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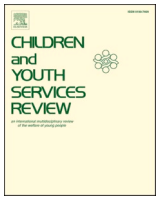

High-risk substance use and psychosocial functioning in young adult care leavers: Findings from a 10-year follow-up study

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ABSTRACT

Background: Care leavers transitioning into adulthood represent a highly vulnerable population, confronted with usual developmental tasks under difficult predisposing conditions. Early-risk and persistent substance use may be an obstacle for care leavers transitioning from youth residential care settings into an independent adult life.
Objectives: This study aims to address the following questions: (1) How stable is high-risk substance use from within care to after youth residential care? (2) Are there differences between longitudinal substance use risk pathways and sociodemographic characteristics, placement history, and adverse exposures? (3) Is the persistency of high-risk substance use associated with impaired young adult psychosocial functioning? Method: In a prospective longitudinal design, with a baseline in youth residential care (t1) and a follow-up ten years later (t2), we investigated the courses of substance use in 182 young adult care leavers in Switzerland (32.4 % women; Mean age = 26.7 years). Psychosocial functioning was assessed across health, legal, educational, and financial domains.
Results: We found large prevalence rates of high-risk substance use in and after residential youth care (41.2 % in residential care; 46.2 % after leaving care). Of those care leavers who reported earlier high-risk substance use, 61.3 % persisted, while 38.7 % remitted. Four substance risk pathways were identified longitudinally: low (N = 69, 37.9 %), remitted (N = 29, 15.9 %), newly-developed (N = 38, 20.9 %), and persistent risk (N = 46, 25.3 %). Persistent high-risk substance use was associated with higher rates of adverse functional outcomes in young adulthood.
Conclusions: Findings of this study shed light on the high prevalence of earlier and persistent high-risk substance use in youth residential care leavers. High-risk substance use appears to have the potential to coincide with impaired psychosocial functioning during and after the transition to young adulthood. Implications for educational and vocational paths as well as harm-reducing interventions are discussed. More research disentangling risk pathways and intervention research in at-risk populations is warranted.

Abbreviations: ANOVA, Analysis of Variance; AUDIT, Alcohol Use Disorders Identification Test; CTQ-SF, Childhood Trauma Questionnaire-Short Form; JAEL, 'Youth Welfare Trajectories: Learning from Experiences' (German: *Jugendhilfeverläufe: Aus Erfahrung lernen*); LEC-R, Life Events Checklist - revised; M, Mean; MAYSI-2, Massachusetts Youth Screening Instrument-V2; MAZ., 'Swiss study for clarification and goal-attainment in youth welfare and juvenile justice institutions (German: *Modellversuch Abklärung und Zielerreichung in stationären Massnahmen)*; N, Number of Participants; PTEs, Potentially Traumatic Events; SCID5, Structured Clinical Interview for DSM-5 Disorders; SCIDII, Structured Clinical Interview for axis II disorders; SDS, Severity of Dependency Scale; SE, Standard Error; WHO, World Health Organization.

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1. Background

Persistent high-risk substance use may be an obstacle for care leavers (i.e., adults formerly in out-of-home care) transitioning from out-of-home care settings into an independent adult life (Havlicek et al., 2013; Osgood et al., 2010). Care leavers represent a highly vulnerable population, confronted with typical developmental tasks under difficult predisposing and current conditions. Such vulnerabilities include frequent placement and caregiver changes, low socioeconomic status, histories of maltreatment and neglect, as well as parental mental and physical illness (Fischer et al., 2016; Burns et al., 2004; Dölitzsch et al., 2014; Kisiel et al., 2014; Teicher and Samson, 2016). Despite these accumulated vulnerabilities, youth care mandates due to civil law placements are usually terminated at the age of majority at 18 years and care leavers are forced to live and work independently much earlier than their peers in the general population. Additionally, youths in residential care are at higher risk for substance related problems which can impact their transitioning and may seriously limit their ability to partake in society later on. To date, the extent of the association between persistent high-risk substance use and young adult functioning among care leavers remains unclear. With this longitudinal study we aimed to examine the relationship between persistence in high-risk substance use and psychosocial functioning in young adults who were previously placed within child welfare and juvenile justice institutions in Switzerland.

Substance use in youths living in out-of-home care – on a non-clinical and clinical level – is not only more common than in the general population, but the age-of-onset is notably earlier (Aarons et al., 2008; Courtney and Dworsky, 2006; Fettes et al., 2013; Pilowsky and Wu, 2006; Traube et al., 2012; Vaughn et al., 2007; Wall and Kohl, 2007). In their systematic review on substance use among youths in foster care, Braciszewski and Stout (Braciszewski & Stout, 2012) reported a prevalence of 54 % for lifetime and 34 % for past year alcohol use, a prevalence of 39–41 % for marijuana use and of 22–34 % for other drug use. In a representative national school sample of 6,573 Swiss students, 15-year-olds reported 69 %, 22 %, and 2 % lifetime prevalence (i.e., having ever tried the substance) for alcohol, cannabis, and 'hard' drug consumption (Jordan, Schneider, Eichenberger, & Kretschmann, 2018). A sample of age-matched youths in residential care, 86 % reported lifetime prevalence for alcohol, 71 % for cannabis, and 28 % for other illegal drug consumption (Kind, Schröder, & Jenkel, 2019). From a clinical perspective, youths in residential care show a high prevalence of substance use disorder with rates varying between 20 % and 38 % (Seker et al., 2021), which stay elevated even after leaving care as shown in a recent meta-analysis (Seker et al., 2022). Though experimentation and exploration might be important aspects of adolescent development, youths placed out-of-home consistently demonstrate a high susceptibility to problematic and thus high-risk substance use at a younger age.

From a theoretical perspective, early-onset and more frequent substance use in out-of-home care can be attributed to various psychosocial factors. Diathesis-stress models suggest that a state-trait interaction puts some individuals at greater risk for developing psychopathology, including problematic substance use, if they are exposed to maladaptive socialization contexts (Belsky et al., 2007; Brody et al., 2013; Cleveland et al., 2015; Pluess, 2017). Therefore, it is not surprising that behavioral problems (e.g., aggression or delinquent behaviors), age and gender, but also childhood adversities, maltreatment, trauma, and mental health issues are related with substance use (Aarons et al., 2008; Seker et al., 2021; Hayatbakhsh et al., 2007; Kepper et al., 2011; Mason et al., 2013; Rogers et al., 2021; Schauss et al., 2020; Felitti et al., 1998). From another perspective, social learning theory suggests that both adaptive and maladaptive behavior are learned by observing others (Bandura & Walters, 1977). Indeed, in institutions, older peers already engaged in substance use behaviors may initiate younger ones (Pilowsky and Wu, 2006; Dunne et al., 2017; Kepper et al., 2014). Specifically in Switzerland, youths placed for criminal law reasons (who show the highest rates of substance use disorders) and youths placed for civil law reasons, are often placed in the same residential care facility, which may influence their socialization context (Traube et al., 2012; Seker et al., 2021; Schauss et al., 2020). The higher susceptibility to problematic substance use of out-of-home care youths may thus result from a combination of predisposing vulnerabilities, adverse experiences, maladaptive coping, unfavorable past and present social circumstances including care settings (Fettes et al., 2013; Degenhardt et al., 2016; Schulte and Hser, 2013; Singh et al., 2011; Jäggi et al., 2021).

From a developmental perspective, substance use has been shown to be generally very stable from adolescence into young adulthood in the general population, with young people being more likely to increase rather than decrease their substance use into young adulthood (Merrin, Thompson, & Leadbeater, 2018). In particular, young people with childhood adversities were shown to develop more stable high-risk consumption patterns during young adulthood (Davis, Tucker, Stein, & D'Amico, 2021). Thus, monitoring substance use of children and adolescents placed out-of-home is crucial, as behavioral problems that manifest early in life carry a high risk of persisting into adulthood and might severely influence long-term functionality (Copeland et al., 2015; Kretschmer et al., 2014). Still while being in the care system, externalizing behaviors in part linked and co-occurring with substance abuse, thus, are among the primary reasons for placement disruptions and breakdowns – resulting in further instability, relationship disruptions and school discontinuity (Kind et al., 2020; Lee et al., 2010; Rock et al., 2015; van Rooij et al., 2015). After leaving the care system, young adulthood becomes a vulnerable period with regard to the development and chronicity of substance use problems are concerned, even more so for cumulating vulnerabilities (Havlicek et al., 2013; Arnett, 2000). Young people are expected to achieve numerous developmental tasks: taking on new responsibilities, completing education, financial independence, developing romantic relationships and social (support) networks (Sroufe et al., 2009; Roisman et al., 2004). Thus, it is not surprising, that the rate of substance use disorders remains high among those who left the care system (Havlicek et al., 2013; Braciszewski and Stout, 2012). Focusing on various psychosocial outcomes in young people, early and extended use of substances during adolescence has been associated with delinquency, school drop-out, delayed entry into the work force, and job instability in young adulthood (Jennison, 2004; Fergusson and Boden, 2008; Schulenberg et al., 2003; Rohde et al., 2007; Newcomb et al., 2001; Wells et al., 2004). Youths with early externalizing behaviors are at risk to consume more illegal drugs and engage in risky behavior in young adulthood (Kretschmer et al., 2014). Additionally, substance use has been linked to impaired relationships with family and friends, loneliness, risky sexual behavior, early parenthood, and inadequate coping skills in young adulthood (Wells et al., 2004; Dishion and Owen, 2009; Newcomb and Bentler, 1988; Kellogg et al., 1999; Leigh and Stall, 1993; Riehman et al., 2006; Tapert et al., 2001; Zullig et al., 2001; Spooner, 1999). Thus, existing literature suggests that substance abuse generally puts young people at risk for adverse psychosocial outcomes. This may be a further obstacle for out-of-home placed young people leaving the care system and may seriously limit their ability to partake in society later on.

Considering the manyfold and interwoven psychosocial risk factors, addressing substance use in out-of-home care and in those leaving care, remains an uphill battle. It poses a serious challenge for care mandates, which aim to provide a supportive, stable environment for healthy child and adolescent development. In Switzerland, young people are mostly placed in youth residential care due to child protection reasons (civil law measure, e.g., different types of maltreatment, or supervisory neglect, psychopathology), or due to externalizing and delinquent behavior as juvenile justice measures (on criminal/penal law bases). The Swiss juvenile justice system, in particular, is an offender-oriented criminal law system allowing the personal and skills development to reduce and prevent such behavior in the future over purely punitive aspects (Aebersold and Jugendstrafrecht, 2017; Seker et al., 2021). In most Swiss institutions, young people are placed due to various and diverse

reasons according to their needs and not the legal basis of placement. Therefore, civil-law and criminal-law placed youths in Switzerland can reside in the same institution based on their educational or treatment needs and not on a mere basis of jurisdiction (Jäggi et al., 2021; Aebersold and Jugendstrafrecht, 2017; Schmid et al., 2013). Internationally, research in countries that have more separate systems (child welfare next to juvenile justice) has shown that a proportion of adolescents appear in both systems during their childhood/young adulthood, which are often labelled as 'crossover'-youths (Lee & Villagrana, 2015). We previously have shown that on many levels these young people do not differ (Jäggi et al., 2021). Of note, many Swiss youth welfare institutions have severe substance use and substance dependency as an exclusion criterion for admission and not many specialized institutions for minors exist. However, to date, no systematic Swiss research on the specific topic of substance use among civil-law and criminal-law placed individuals exists. Yet, despite the challenges for out-of-home care posed by substance use – a resigned attitude in the care system is premature.

In more recent years, a sociopolitical shift in youth welfare policy has placed a greater focus on aftercare and functioning of care leavers. Still, there is a lack of longitudinal studies examining the relationships between substance use and psychosocial functioning in young people leaving the care systems. Longitudinal studies examining the persistency of high-risk substance use and psychosocial functional outcomes among children and adolescents in out-of-home care into adulthood are lacking. Thus, the relation between high-risk substance use within residential care, persistence versus desistance from substance use into adulthood and psychosocial functioning among care leavers remains unclear.

Therefore, in the present longitudinal study, we investigate the relationship between high-risk substance use within and after residential care and adult psychosocial functioning in young adult Swiss youth residential care leavers. We aimed to address the following questions: (1) How stable is high-risk substance use from within care to after care? (2) Do differences between longitudinal high-risk substance use pathways and sociodemographic characteristics, placement history, and adverse exposures exist? (3) Is the persistency of high-risk substance use associated with impaired young adult psychosocial functioning?

2. Method

2.1. Procedure and participants

The data used in this study originates from the epidemiological 'Swiss study for clarification and goal-attainment in youth welfare and juvenile justice institutions' (German: *Modellversuch Abklärung und Zielerreichung in stationären Massnahmen [MAZ.]*)-study conducted from 2007 to 2012 in Switzerland (Schmid, M., M. Kölch, J.M. Fegert, K. Schmeck, and M.A.Z. Team, 2013) and the follow-up study 'Youth Welfare Trajectories: Learning from Experiences' (German: *Jugendhilfeverläufe: Aus Erfahrung lernen [JAEL]*) conducted from 2016 to 2024. We used a prospective longitudinal design to compare young adult functioning between participants who reported different pathways of substance use from within care to after care in young adulthood.

The baseline MAZ. study is a large-scale research project systematically collecting data with standardized instruments of youths placed in out-of-home care institutions accredited by the Swiss Federal Office of Justice. Participants answered well established questionnaires at baseline [see 36, 63, 66–68]. Participants reported on their substance use including alcohol, cannabis, cocaine, opiates, and amphetamines. Informed consent for participation in the study was obtained from children and adolescents and their legal representatives. Trained psychologists from the study team conducted well-established, semi-structured clinical interviews and psychometric questionnaires with the participants. Further details on the MAZ. study design can be found in the final report of the MAZ. study [see 63]. All included institutions (64 institutions; 35 % of all eligible institutions in Switzerland) were accredited by the Swiss Federal Ministry of Justice and represent the diverse types of Swiss residential youth care institutions in regard of size, schooling opportunities, treatment options, and residing of children, adolescents, and young adults (Jäggi et al., 2021; Schmid et al., 2022; Seker et al., 2022; Urben et al., 2022). Overall, institutions were distributed in 15 of the 26 Swiss cantons (states); 38 institutions came from the German speaking areas of Switzerland, 20 institutions from the French-speaking regions, and 6 from the Italian-speaking part of Switzerland. Participants were placed due to either civil law, criminal law, or other reasons at baseline [see 63]. Other reasons included placements based in school laws in some specific Swiss cantons (states), or voluntary placements, with parents consenting in placements without a judicial mandate. All juveniles in partaking institutions were allowed to participate and caregivers in the institutions recruited juveniles into the study. Participants with non-sufficient language skills and intelligence impairments had to be excluded from the MAZ. study [see 63]. Within the MAZ. study, 592 young people took part in the overall study, these represent around a third of all adolescents in these respective institutions (Jäggi et al., 2021). Representativeness of the study sample was checked by asking institutional caregivers to report on mental health problems of adolescents not participating in the assessments (N = 46) on the Child or Young Adult Behavior Checklist (CBCL/YABCL) (Schmid, Kölch, Fegert, & Schmeck, 2013). Age and gender matched comparisons showed no significant differences in the frequency of scoring in the clinical range on the internalizing-, externalizing- and total problems scales suggesting the participants to be representative of all residing in the partaking institutions (Jäggi et al., 2021). The MAZ. study was reviewed and approved by the Ethics Committees for Research on Human in the cantons (states) of Basel and Vaud (Switzerland), and by the Institutional Review Board at Ulm University (Germany).

From these 592 participants included in the MAZ.-study, 511 participants gave their consent to be contacted again for future studies. With an extensive recruitment effort, we were able to enrol a total of 231 care leavers into the follow-up JAEL study (for an overview see the flow chart in Supplementary Fig. 1 and Missingness Analyses in Supplementary Table 1 & 2). Between November 2017 and April 2020, participants were reassessed, amongst others, using web-based psychometric questionnaires as well as clinical interviews about substance use and problems, psychopathology, delinquency, quality of life, and their own experiences in the youth residential care institutions. All participants provided written informed consent. The responsible ethics committee (Ethics Commission Northwestern Switzerland; EKNZ) approved the JAEL study (Ref.–No.: 2017-00718).

In the present study, 182 care leavers (123 [67.6 %] men, 59 [32.4 %] women) with an average age of 26.7 years (SD = 2.99, Range [20.5;38.5]), who participated in both the baseline and follow-up study were included into the study. Participants at average were 16.5 years old at baseline (SD = 2.6, Range [11.3;26.8]), thus an average of 10.3 years (SD = 1, Range [7.9;12.4]) lay between baseline and follow-up. 49 participants were excluded due to missing data (proportion included = 78.8 %). Patterns of non-response and missingness are described in the statistical section below and further explored within the supplementary material (Supplementary Table 1 & 2).

2.2. Measures

2.2.1. Alcohol use disorders Identification Test (AUDIT)

The AUDIT is a well-established multilingual instrument developed from a World Health Organization (WHO) collaborative project to screen for hazardous and harmful alcohol consumption (Saunders, Aasland, Babor, De la Fuente, & Grant, 1993). The screening instrument has been validated in a number of studies with multinational populations of different ages [e.g. see *meta*-analyses Berner, Kriston, Bentele, and Härter (2007), Kuitunen-Paul and Roerecke (2018)]. The 10-item questionnaire covers the domains of alcohol consumption,

drinking behavior and alcohol-related problems. Items are scored on a 5-point scale; 0 = never, 1 = less than once a month, 2 = monthly, 3 = weekly, 4 = daily or almost daily. Previous studies report Cronbach's alpha between 0.77 and 0.94 (de Meneses-Gaya et al., 2009; Rumpf et al., 2013). In the current sample, Cronbach's alpha was 0.77 at baseline within residential care (t1) and 0.86 at follow-up in young adulthood (t2). The cut-off score for high-risk alcohol use was 8 (Saunders et al., 1993).

2.2.2. Severity of dependency scale (SDS)

The SDS is a screening instrument measuring the degree of dependence on different types of substances (Gossop et al., 1995). Several validation studies have been conducted for cannabis (cut-off = 4), amphetamine (cut-off = 4), cocaine (cut-off = 3), and opiate (cutoff = 5) use (Steiner et al., 2008; Topp and Mattick, 1997; Kaye and Darke, 2002; Iraurgi Castillo et al., 2010). Next to determining the frequency of consumption, the five-item questionnaire includes the following questions: (1) Did you think your use was out of control? (2) Did the prospect of missing a dose make you anxious/worried? (3) Did you worry about your substance use? (4) Did you wish you could stop using? (5) How difficult would you find it to stop or go without the substance use? Items are scored on a 4-point scale; 0 = never/not difficult; 1 = sometimes/quite difficult; 2 = often/very difficult; 3 = always/impossible. Previous studies reported Cronbach's alpha between 0.8 and 0.9 (Gossop et al., 1995). In the current study Cronbach's alpha for Cannabis was 0.65 at baseline (t1) and 0.82 at follow-up (t2), for Cocaine Cronbach's alpha was 0.64 at baseline (t1) and 0.83 at follow-up (t2). We did not provide Cronbach's alphas for all other substances included in the SDS as reported prevalences were too low.

2.2.3. Substance use pathways

Four substance use pathways were defined based on the high-risk ratings of the AUDIT and SDS (above cut-off) at both baseline within residential care and follow-up in young adulthood – (1) the "low-risk" group never reported high-risk substance use for a single substance on both measures, (2) the "remitted" group only reported high-risk substance use at baseline, (3) the "newly developed" group only reported high-risk substance use at follow-up, and (4) the "persistent risk" group who reported high-risk substance use at both baseline and follow-up on any of the substances measured.

2.2.4. Adverse psychosocial functioning index

Several outcomes have been identified that affect functioning in most individuals across psychosocial domains over time. Outcomes were oriented following the functional outcomes as implemented in the Great Smoky Mountain Study (Copeland et al., 2015; Copeland et al., 2018) with adjustments to the Swiss context. Mental disorders were assessed with the Structured Clinical Interview for DSM-5 Disorders (SCID-5) and with the SCID-II for personality disorders (First, Gibbon, Spitzer, & Williams, 1997). Somatic complaints and suicide ideation were screened with the Massachusetts Youth Screening Instrument-V2 (MAYSI-2) (Grisso, Barnum, & Screening, 2000). Poor well-being was screened with the WHO5 (Topp, Østergaard, Søndergaard, & Bech, 2015). Felony charges and incarcerations were obtained from the Swiss Federal Office of Statistics (Data available until 01.01.2018). The remaining educational, financial, and placement history outcomes were assessed using a self-developed sociodemographic questionnaire. An individual was positive for an outcome if it was reported at follow-up (t2). For analyses a total score summing up all outcomes was created, next to the total count scores, items were investigated separately. Table 1 provides a full list of outcomes, their definitions and prevalences.

2.2.5. Childhood maltreatment

To assess childhood maltreatment, the Childhood Trauma Questionnaire-Short Form (CTQ-SF) was used as a retrospective self-report instrument (Bader, Hänny, Schäfer, Neuckel, & Kuhl, 2009).

Table 1
Definitions and prevalence of young adult outcomes at follow-up.

Domains	Definition	Prevalence
Health & Legal Outcomes		**%**
Multiple Mental Disorders	Meeting full criteria for 2 or more mental disorders or personality disorders assessed in clinical interviews (excl. substance use disorders).	29.1 %
Poor Wellbeing	Screening positive for Poor Wellbeing (WHO5).	45.3 %
Somatic Complaints	Screening positive for various bodily aches and pains (MAYSI-2).	40.8 %
Suicide Ideation	Screening positive for thoughts and intentions about self-harm including depressive symptoms that may present risk for suicide (MAYSI-2).	24.0 %
Criminal activity	Committing an offence or felony committed after the age of 18. Data derived from the official criminal conviction statistics of the Swiss Federal Statistical Office (SFSO).	33.5 %
Incarceration	Receiving a sentence of imprisonment after the age of 18 from the official criminal conviction statistics of the SFSO.	11.5 %
Education & Financial Outcomes		**%**
No higher education	Not completing any post-mandatory schooling.	31.1 %
Fired	Having been fired from a job at least once.	47.5 %
Long-term Unemployment	Having been unemployed for more than a year.	40.7 %
Current Unemployment	Currently being unemployed and not in school for further education.	37.3 %
Receiving Social Welfare	Currently receiving monthly payment from social welfare services.	28.3 %
Debt	Currently being in debt.	59.3 %

The CTQ and its short version CTQ-SF are one of the most widely used questionnaires internationally to assess experiences of abuse and neglect. Based on the German norm data, severity classifications can be formed ("none-minimal", "slight-moderate", "moderate-severe" to "severe-extreme") (Hauser, Schmutzer, Brahler, & Glaesmer, 2011). Within this study however, we used the CTQ total score as an overall index of the severity of maltreatment exposure before the age of 18.

2.2.6. Potentially traumatic events

The Life Events Checklist – revised (LEC-R) is a self-report measure designed to screen for potentially traumatic events (PTEs) in an individual's lifetime (Weathers, Litz, Keane, Palmieri, Marx, & Schnurr, 2013). The 17-item questionnaire addresses events known to potentially result in posttraumatic stress disorder or distress and includes one additional item assessing any other extraordinarily stressful event not mentioned. Items are scored on a 4-point scale: 0 = does not apply; 1 = I don't know; 2 = learned about it; 3 = witnessed it; 4 = happened to me. Items were dichotomized as present when life events were personally experienced or witnessed. A total score was then calculated for each participant for the total sum of their reported life events.

2.3. Statistical methods

To address our first research question, high-risk substance use and subsequent pathways were explored using descriptive statistics; mean level stability is reported. To address our second question, sociodemographic characteristics, characteristics of the placement history, and adverse exposures, as well as the prevalence of adverse psychosocial outcomes were presented descriptively with absolute and relative frequencies. Differences between substance use pathways in these characteristics were then analyzed using Chi-Square tests for categorical variables, Analysis of Variance (ANOVA) for continuous variables, and Kruskal-Wallis Tests as a nonparametric alternative if the assumptions for ANOVAs were not met. To address our third question, the association between substance use pathways and adverse psychosocial outcomes

was visualized using group-specific means with corresponding standard errors and modeled with a linear regression model for the adverse functional outcome score and with exploratory logistic regressions for specific outcomes controlling for gender and age.

A total of 182 study participants in the JAEL study were included in the present analyses. Of all these participants, both screenings on substance abuse at the time within the care system (t1) and in young adulthood (t2) were available. A proportion of 13.2 % of all participants had missing values in one or more of the variables used within the index score for adverse psychosocial outcomes. 158 participants had complete data in all variables relevant to the analyses. Study participants (N = 182) did not differ substantially from non-included MAZ.-participants (N = 410), nor did participants with complete data (N = 158) differ substantially from participants with incomplete data (N = 24). For a detailed overview and analyses, a flow chart of participants and analyses regarding patterns of non-response/missingness are found in the supplementary material (Supplementary Fig. 1 and Table 1 and 2). Regression models and inferential statistical analyses were therefore based on complete data for each model with a sample size between 158 and 182, excluding all participants with partially missing values, exact sample size for each model is indicated. All p-values were two-sided tested and p-values < 0.05 were marked as statistically significant.

3. Results

3.1. Stability of high-risk substance use and substance use pathways

Overall, 41.2 % of participants reported some type of alcohol and/or illegal high-risk substance use during their time within the child welfare system and 46.2 % in young adulthood after leaving the care system (see Table 2). Of those who reported earlier substance misuse (at t1; N = 75), 61.3 % (N = 46) reported persistent high-risk use into young adulthood. Persistency seems to be most common for high-risk alcohol consumption (45.2 %), whereas cocaine tends to be misused more in young adulthood than in adolescence (see Table 2). Based on screenings for high-risk substance use at both time points, four different pathways were identified: those with low risk, with remitted risk, with newly developed risk, and with persistent high-risk substance use. Overall, the low-risk group was most common, followed by the persistent, the newly developed and the remitted risk groups (see Table 1).

Table 2
Stability of High-Risk Substance Use (N = 182).

	Low-Risk	Remitted	Newly-Dev.	Persistent	Percentage Persistent
Any Substance	69 (37.9 %)	29 (15.9 %)	38 (20.9 %)	46 (25.3 %)	46/75 = 61.3 %
Alcohol	105 (57.7 %)	23 (12.6 %)	35 (19.2 %)	19 (10.4 %)	19/42 = 45.2 %
Cannabis	111 (61 %)	35 (19.2 %)	25 (13.7 %)	11 (6 %)	11/46 = 23.9 %
Cocaine	143 (78.6 %)	12 (6.6 %)	21 (11.5 %)	6 (3.3 %)	6/18 = 33.3 %
Opioids	178 (97.8 %)	1 (0.5 %)	2 (1.1 %)	1 (0.5 %)	–
Amphetamines	170 (93.3 %)	8 (4.4 %)	4 (2.2 %)	0 (0 %)	–

Note. High-risk substance use was defined as scoring above the cut-off on the A.U.D.I.T. for alcohol use and the SDS for all other substances. Scoring above the cut-off indicates a troubling consumption pattern indicating a high risk for substance use disorders.

3.2. Sociodemographic differences between substance use pathways

First, regarding sociodemographic characteristics, participants that reported high-risk substance use while living in out-of-home care (i.e., remitted, or persistent high-risk users) were significantly older and more often placed due to criminal law reasons compared to adult high-risk users. However, no significant differences regarding the gender distribution between pathways were found. Second, focusing on placement characteristics, participants in the persistent high-risk group were significantly older at first placement than those with no substance use risk while living in youth residential care (i.e., low-risk and newly developed high-risk users). Participants from all at-risk groups (i.e., remitted, newly developed, and persistent substance use) reported more prematurely interrupted placements compared to participants from the low-risk group. Overall, there were no significant group differences in mean age at termination of the last placement, however, participants from the persistent group were significantly older than participants from the low-risk group. Last, looking at adverse exposures, substance use pathways did not differ regarding participants' exposure to childhood maltreatment. However, significant differences regarding self-reported lifetime PTEs were found, due to the cumulation of exposures in the persistent risk users' group. Differences between substance use pathways are displayed in Table 3.

3.3. Substance use pathways and overall adverse functional outcomes

Overall participants reported on average 4.13 (SD = 2.56) adverse functional outcomes. The mean of adverse functional outcomes per substance use course is displayed in Fig. 1. In a linear regression model (N = 158) those with persistent substance use were found to report significantly more adverse functional outcomes compared to those in the low-risk group ($\beta = 0.44$, 95 % CI [0.05, 0.82], $t(171) = 2.21$, $p < .05$) controlling for age and gender. The remitted and newly developed pathways did not differ significantly from the low-risk group.

3.4. Exploratory analyses: substance use pathways and specific functional outcomes

In logistic regression models predicting the specific adverse functional outcomes (see Figs. 2-3), we found that compared to the low-risk group, participants from the remitted risk group still showed largely increased odds for criminal offences and incarceration after the age of 18. They also showed higher odds for having no post-mandatory education and for having been fired. However, they showed lower odds for poor well-being and for being currently unemployed. Participants from the newly developed risk group also showed higher odds for criminal offences and incarceration compared to participants from the low-risk group, but did not differ from the low-risk group in the other outcome measures. Participants from the persistent risk group showed a higher risk for multiple mental disorders, as well as for criminal offences and for being currently in debt compared to participants from the low-risk group. We did not find any differences between substance use pathways regarding long-term unemployment, receiving social welfare support, somatic complaints, and suicidal ideation between groups. Regression models are displayed in Figs. 2-3, full model descriptions of these exploratory analyses are found within the supplementary material Table S3-S4.

4. Discussion

To the best of our knowledge, our longitudinal study is the first investigating the relationship between pathways of high-risk substance use within youth residential care and young adult psychosocial functioning among care leavers. High-risk substance use, within and after youth residential care, were common among our study sample. In line with previous studies, 41.2 % of participants reported high-risk

Table 3
Differences between Risk Substance Use Pathways.

	Total (N = 182)	Low-Risk (N = 69,37.9 %)	Remitted (N = 29,15.9 %)	Newly-dev. (N = 38,20.9 %)	Persistent (N = 46,25.3 %)	Test-Statistic	Significance level
	N (%)	**N (%)**	**N (%)**	**N (%)**	**N (%)**		
Gender						χ^2 = 4.661; df = 3	p =.198
Men	123 (67.6 %)	44 (35.8 %)	16 (13 %)	28 (22.8 %)	35(28.5 %)		
Women	59 (32.3 %)	25 (42.4 %)	13 (22 %)	10 (16.9 %)	11(18.6 %)		
Reason for placement (t1)						χ^2 = 31.05; df = 6	**p <.001**
Civil law	83 (46.2 %)	32 (38.6 %)	11 (13.3 %)	21 (25.3 %)	19 (22.9 %)		
Criminal law	52 (28.9 %)	10 (19.2 %)	13 (25 %)	6 (11.5 %)	23 (44.2 %)		
Other	45 (25.1 %)	27 (60 %)	5 (11.1 %)	10 (22.2 %)	3 (6.7 %)		
	M (SD)	**M (SD)**	**M (SD)**	**M (SD)**	**M (SD)**		
Age (at t2)	26.22 (3.02)	25.43 (2.7)	27.52 (2.96)	25.13 (2.37)	27.48 (3.3)	F(3,178) = 8.61	**p <.001**
Age at first placement	11.82 (4.68)	11.41 (5)	11.93 (4.51)	10.86 (4.67)	13.18 (4.09)	KW χ^2(3) = 8.00	**p =.046**
Nr. of total placements	3.65 (3.24)	3.21 (3.43)	3.64 (2.71)	4.08 (3.52)	3.98 (2.99)	KW χ^2(3) = 5.16	p =.161
Nr. early plac. breakdowns	0.7 (1.52)	0.28 (0.67)	0.75 (1.35)	1.19 (2.33)	0.91 (1.61)	KW χ^2(3) = 9.11	**p =.028**
Age at leaving care	18.85 (3.1)	18.46 (2.98)	19.25 (3.38)	18.36 (2.49)	19.63 (3.45)	KW χ^2(3) = 4.94	p =.176
CM (CTQ, t2)	51.63 (15.87)	50.13 (16.04)	52.14 (15.57)	52.87 (17.96)	52.54 (14.24)	KW χ^2(3) = 1.25	p =.741
PTEs (LEC-R, t2)	4.55 (3.13)	3.69 (2.96)	4.59 (2.88)	4.63 (3.11)	5.72 (3.23)	KW χ^2(3) = 11.81	**p =.008**

Notes. High-risk substance use was defined as scoring above the cut-off on the A.U.D.I.T. for alcohol use and the SDS for all other substances. Scoring above the cut-off indicates a troubling consumption pattern indicating a high risk for substance use disorders. N = number of participants; CM = childhood maltreatment; CTQ = Childhood Trauma Questionnaire, PTEs = potentially traumatic events; LEC-R = Life-events Checklist – revised; KW = Kruskal Wallis.

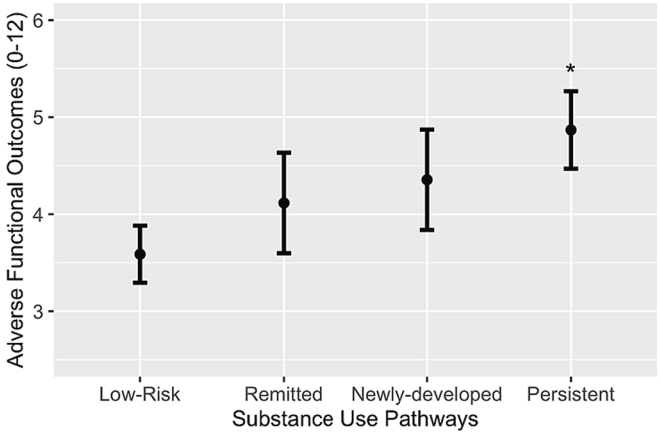

Fig. 1. Adverse functional outcomes by substance use pathways. Error bars indicate +/- one standard error (SE). The reference group for significance tests is the low-risk group * p <.05.

adolescent substance use at a mean of 16 years of age (Aarons et al., 2008; Courtney and Dworsky, 2006; Fettes et al., 2013; Pilowsky and Wu, 2006; Traube et al., 2012; Vaughn et al., 2007; Wall and Kohl, 2007). A concerning two-thirds of high-risk adolescent users reported persistent use at follow-up, with persistence in high-risk substance use being most common for alcohol. These prevalences suggest that high-risk substance use is hard to overcome for most care leavers and that the risk of persistent substance use into adulthood remains high in this at-risk population, with high persistency often also found in studies of the general population (Merrin et al., 2018; Davis et al., 2021). Of note, both rates of high-risk substance use within youth residential care and after leaving the care system in young adulthood are considerably higher than rates found in Swiss population-based and community samples (Jordan et al., 2018; Studer et al., 2017; Gmel et al., 2016).

Some adolescent and adult psychosocial factors differed between substance use pathways. Care leavers using substances while in residential care were generally older at that time and were more often placed out-of-home based on criminal law jurisdiction compared to those with no high-risk consume. Increased rates of high-risk substance use in those placed on criminal law bases might be due to their older age, due to substance-specific criminality (e.g., illegal substance use, dealing), or underlining behavioural traits being linked to bothsubstance-use and co-occurring deliquency. Care leavers across substance use pathways did not differ in their overall number of placements, however, those with high-risk substance use (either remitted, newly developed, or persistent) were more likely to experience prematurely terminated placements. Besides, those with persistent high-risk substance use were older when first placed and they cumulated more lifetime traumatic exposures. Problematic substance use has consistently been associated with older age of juveniles, delinquency, and trauma (Aarons et al., 2008; Kepper et al., 2011; Mason et al., 2013; Rogers et al., 2021; Schauss et al., 2020). Interestingly, and contrary to our expectation, we did not find differences regarding childhood maltreatment between substance use pathways, which might be due to the overall high burden of maltreatment among care leavers. However, it might also be indicative that young people with persistent high-risk substance use accumulate more potentially traumatic exposures due to their substance use along the life-course (e.g., accidents). These findings are consistent with the diathesis-stress model, showing both trait-like and environmental factors being associated with high-risk substance use. When taking the still primarily sanction-oriented substance use interventions of the care system into account, it seems congruent that (persistent) high-risk users experienced the most frequent placement interruptions. More frequent placement changes, particularly unexpected terminations of placements, are however unfortunate, since placement instability exacerbates inadequate coping, psychopathology, and substance use, as well as school discontinuity in a vicious cycle (Kind et al., 2020; Lee et al., 2010; Rock et al., 2015; van Rooij et al., 2015; Schulenberg et al., 2003; Wells et al., 2004).

Consistent with decades of research, overall high-risk substance users were more likely to report impaired adult functioning than low-risk users (Jennison, 2004; Fergusson and Boden, 2008; Schulenberg et al., 2003; Rohde et al., 2007; Newcomb et al., 2001; Wells et al., 2004; Dishion and Owen, 2009; Newcomb and Bentler, 1988; Kellogg et al., 1999; Leigh and Stall, 1993; Riehman et al., 2006; Tapert et al., 2001; Zullig et al., 2001; Spooner, 1999). Persistent high-risk users reported the highest sum of impairments across health, legal, educational, and

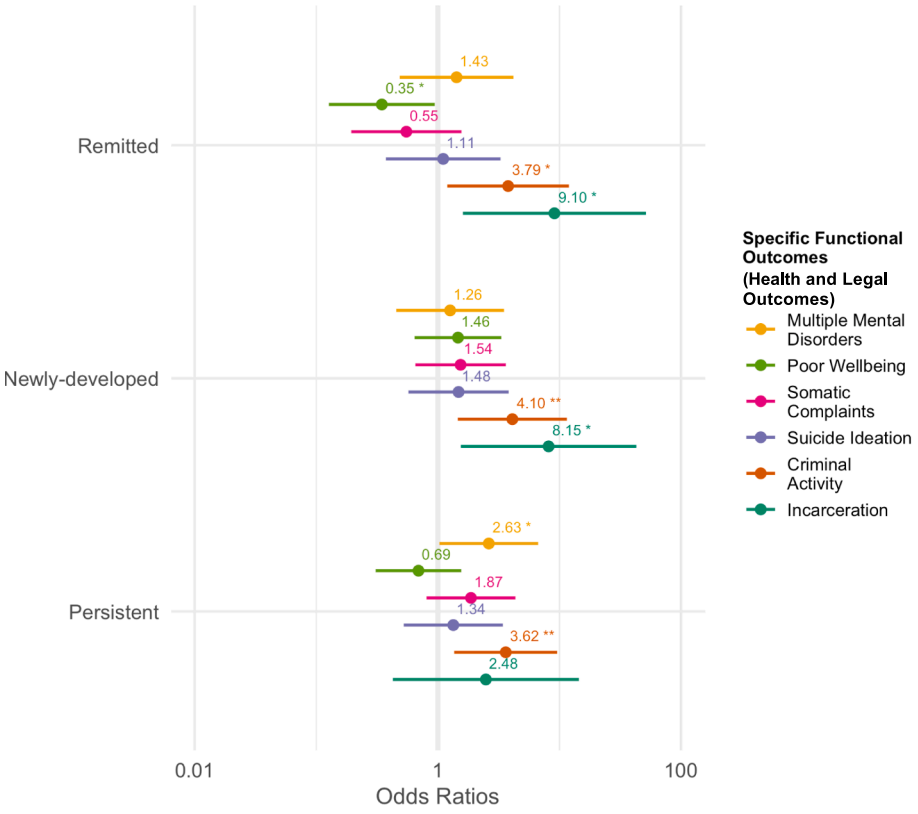

Fig. 2. Exploratory Logistic Regression Models predicting the specific functional outcomes (health and legal) by substance use pathway groups controlled for age and gender. The reference group is the low-risk group. Regression models underlying the figure are to be found within the supplementary material. Error bars indicated the 95 %-Confidence Interval. Significance levels are indicated at: * p <.05, ** p <.01, *** p <.001.

financial domains. These overall impairments may in part derive from motivational and cognitive impairments after long-term consumption (Cohen and Weinstein, 2018; Colizzi et al., 2020; Spear, 2018). However, important to acknowledge is the observation that only the persistent risk group differed significantly from the low-risk group in their overall adverse functional outcomes and that the observed medium effect size (between persistent and low-risk) seems smaller than one might anticipate. The sample size of the two other risk groups (remitted and newly developed) is rather small, which might contribute to a lack of distinction found. The lack of discrepancy of some findings might also be explained by a 'ceiling' effect resulting from the overall vulnerability of care leavers as a more burdened population (Burns et al., 2004; Dölitzsch et al., 2014; Kisiel et al., 2014; Teicher and Samson, 2016). Contrary to studies in the general population, there might be no unburdened 'low-risk' control group within this high-risk population – only a 'different-risk' group or a different risk profile. If care leavers already find themselves on the upper end of the vulnerability spectrum, they may achieve lower adult functioning with or without adolescent substance use.

Following this line of thinking, one might argue that contrary to previous studies, young adult functioning of nowadays remitted high-risk substance users might be more comparable to low-risk users as to persistent high-risk users (Fergusson and Boden, 2008; Rohde et al., 2007; Wells et al., 2004; Newcomb and Bentler, 1988). Acknowledging all other potential risk factors, those with earlier substance abuse were at greater risk for lacking higher education later on (e.g., no high school or vocational diploma), and at higher risk to be fired from a job compared to low-risk users. Additionally, it must be considered that the social and financial consequences of lacking any higher education may be more long-term, widening the rift later in life. However, despite their risk for lacking higher education, those that remitted from their consumption patterns have even lower odds to be currently unemployed and to have poor wellbeing compared to the low-risk group. And contrary to those with persistent high-risk use, they have no increased risk to be currently in debt. Thus, setting a more unyielding focus on adequate support for schooling and vocational perspectives in out-of-home care for adolescents with high-risk substance use may be highly relevant for later life trajectories. Working with youth school psychological and child and adolescent psychiatric services to assess cognitive potential may provide additional orientation. Switzerland has a very flexible and accommodating higher education system, which is unfortunately however, quite untransparent, constantly changing, and inconsistent between the cantons ('states'). Navigating the system to find solutions for schooling gaps demands early planning, investment of time and thinking ahead by professional caregivers. The ability to act is often limited when youths turn 18 years of age and must leave their care and often the child welfare system (often the case for civil law placements) and cases are transferred into new departments and case coordinators and the adult social care systems. In respect to these considerations and later-life functioning, frequent placement changes and resigned attitudes in the care system may be truly damaging for adolescents with high-risk substance use.

The presented research has certain limitations. First, the sample sizes for the four substance-use pathways were relatively small and the age range of participants rather broad, therefore associations with specific outcomes are exploratory in nature and generalization should be made with caution and considering the heterogenous sample and the Swiss-specific system. Nevertheless, study samples of care leavers of any size, let alone spanning 10 years longitudinally, are globally rare, and still completely lacking in Swiss and German out-of-home care literature. Second, since reports of life events, maltreatment, substance use, and adult functioning were based primarily on primarily self-reports, social desirability and recall bias cannot be ruled out in regard to these measures. Third, due to the longitudinal nature and time-

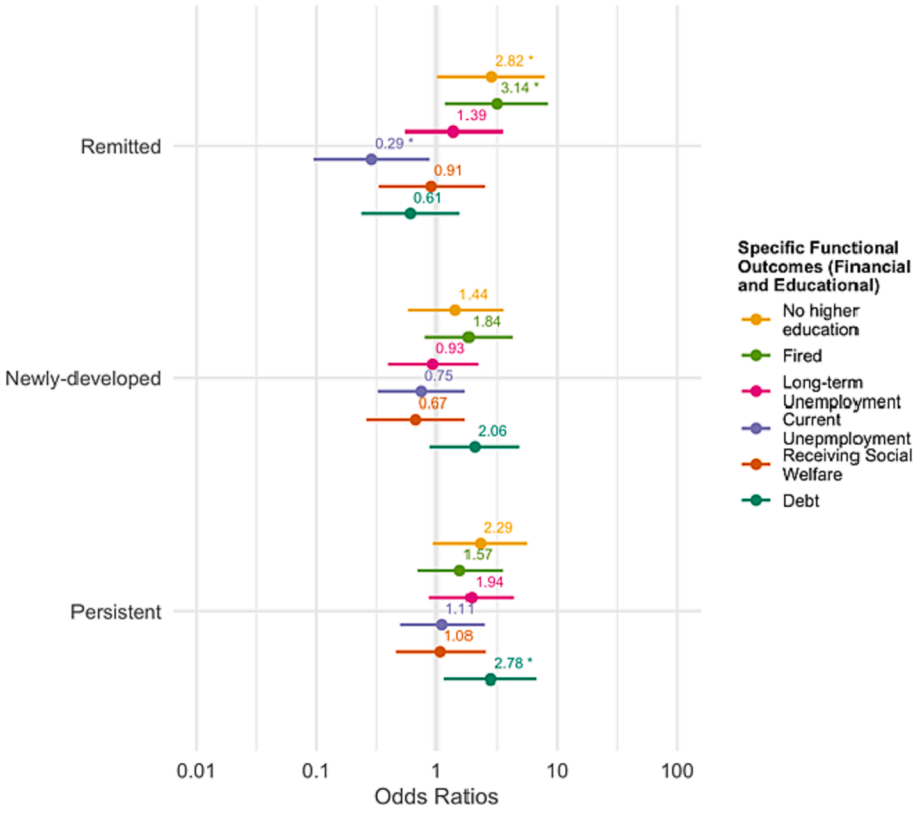

Fig. 3. Exploratory Logistic Regression Models predicting the specific functional outcomes (educational and financial) by substance use pathway groups controlled for age and gender. The reference group is the low-risk group. Regression models underlying the figure are to be found within the supplementary material. Error bars indicated the 95 %-Confidence Interval. Significance levels are indicated at: * p <.05, ** p <.01, *** p <.001.

censoring of our data and unmeasured factors, we cannot confidently answer questions of directionality of effects and causality. As such with all longitudinal studies, with outcomes measured at follow-up, one main issue of predictive modeling lies in the uncertainty of what came first, the outcome or the predictor. This means that some youths were likely to have psychosocial impairments prior to baseline assessments, but it might also be the case that the reason for placement can both be related to prior substance use or interfere with later substance use. Fourth, despite having no systematic differences between complete cases and longitudinal drop-outs at baseline (see Supplementary Table 1 and 2), one unresolvable problem is that we were unable to compare these two to the outcomes assessed at follow-up. Therefore, we are not able to entirely rule out selection biases. Additionally, our sample is rather heterogenous and includes young people placed in residential care due to different jurisdictions (due to civil and criminal law and due to other reasons). While our models investigating associations between substance use pathways and functional outcomes were controlled for age and gender, we did not control for jurisdiction of placements nor were we able to test the stability of high-risk substance use stratified by jurisdiction due to limited sample size. Last, all study participants were within the Swiss residential child welfare and juvenile justice system and direct comparisons to other out-of-home placed populations (e.g., foster or kinship care) and different international care systems should be made with caution and according to the outlined specifics of the Swiss system and the heterogenous sample apparent.

5. Implications

The current findings highlight risks coinciding with problematic and consistent substance use during and after youth residential care, but also suggest that it pays off if young people manage to reduce their substance use to a low-risk level by the time they leave care. Since early-onset substance use is common in out-of-home care, the time for drug prevention strategies is often gone when adolescents enter a placement (Aarons et al., 2008; Fettes et al., 2013; Vaughn et al., 2007; Backović et al., 2006). Intervention research is needed in out-of-home care to test the effectiveness of emerging drug programs that are relatable and meaningful to young people, aimed at harm-reducing consumption rather than abstinence – moving past outdated and oversimplified sanctioning approaches [for review see Logan and Marlatt (2010)]. Harm-reduction may not avoid all negative consequences associated with substance use, the approach however meets vulnerable young people at the current stage of their life amidst their struggles and, thus, might be better suited to improve their motivation and thus their ability for change. Further intervention approaches may include peer-to-peer interventions, but might also include the incorporation of app-based and mobile implementations of programs (Dunne et al., 2017; Jenkins et al., 2017). Furthermore, research targeting the causes of high-risk substance use (e.g., self-medication due to emotion-regulation difficulties or mental health problems) and the social contexts of consumption (e.g., peer effects within residential care) need to be addressed. Both developing and testing peer-interventions and conducting research targeted towards the social context of substance use within residential care are important from a social-learning theoretical perspective, as peer-context can potentiate but also protect from aversive substance use. What remains yet to be explored are potential dynamic and multileveled resources and resilience factors, as well as the interplay of risk and resilience factors that contribute to adolescent high-risk users reducing their substance use into adulthood (Ungar and Theron, 2020; Panter-Brick and Leckman, 2013; Masten et al., 2021).

6. Conclusion

The findings of this study shed light on the concerning prevalence of

earlier and persistent high-risk substance use among care leavers. Persistent, but particularly also non-persistent high-risk substance use coincide with impaired psychosocial functioning during and after the transition to adulthood, making it even more pressing to instigate adequate harm-reducing interventions while adolescents are still in-reach within the child welfare system. One in three adolescent high-risk users found their way out of earlier high-risk substance use. Professional caregivers should stay mindful and self-reflected about their own potentially prematurely resigned attitudes towards difficult adolescents with high-risk substance use to adequately gage cognitive potential, provide stability, foster motivation, and support adolescents' educational and vocational paths.

7. Ethical approval and consent to participate

The MAZ study was reviewed and approved by the Ethics Committees for Research on Humans in the Cantons of Basel and Vaud (Switzerland), and by the Institutional Review Board at Ulm University (Germany). The JAEL study was reviewed and approved by the responsible ethics committee ("Ethics Commission Northwestern Switzerland"; Ref.-No.: 2017-00718).

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Declaration of Competing Interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

Data availability

Data will be made available on request.

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Appendix A. Supplementary material

Supplementary data to this article can be found online at https://doi.org/10.1016/j.childyouth.2023.107290.

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