in risk of AUD + DUD 5 years later among both males (OR = 4.36, 1.24–15.32) and females (OR = 3.94, 1.07–14.47).

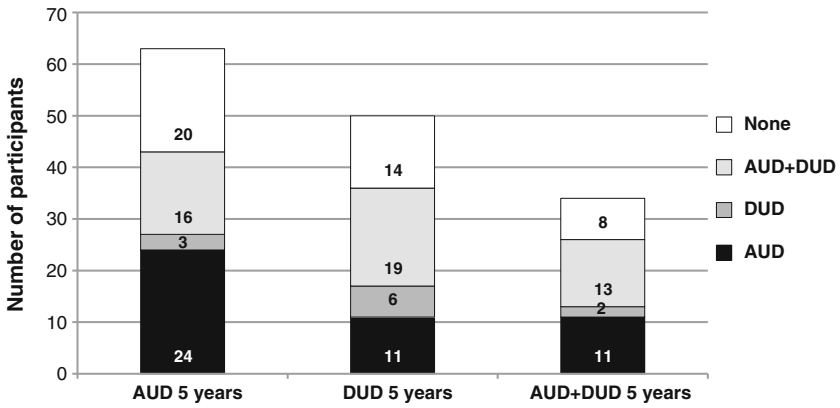

Fig. 1 Number of ex-clients presenting an AUD, DUD, and AUD + DUD 5 years after first contact with the clinic as a function of diagnoses at baseline. *AUD* alcohol use disorder, *DUD* drug use disorder, *AUD+DUD* alcohol use disorder and a drug use disorder

Baseline factors that predicted AUD 5 years later

As presented in Table 2, in univariate analyses, AUD at follow-up was predicted by three family factors, mother's AUD, the interaction of mother's AUD and sex, father's DUD, and four individual factors, CD, non-violent and violent crimes, and victimization by peers. In the multivariate model that included the family factors that were significant in univariate analyses, the interaction of mother's AUD and sex remained significant. As illustrated in Fig. 2, among the adolescents of with mothers presenting AUD, the females were more likely than the males to present AUD. In the multivariate model that included the individual factors that were significant in univariate analyses, only non-violent crime and victimization by peers remained significant. In the final model that included the family and individual factors that were significant in multivariate models, all three factors remained significant indicating that non-violent crime and victimization by peers assessed at baseline were independent predictors of AUD 5 years later, as was mother's AUD among females.

When the final model was re-run including AUD, DUD, AUD + DUD at baseline as predictors, the presence of AUD at baseline predicted a fivefold increase in risk y of AUD at the 5-year follow-up. Additionally, the likelihood of AUD at the 5-year follow-up was increased almost four times by victimization by peers, and eight times by an interaction of sex × mothers' AUD.

When the final model was re-run including treatment for mental health problems and treatment for SUDs, the predictors of AUD in early adulthood did not change.

Baseline factors that predicted DUD 5 years later

In univariate analyses, only one family factor, the interaction of sex and neglect, and four individual factors, CD, non-violent crime, victimization by peers, and sex assessed at baseline were associated with DUD 5 years later. In the multivariate model of individual factors, only non-violent crime and sex remained significant. In the final multivariate model, only non-violent crime and male sex were significant predictors of outcome.

When the final model was adjusted for AUD, DUD, and AUD + DUD at baseline, AUD + DUD at baseline predicted a sixfold increase in the risk of DUD after 5 years and the two previous predictors, non-violent crime and sex, remained in the model.

When the final model was adjusted for treatments, treatment for SUDs during the follow-up period predicted a sixfold increase in the risk of DUD 5 years later and female sex remained protective.

Baseline factors that predicted AUD + DUD 5 years later

In univariate analyses, no family factor and two individual factors, non-violent and violent crime, were associated with AUD + DUD at follow-up. When these two individual factors were entered into a final model, only non-violent crime at baseline predicted AUD + DUD at follow-up. When this final model was adjusted for AUD, DUD, and AUD + DUD at baseline, AUD at baseline predicted a threefold increase in the risk of AUD + DUD 5 years later, and non-violent crime was no longer significant. When the final model was adjusted for treatments, treatment for SUDs predicted a twofold increase and non-violent crime predicted an eightfold increase in AUD + DUD 5 years later (Table 3).

Discussion

The present study followed for 5 years 147 males and females who as adolescents had sought treatment at a clinic for substance misuse in Sweden. Just more than half (53 %) of the ex-clients presented SUDs at follow-up. The prevalence of AUD was similar among the males and females (45.9, 40.7 %), while proportionately more of the

Table 2 Odds ratios derived from univariate logistic regression models estimating the associations between family and individual factors at baseline with AUD, DUD and AUD + DUD 5 years later

Characteristics at baseline	AUD		DUD		AUD + DUD	
	OR (95 % CI)	*p*	OR (95 % CI)	*p*	OR (95 % CI)	*p*
Family factors						
Fathers' AUD	1.20 (0.60–2.41)	0.614	0.93 (0.45–1.94)	0.853	1.21 (0.54–2.71)	0.650
Mothers' AUD	**3.37 (1.35–8.44)**	**0.009**	1.61 (0.67–3.88)	0.286	2.12 (0.84–5.35)	0.114
Sex × mothers' AUD	**6.12 (1.65–22.75)**	**0.007**	1.29 (0.43–3.85)	0.651	1.72 (0.55–5.45)	0.353
Fathers' DUD	**2.78 (1.19–6.48)**	**0.018**	1.77 (0.77–4.08)	0.182	1.21 (0.54–2.71)	0.650
Mothers' DUD	1.14 (0.39–3.33)	0.810	0.93 (0.30–2.90)	0.905	1.20 (0.36–4.05)	0.769
Fathers' conviction non-violent crime	1.61 (0.79–3.29)	0.192	1.62 (0.78–3.38)	0.198	1.44 (0.64–3.26)	0.378
Mothers' conviction non-violent crime	1.73 (0.72–4.16)	0.224	0.96 (0.38–2.44)	0.939	1.13 (0.41–3.12)	0.812
Fathers' conviction violent crime	1.89 (0.62–5.76)	0.262	2.89 (0.94–8.85)	0.063	1.99 (0.62–6.41)	0.247
Mothers' conviction violent crime	[a]		1.98 (0.27–14.49)	0.501	1.9 (0.27–14.49)	0.501
Physical abuse of participant	1.03 (0.54–1.98)	0.924	1.25 (0.63–2.48)	0.524	1.34 (0.62–2.89)	0.462
Neglect of participant	2.04 (0.83–5.03)	0.121	1.05 (0.43–2.55)	0.912	1.42 (0.49–4.08)	0.518
Sex × neglect of participant	1.10 (0.56–2.10)	0.831	**0.44 (0.22–0.88)**	0.021	0.59 (0.27–1.27)	0.177
Family poverty	0.83 (0.39–1.76)	0.625	0.62 (0.27–1.40)	0.247	0.69 (0.27–1.74)	0.426
One or both parents born outside of Sweden	1.54 (0.71–3.33)	0.274	1.10 (0.50–2.43)	0.814	1.12 (0.46–2.75)	0.802
Individual factors						
Mood disorder	1.16 (0.48–2.78)	0.748	0.77 (0.30–1.99)	0.584	1.13 (0.41–3.12)	0.812
Anxiety disorder	1.00 (0.49–2.06)	1.000	1.29 (0.61–2.71)	0.509	1.27 (0.55–2.90)	0.578
Conduct disorder	**2.21 (1.12–4.37)**	0.023	**2.49 (1.23–5.05)**	0.012	2.16 (0.99–4.71)	0.053
Self-report/conviction non-violent crime	**5.32 (1.73–16.37)**	0.004	**5.08 (1.44–17.86)**	0.011	**9.71 (1.26–74.56)**	0.029
Self-report/conviction violent crime	**3.04 (1.52–6.09)**	0.002	1.86 (0.92–3.75)	0.086	**2.99 (1.28–6.98)**	0.011
Experience of sexual abuse	1.62 (0.80–3.29)	0.181	0.96 (0.46–2.01)	0.908	1.32 (0.59–2.98)	0.500
Experience of victimization by peers	**3.16 (1.59–6.28)**	0.001	**2.054 (1.02–4.15)**	0.044	1.93 (0.87–4.28)	0.104
Sex	0.81 (0.42–1.57)	0.530	**0.36 (0.18–0.72)**	0.004	0.47 (0.22–1.02)	0.055
SUDs at baseline						
AUD	**4.10 (2.05–8.22)**	0.000	**2.66 (1.32–5.36)**	0.006	**4.22 (1.84–9.68)**	0.001
DUD	1.15 (0.56–2.36)	0.712	**4.71 (2.20–10.09)**	0.000	**2.52 (1.13–5.62**	0.024
Sex × DUD	0.77 (0.31–1.89)	0.563	2.24 (0.92–5.43)	0.075	1.46 (0.55–3.89)	0.445
AUD + DUD	2.26 (0.97–5.29)	0.060	**6.82 (2.71–17.14)**	0.000	**4.38 (1.80–10.66)**	0.001
Treatments during the follow-up period						
Treatment for SUDs	1.53 (0.79–2.96)	0.205	**5.43 (2.54–11.61)**	0.000	**2.89 (1.29–6.50)**	0.010
Treatment for other mental problems	1.08 (0.52–2.21)	0.839	1.51 (0.69–3.29)	0.299	1.21 (0.51–2.87)	0.664

Only significant interaction terms are reported

Significant results are represented in bold

AUD alcohol use disorder, *DUD* disorder

[a] The model could not be computed as all four ex-clients with mothers who had convictions for violent crimes had AUD

males than the females presented DUD (47.5, 24.4 %) and AUD + DUD (31.1, 17.4 %). Importantly, the sample studied was similar to both treatment and community samples of adolescents with substance misuse previously described in the literature as to the high rates of co-morbid mental disorders [11, 15], onset of these disorders in childhood prior to SUDs [11], the high prevalence of CD [8], high rates of maltreatment by parents in childhood [21], parents with SUDs and/or criminality [52], and high levels of aggressive behavior [53].

Four major findings emerged from the present study: (1) AUD, DUD, and AUD + DUD present in mid-adolescence were in most cases also present in early adulthood; (2) despite extensive clinical assessments of the participants and their parents, few factors assessed in mid-adolescence were associated with SUDs 5 years later; (3) there were few gender differences; and (4) the highest risk cases were those most likely to receive treatment.

The first important finding from the present study was that despite treatment-as-usual most individuals with SUDs

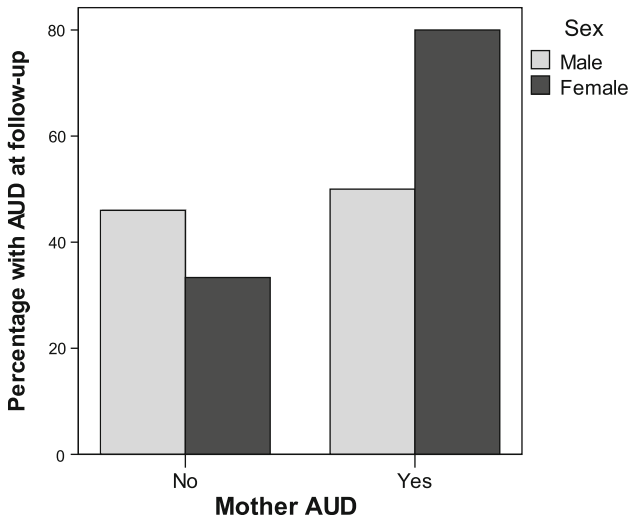

Fig. 2 Percentages of boys and girls with AUD at 5-year follow-up as a function of mother's AUD

at follow-up had presented SUDs 5 years earlier when they first contacted the clinic. In fact, only 20 of 63 (32.7 %) with AUD at follow-up, 14 of 50 (28.0 %) with DUD at follow-up, and 8 of 34 (23.5 %) with AUD + DUD at follow-up had not presented SUDs at baseline. A question that remains to be investigated is the extent of sub-clinical symptoms at baseline among those with SUDs at follow-up and not at baseline. Previous studies have suggested that when SUDs onset in adolescence, their persistence is likely [5, 6, 54–57]. For example, in a study of a large community sample, AUD in mid-adolescence was found to be strongly predictive of AUD at age 24 [16]. In the present study, in multivariate models predicting SUDs at follow-up, generally the SUD that was present at baseline independently predicted the disorder 5 years later in addition to the other predictors. Thus, treatment-as-usual in Sweden of adolescents with SUDs failed to prevent persistence of these disorders.

The second important finding to emerge from the present study was that few of the risk factors assessed in mid-adolescence were independently associated with AUD, DUD, or AUD + DUD 5 years later. Even in univariate analyses, few family factors were associated with SUDs. Mother's AUD and father's DUD were associated with AUD at follow-up as was an interaction of mother's AUD and sex indicating that mother's AUD was more strongly associated with AUD at follow-up among females than males. In the multivariate models predicting AUD at follow-up, this interaction term remained significant even in the models adjusted for prior SUDs and for treatment. This association could result from many factors including transmission from mothers to daughters of genes that confer vulnerability for AUD, and/or non-optimal parenting provided by mothers with AUD that has a particular negative impact on their daughters, and/or mothers with AUD failing to develop positive attachments and healthy relationships with their daughters [58]. The only family factor associated with DUD was an interaction of sex and neglect indicating that among boys, but not girls, neglect was associated with an increased risk for DUD. No family factors, including physical abuse, were associated with AUD + DUD at follow-up.

Surprisingly, few of the individual factors, other than the prior SUDs, assessed when the adolescents first contacted the clinic predicted SUDs 5 years later. Committing non-violent crimes in mid-adolescence was associated with AUD, DUD, and AUD + DUD in early adulthood. This finding is consistent with a large body of evidence showing that CD, conduct problems, and ASB, are associated with an increased risk of SUDs [16, 59] and highlights the importance of implementing evidence-based interventions to reduce conduct problems among children before they escalate into criminality [60]. Victimization by peers was an independent predictor of AUD in multivariate models and a predictor of DUD in a univariate model. Victimization by peers may index pure victimization or victimization that is associated with high levels of aggressive behavior. These latter children are sometimes referred to as bully-victims. Being drunk in public, buying illicit drugs, engaging in aggressive behavior all increase the likelihood of victimization. Generally, however, the results suggest that from mid-adolescence to early adulthood, family and individual factors assessed at baseline exert little influence on SUDs.

Taken together, the results may be interpreted to suggest that these family and individual factors act early in life to influence CD or anxiety, that in turn lead to substance misuse, and that they have little, or no, influence in maintaining the SUDs once it is present. The results draw attention to the urgent need to further understanding of the risk factors for the onset of SUDs in adolescence. For example, what are the genetic and environmental aspects of mother's AUD that increase the risk of AUD in their daughters? Since previous studies have shown an association of physical abuse and subsequent SUDs, what is the mechanism, that is what are the antecedents of adolescent SUDs that result from physical abuse and when during the course of development do these antecedents emerge? Answers to these, and many more questions, are needed to inform early childhood interventions that would be effective in preventing SUDs in adolescence. In order to provide meaningful answers such studies need to be conducted with population samples or large samples of children-at-risk. Such studies would ideally begin early in life to take account of pre-natal factors and early parenting and continue into early adulthood while taking account of both genetic [61] and environmental risk factors [24] that change over developmental periods [62, 63].

Table 3 Significant odds ratios estimating the associations between factors at baseline with AUD, DUD, and AUD + DUD 5 years later

	Predictors assessed at first contact with the clinic									
	Family		Individual		Family and individual		Family and individual adjusted for SUDs		Family and individual adjusted for treatments	
	OR (95 % CI)	*p*	OR (95 % CI)	*p*	OR (95 % CI)	*p*	OR (95 % CI)	*p*	OR (95 % CI)	*p*
AUD										
Sex × mothers AUD	6.12 (1.65–22.75)	0.007			7.91 (1.92–32.62)	0.004	8.37 (1.90–36.99)	0.005	7.83 (1.90–32.24)	0.004
Self-report/conviction non-violent crime			4.00 (1.26–12.75)	0.019	4.20 (1.22–14.46)	0.023			4.07 (1.18–14.05)	0.027
Victimization by peers			2.32 (1.13–4.78)	0.022	2.81 (1.30–6.10)	0.009	3.86 (1.71–8.68)	0.001	2.80 (1.30–6.05)	0.009
AUD							5.05 (2.32–11.02)	0.000		
DUD										
Sex × neglect	0.44 (0.22–0.88)	0.021								
Self-report/conviction non-violent crime			3.83 (1.06–13.84)	0.040	4.17 (1.16–14.99)	0.029	3.94 (1.05–14.82)	0.043		
Sex			0.40 (0.19–0.83)	0.014	0.40 (0.19–0.83)	0.014	0.43 (0.20–93)	0.033	0.27 (0.12–0.61)	0.002
Treatment for SUDs									6.34 (2.79–14.43)	0.000
AUD + DUD							6.44 (2.42–17.12)	0.000		
AUD + DUD										
Self-report/conviction non-violent crime			9.71 (1.26–74.56)	0.029	9.71 (1.26–74.56)	0.029	7.39 (0.94–58.04)	0.057	8.07 (1.04–62.85)	0.046
AUD							3.45 (1.48–8.07)	0.004		
Treatment for SUDs									2.46 (1.07–5.63)	0.034

The third important finding from the present study was that risk factors differed little for males and females. The prevalence of DUD and AUD + DUD was higher among males than females, consistent with previous studies [64, 65], and the stability of AUD, DUD, and AUD + DUD from mid-adolescence to early adulthood was similar in the two sexes as has been previously reported [16]. In adolescence, females were more likely than the males to experience anxiety disorders, sexual abuse, and neglect by parents, while males were more likely to engage in non-violent and violent crimes. There were few interactions of sex with family or individual predictors of SUDs. Mother's AUD was strongly associated with daughter's AUD at follow-up. In univariate analyses, neglect among girls limited DUD. Both genetic [66, 67] and environmental factors [68, 69] associated with the development of ASB generally, differ among males and females, yet in this extreme sample outcomes and predictors of outcomes differed little. This finding is similar to those from prospective longitudinal investigations showing that the long-term outcomes of females and males with early onset conduct problems differ little [70]. The prevalence of adolescent girls seeking treatment for SUDs has dramatically increased in recent years in Sweden as elsewhere [71]. SUDs in females increase the risk of both physical and sexual victimization and constitute a genetic and an environmental risk for their offspring.

The fourth important finding from the present study was that receiving treatment for a SUD in adolescence was a strong predictor of DUD and AUD + DUD in early adulthood. Thus, clinicians selected the most high-risk cases for treatment, but treatment failed to limit SUDs. In our study of the cohort treated at this same clinic in the late 1960s, a similar finding emerged [2]. There was no indication that either treatment for SUDs or for other mental health problems limited AUD, DUD, or AUD + DUD.

Strengths and limitations

The sample was small, but only 18 % of the participants were lost to follow-up. Given the high prevalence of ASB and criminality in the sample, the rate of attrition is relatively low. The 33 participants who did not complete the follow-up presented more serious histories of ASB and criminality than those who participated. Another limitation relates to the lack of information about whether treatment was an alternative to criminal prosecution or not. The strengths of the study include the extensive clinical assessments of the participants and their parents in mid-adolescence using structured, validated instruments, and the use of both national registers and self-reports to document criminality. Additionally, interaction terms of each predictor of substance use disorders with sex were modeled so as to determine sex differences.

Clinical implications

The adolescents who participated in this study, like those described in previous research, presented a substantial challenge to clinical services as they were characterized by several co-occurring disorders that had onset in childhood; in addition to substance misuse, many had experienced physical maltreatment, and had parents who themselves presented ASB. These adolescents require evidence-based treatments for each of their disorders and protection from maltreating parents. Effective treatments for CD, anxiety, and depression in childhood are available [72]. Importantly, however, treatments that are effective in one country may not show similar results when implemented in another country as was recently shown in a randomized-controlled-trial of multi-systemic therapy in Sweden that failed to show any advantage over treatment-as-usual [73]. Thus, studies of imported evidence-based treatments are needed to adapt them to a new environment.

While treatment-as-usual involved both child psychiatric and social services, neither provided interventions aimed at reducing conduct problems or aggressive behavior. In addition to providing such treatments, similar clinics need to implement strategies that promote engagement in treatment by adolescents with CD and SUDs. Co-ordination among psychiatric and social services is needed to ensure that all information relevant to treating the adolescent is shared and to specifically delineate services to be provided by each. In the clinic, little information on cases was shared between the child psychiatrists, social workers, and police. Given the high rate of externalizing disorders among the adolescents, and evidence that treatments for substance misuse and co-occurring disorders are most effective when integrated [15], psychiatric care needs to incorporate these other services into individual treatment plans. In Sweden, criminal offending by adolescents is referred by police to the social services [73]. Yet knowledge of offending is needed by those providing treatments for ASB and substance misuse. Further, physical abuse of children is illegal, but clearly interventions in Sweden to prevent abuse need to be made effective and coordinated with other on-going treatments of the victims and their parents.

The long-standing disorders presented by the adolescents when they first consulted the clinic suggest that studies are needed to determine whether provision of adequate and appropriate evidence-based treatments in childhood would prevent the subsequent development of SUDs. Further, the findings showing that the persistence of

SUDs was related to few of the family and individual factors assessed in adolescence may be interpreted to suggest that these factors acted early on the antecedents of SUDs. This hypothesis warrants testing. Children suffering from mental disorders have a right to effective treatment and a right to a home environment that is nurturing and free of violence. Respecting these rights might prevent adolescent substance misuse.

Many of the adolescents in the present study had parents with current or past SUDs and/or ASB. Presently, little information is available to determine whether the contribution of such parents is limited to increasing the risk of SUDs and ASB in their offspring, or whether they can become a positive resource for their children. At the 5-year follow-up, more than one-quarter of the female ex-clients already had children. Thus, given that SUDs and ASB aggregate in families, prevention policies that adopt a multi-generational perspective may be helpful.

Conclusion

In Sweden, adolescents consulting for substance misuse presented multiple disorders that had onset in childhood, consistent with studies of similar clinical samples elsewhere. After 5 years, more than half continued to present AUD, DUD, or AUD + DUD. In the majority of cases these disorders were already present when the adolescents first sought treatment. Multiple family and individual factors failed to predict SUDs at the 5-year follow-up after taking account of the disorder present in adolescence again showing the strength of continuity of AUD, DUD, and AUD + DUD, but suggesting that these factors act earlier in life to promote disorders that constitute antecedents of SUDs. Treatment-as-usual did not include evidence-based treatments for externalizing disorders nor protection against physical maltreatment and neglect.

Conflict of interest On behalf of all authors, the corresponding author states that there is no conflict of interest.

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