Treated Together: Spillovers Among Youths Admitted to Residential Treatment

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Abstract

Individuals struggling with substance abuse and self-harm are often treated in group-based programs. However, concerns have been raised about the risk of adverse outcomes through peer-to-peer spillovers. This paper analyses the effects of peers placed in residential treatment facilities on each other's outcomes. I use novel data on the universe of youths (over 16,000) admitted to state-owned treatment facilities in Sweden between 2000 and 2020. To overcome the issue of nonrandom assignment of youths, I use an IV design and exploit the natural flow of youths to and from facilities within a given year. I find strong evidence of reinforcing peer effects in substance abuse and self-harm: exposing youths with a history of substance abuse (self-harm) to peers with a similar background greatly increases the risk of hospitalization due to substance abuse (self-harm) post-discharge. Social influence is a likely mediator. Moreover, increased exposure to peer substance abuse has a significant negative impact on youths' educational attainment, partly through the effect on own substance abuse.

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1 Introduction

Youth suicide rates and, especially, drug overdose rates have risen dramatically during recent decades in many Western countries. In the US, the rate of drug overdose among youths (ages 15-25) has more than quintupled since 2001, while the rate of suicide has increased by 46%, resulting in 8,000 unintentional overdoses and 7,000 suicides in 2020 (CDC, 2023). Major predictors of overdose and suicide are nonlethal substance abuse and self-harm (Hawton et al., 2003; Degenhardt and Hall, 2012).[1] People struggling with substance abuse and self-harm are often treated in group-based programs. However, the cost-effectiveness, efficacy, and safety of group programs have been questioned (Beetham et al., 2020; Wakeman et al., 2020). In particular, exposure to individuals who engage in the same type of behavior may have detrimental effects on the recovery process (Taiminen et al., 1998; Richardson et al., 2012). But, due to the challenges with estimating peer effects, little is known about the presence and character of such effects.

In this paper, I exploit novel Swedish data on youths (under age 21) placed together in residential treatment facilities to estimate the effects of exposure to peers with a history of severe substance abuse and self-harm on the risk of hospitalization due to substance abuse and self-harm post-placement. In particular, this paper is focused on peer behaviors that are serious enough to warrant institutionalization, hospitalization, or prosecution. To further deepen our understanding of the effects of exposing youths to substance-abusing and self-harming peers, I also estimate the effects on educational attainment.

Estimating peer effects is empirically difficult (Manski, 1993; Angrist, 2014). In most natural settings, individuals select into peer groups. If similar individuals tend to interact with one another, allowing for self-selection inflates estimated peer effects. In addition, the environments in which peer groups operate might vary across groups, thereby creating within-group correlation in unobservables. It is especially challenging to identify the effect of peer behavior when individual and peer behavior are measured simultaneously (known as the reflection problem).

With these challenges in mind, the setting considered in this paper lends itself well to the study of peer effects. Specifically, I use data on the universe of individuals admitted to residential youth facilities managed by the Swedish National Board of Institutional Care (NBIC). These youths are placed in the care of NBIC because they engage in substance abuse or some other destructive behavior that threatens their health or development. Using register data on the reason for placement as well as universal hospital and crime data, I can measure youth characteristics *before* social interaction commences, thereby avoiding the infamous reflection problem.[2]

[1] I use the term substance abuse to refer to patterns of substance use (alcohol, drugs, and other addictive substances) that pose a significant risk to an individual's health or development. I use the term self-harm to refer to self-inflicted poisonings and injuries, regardless of suicidal intent.

[2] The focus of this paper is on so-called exogenous (contextual) peer effects, i.e., the effect of pre-determined peer

Assignment of youths to facilities is done by a central placement unit based on the availability of beds and observable characteristics. These facilities are miles apart, meaning that across-facility contact is limited. Within facilities, youths spend large amounts of time together, partly because they are not free to leave the premises. A key empirical challenge is within-group correlation in unobservables stemming from systematic differences across NBIC facilities and over time. To this end, I apply the identification strategy used originally in Bayer et al. (2009) and replicated by Stevenson (2017) and Damm and Gorinas (2020), which relies on the natural variation in the peer group generated by the continuous entry and exit of individuals from the group. Specifically, I use fixed effects (FEs) to exploit variation in peer composition within facility-by-year cells.

Another important challenge is that total peer exposure is a function of placement length and future peer composition, which can depend on unobservable characteristics of the youth. To avoid this issue, I exploit variation in the share of peers with a particular history on the youth's *first* day at NBIC as an instrument for total peer exposure in an IV design. In my main specification, I define total peer exposure as the sum of daily peer exposure over the entire first placement spell, where peer exposure on day d is defined as the share of other youths with a pre-placement history of behavior h (e.g., substance abuse) on day d. A placement spell is an uninterrupted placement at NBIC but can include periods of isolation, absconding, and facility transfers.

Guided by previous research showing reinforcing peer effects in crime and substance use (Kremer and Levy, 2008; Bayer et al., 2009), I estimate separate effects for youths with versus without a history of the behavior of interest. There are several reasons to expect that peer effects differ in magnitude depending on the youths' own history. For example, there is variation in individuals' predisposition to different types of behaviors and susceptibility to peer influence in that behavior. Specific genes, underlying disorders, and personality traits can be important risk factors for developing one particular behavior but not another (Brown, 2002; Laukkanen et al., 2009; Allen et al., 2012; Hilt and Hamm, 2014). At the same time, youths placed at NBIC are on average 16 years old at the time of first placement and have typically already been heavily exposed to peers who engage in a host of problematic behaviors via pre-placement networks. It is possible that youths who have not yet started to engage in behavior h before institutionalization are not predisposed to behavior h and not susceptible to peer influence in that regard.

The considered setting has two key features that enable me to use first-day peer exposure by own history as instruments for total peer exposure by own history. First, there is considerable variation in each instrument within facility-by-year cells, and the instruments are highly predictive of the treatment variables. Second, I empirically show that the variation in first-day peer

characteristics, which are distinct from endogenous social effects (Manski, 1993). For identification of endogenous social effects, i.e., the effect of simultaneous peer behavior, see, e.g., Lee (2007), Bramoullé et al. (2009), and Blume et al. (2015). Focusing solely on the effect of pre-determined peer characteristics is common in empirical work (e.g., Feld and Zölitz, 2017; Golsteyn et al., 2020).

exposure is plausibly exogenous after netting out facility-by-year FEs.

There is ample correlational evidence that exposure to substance abuse and self-harm (via peers, family members, and the media) are important predictors of own substance abuse and self-harm, respectively (Hawton et al., 2012; Costello et al., 2021). In particular, studies in psychology and sociology document that segregation of youths who engage in problematic behaviors in special education, community, and treatment programs appears to exacerbate problematic behavior (Dishion and Tipsord, 2011).

There are several reasons to expect that peer substance abuse and self-harm impact own behavior. These reasons can be grouped into four broad categories: (i) social influence, (ii) social learning, (iii) spread of mental illness, and (iv) treatment provision, where the former two are social effects and the latter are indirect effects of peer characteristics. To design interventions aimed at reducing the harmful effects of exposure to peer substance abuse and self-harm, distinguishing between these mechanisms is essential. Below, I elaborate on each type of mechanism.

First, if peers with a history of substance abuse and self-harm are more likely to engage in these activities at NBIC than other peers, an increase in exposure to such incidents during placement can impact own risk of substance abuse and self-harm through, for example, triggering of craving or emotional distress (Walton et al., 1995). In addition, youths who identify with peers who engage in these behaviors may imitate the behavior and increase the intensity of own behavior to match their peers, which can be a form of socialization and create a sense of closeness and community (Taiminen et al., 1998). Due to the addictive nature of both behaviors (Davis and Lewis, 2019), such an increase in intensity can impact the risk of experiencing adverse outcomes even after placement.

Second, social learning can be an important channel (Bayer et al., 2009). For example, youths might learn from each other about more potent drug combinations and effective ways to self-harm. Youths may also learn about the adverse consequences of these behaviors by observing and interacting with more senior peers, which could have a deterring effect. In addition, youths who are further along in their recovery process may share helpful insights with newcomers.

Third, a positive relationship between peer substance abuse (self-harm) and own substance abuse (self-harm) may reflect peer effects in other mental disorders such as depression. In particular, increased exposure to substance-abusing and self-harming peers may also imply increased exposure to peers who suffer from depression since depression is a predictor of self-harm and substance abuse (Beautrais, 2000; Bostwick et al., 2016). In turn, it has been suggested that depression is 'contagious', i.e., being exposed to depressed peers may increase the risk of developing depression (e.g., Giulietti et al., 2022).

Fourth, peer composition may impact post-placement outcomes by affecting treatment provision. For example, if a peer group is functioning poorly (e.g., frequent overdoses and self-harming

incidents), some youths may need to be moved. Such a move naturally creates a discontinuity in treatment, which can adversely affect the youth's recovery process. Moreover, a youth who goes through withdrawal or self-harms frequently requires close supervision, which could affect how much time staff can allocate to other youths. Substance-abusing peers may also affect the quality of the provided care by smuggling in greater quantities of addictive substances to the facility.

I find strong evidence of peer effects in substance abuse and self-harm among youths with a prior history of the *same* behavior. Specifically, a 1-standard-deviation higher exposure to peers with a history of substance abuse increases the risk of hospitalization due to substance abuse within one year of discharge from the treatment facility by 17.9 percentage points (82.7% relative to the complier mean) for youths with a history of substance abuse. Similarly, a 1-standard-deviation higher exposure to peers with a history of self-harm increases the risk of being hospitalized for self-harm by 12.1 percentage points (41.1% relative to the complier mean) for youths with a history of self-harm.[3]

Among youths with no history of substance abuse or self-harm, there is little evidence of significant peer effects. However, the outcomes I consider are severe. If there are introductory peer effects, it might take several years before the behavior has progressed to the point where I can observe an effect on hospitalization.

I present evidence suggesting that social influence is a key channel. In particular, there is evidence of adverse peer effects already during placement and considerable clustering in incidents. Among youths who are hospitalized for self-harm or substance abuse during placement at NBIC, 1 in 5 are hospitalized in the same month as their peer is hospitalized for the *same* reason. Moreover, the reinforcing peer effects increase with connectivity. In fact, the effects are entirely driven by peers of the same sex. I find little evidence in support of the other three groups of mechanisms.

Given the large peer effects in substance abuse and self-harm, a natural follow-up question is how exposure to these peers affects educational attainment. I show that a 1-standard-deviation increase in exposure to peers with a history of substance abuse decreases the likelihood of attaining sufficient grades to be eligible for high school by age 21 by 19.2 percentage points among youths with a history of substance abuse. I provide evidence that peer influence on one's own substance abuse is a key mechanism driving its effect on educational attainment.

The bulk of studies that credibly identify the effects of peer substance use consider self-reported drinking, smoking, and marijuana use among students (e.g., Sacerdote, 2001; Duncan et al., 2005; Kremer and Levy, 2008; Card and Giuliano, 2013). Only three papers include heavy

[3]As a complement, estimated peer effects in crime, depression, neurodevelopmental disorders, and other mental disorders are presented. However, the original aim of the paper was to shed light on peer effects in substance abuse and self-harm because (i) there is a gap in the literature, and (ii) there are convincing theoretical arguments in favor of the existence of peer effects in substance abuse and self-harm.

drugs (Gaviria and Raphael, 2001; Lundborg, 2006; Eisenberg et al., 2014), again using surveys in which students are asked whether they have ever used different substances. Most of these studies tend to find some evidence of peer effects.

This paper adds to the literature by directly measuring peer effects in substance *abuse*, i.e., usage that significantly harms the individual's health or development (e.g., alcoholism). Even if there are peer effects in, for example, occasional binge drinking with friends, it is not evident that there are meaningful peer effects in alcoholism, as the underlying mechanisms and importance of biological, environmental, and psychological risk factors are likely different (Tarter and Vanyukov, 2001). At the same time, the welfare consequences of peer effects in substance abuse are likely larger than for substance use. Moreover, even if a peer effect in alcoholism exists among friends, it might not exist in treatment programs where staff can interrupt harmful peer interactions. Knowledge about peer-to-peer spillovers in treatment programs is particularly policy-relevant because it can inform more effective designs.

Lim et al. (2019) estimate that one in five children and adolescents deliberately injure their bodies every year. Despite this stark statistic, there is little causal evidence on peer effects in self-harm. One study uses survey data from college students to estimate peer effects in suicidal ideation and non-suicidal self-injury, but does not find evidence of such peer effects (Eisenberg et al., 2014). However, a key difference is the severity of the self-harm studied. I focus on self-harm that results in hospitalization. In contrast, Eisenberg et al. (2014) classify, for example, having punched oneself as self-harm. The visibility of peer self-harm and the role of peer influence can be vastly different depending on the severity of the self-inflicted harm.[4]

By using plausibly exogenous variation to study reinforcing and introductory peer effects in self-harm and substance abuse, I also add to the growing economic literature on the determinants of self-harm, substance abuse, and mental illness in general (e.g., Persson and Rossin-Slater, 2018; Powell et al., 2018; Adhvaryu et al., 2019; Ruhm, 2019; Baranov et al., 2020; Alpert et al., 2022).

Furthermore, I add to the literature on peer effects in education (see Sacerdote, 2011, 2014, for overviews). As Feld and Zölitz (2017) and Isphording and Zölitz (2022) note, more research is needed to understand which peer characteristics impact student performance, the size of these peer effects, and the underlying channels. By exploring how and why peer substance abuse and self-harm affect educational attainment, I contribute to this important literature.

Last, I extend the knowledge on peer effects inside residential youth facilities.[5] This popu-

[4] A related literature is the small line of work on plausibly exogenous peer effects in mental well-being. In line with the literature on peer effects in substance use, these studies are typically conducted in school environments using survey data (Aizer, 2009; Golberstein et al., 2016; Zhang, 2019; Giulietti et al., 2022; Kiessling and Norris, 2023). The studies that focus on student-to-student spread of mental well-being tend to find no or modest increasing effects, while those that examine the effects of other peer features (such as ability ranking) find larger effects.

[5] Peer effects in residential facilities may be very different from those in school environments. Prior correlational evidence suggests that social effects in mental health predominantly exist in close relationships and relationships

lation fares disproportionately worse than youths living in family-type homes (Li et al., 2019; Gutterswijk et al., 2020) and are at a high risk of future involvement in socially destructive behaviors, such as crime and substance abuse (Shook et al., 2011; Aizer and Doyle, 2015; Eren and Mocan, 2021). Even though at least 6 million children and youths are placed in residential facilities without parental care each year in the name of child welfare and justice (United Nations, 2020), few papers are able to examine peer effects using credible designs in such settings. Three exceptions are Bayer et al. (2009), Stevenson (2017), and Font and Mills (2022), all of which mainly focus on peer effects in crime. Both Bayer et al. (2009) and Stevenson (2017) provide evidence of peer effects in crime when studying juvenile correctional facilities in the US.[6] In contrast, Font and Mills (2022) do not find that exposure to peers with a higher risk of future imprisonment increases own risk of criminal behavior among foster children in the US. By studying novel outcomes (substance abuse and self-harm) and a different setting (treatment facilities in Europe), I add to this small line of work.[7]

2 Institutional Background

2.1 Institutional Care in Sweden

Each year, NBIC houses youths aged below 21 in about 20 residential treatment facilities spread across Sweden.[8] Figure 1 provides a representation of the three possible routes to institutionalization. In 95% of cases, the route to institutionalization starts with the school, police, or another concerned party reporting the youth's substance abuse, criminal behavior, or other destructive behavior (e.g., prostitution) to the local Social Welfare Committee (SWC; *socialnämnden*). Fol-

outside the school environment (Zalk et al., 2010; Fruehwirth et al., 2019). Moreover, limited contact opportunities with family, prior history of problematic behaviors, and experience of adverse childhood events might make youths in residential facilities more susceptible to peer influences (Dishion and Tipsord, 2011).

[6]These findings are in line with a sizable literature in economics that documents the importance of social interactions in explaining criminal behavior (e.g., Case and Katz, 1991; Glaeser et al., 1996; Ludwig et al., 2001; Jacob and Lefgren, 2003; Kling et al., 2005; Deming, 2011; Billings et al., 2014; Damm and Dustmann, 2014; Corno, 2017; Billings et al., 2019; Billings and Schnepel, 2022). Especially relevant for this paper is the work on peer effects in prisons (Harris et al., 2018; Damm and Gorinas, 2020). Literatures in criminology, sociology, and psychology also provide evidence of peer effects in crime (see Pratt et al., 2010).

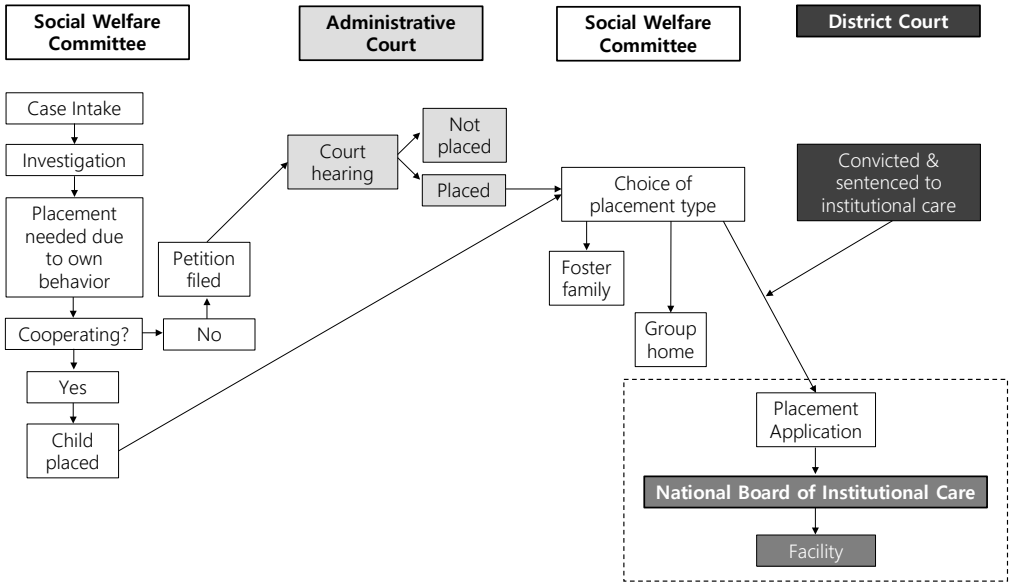
[7]This paper is also related to the literature on the effects of exposure to peers who come from deficient or criminal homes, which finds adverse effects on a range of outcomes (e.g., Carrell and Hoekstra, 2010; Carrell et al., 2018; Billings and Hoekstra, 2019; Santavirta and Sarzosa, 2019). There are also papers on neighborhood effects that include measures of mental health, drinking, and smoking (see Chyn and Katz, 2021, for a review). Moreover, the literature on the effects of placing juveniles in residential facilities is relevant (e.g., Hjalmarsson, 2009; Aizer and Doyle, 2015; Eren and Mocan, 2021). See Bald et al. (2022) for a review of studies on the effects of child protection interventions. Of particular relevance is Helénsdotter (2024), who includes data on youths placed at NBIC in her analysis of the causal effects of court-ordered placement in out-of-home care. Helénsdotter (2024) shows that such placement greatly increases the risk of death and hospitalization due to self-harm.

[8]During the sample period, some facilities have closed and new ones have opened. Hence, the total number of unique facilities during the sample period is higher.

lowing an investigation, the SWC determines that the youth's behavior threatens their health or development and that the youth must be placed in out-of-home care. If the youth consents, they can be directly placed in out-of-home care. Otherwise, a petition for placement must be submitted to the Administrative Court. I refer to the former as voluntary placements and the latter as involuntary placements.

Once the petition is approved, the SWC can choose the appropriate placement type. If the SWC determines that the youth should be placed at NBIC, a placement application is submitted to NBIC. The SWC is also in charge of submitting placement applications for youths who are sentenced to serve time at NBIC by the District Court. According to the Swedish Criminal Code, a person under the age of 18 who commits a crime that would be sanctioned with imprisonment if the perpetrator had been 18 or older should be ordered to serve time at NBIC instead of prison unless there are special circumstances.

Figure 1. *Pathways to Institutionalization in Sweden*



Note: This figure provides a representation of the different routes to placement at NBIC. Almost all youths at NBIC are placed by the SWC, either involuntarily via the court (90%) or voluntarily (5%). All of these youths engage in substance abuse, criminal behavior, or another destructive behavior that poses a significant risk to their health or development. The SWC decides whether the child should be placed at NBIC, but the central placement unit at NBIC allocates youths to facilities. Youths can also be sentenced to serve time at NBIC by a district court for committing a crime punishable by prison (5%).

The placement application submitted by the SWC to the central placement unit at NBIC states the reason for placement. The placement unit assigns the youth to a facility while considering (in order of priority): gender, availability of beds, special needs, security class, age, group composition, and home region. The placement unit is open around the clock, and the assignment should be done immediately upon receiving the application. No applications can be denied. Almost all

youths are placed in their assigned facility the same day or the day after their placement application is submitted. Around one-third of youths are transferred to a new facility at some point after entering their first facility.

At NBIC, youths live together under the supervision of staff, but everyone has separate bedrooms. Since the facilities are miles apart, across-facility contact is essentially non-existent. Within facilities, youths spend large amounts of time together: in the common rooms, fenced-in yard, on-site school, and therapy sessions. In fact, youths are not free to leave the premises, and the facility is usually surrounded by a high fence.

Facilities vary in terms of target group, treatment portfolio, security class, and staff education. For example, some facilities exclusively accept youths of a certain sex or age, while some facilities are more equipped than others to handle youths with special needs. Therefore, it is essential for identification to only exploit variation in peer composition within facilities.

Unless the youth is sentenced to serve time at NBIC, the SWC must reassess whether the need for care persists every six months. If the SWC determines that the youth would benefit from being placed in a foster family or other form of placement, the SWC can transfer the youth from NBIC at any time. If the youth no longer exposes their health or development to a significant risk of harm through their behavior, the SWC should end the placement. At the latest, the NBIC placement ends when the youth turns 21. Youths placed at NBIC for committing an offense punishable by prison serve a fixed sentence. The sentence length is determined by the District Court in advance and must be at least 14 days and at most 4 years. There is no possibility of early release.

The median age at which youths leave NBIC for the first time is 16, and four out of five youths leave before turning 18 (see Figure A1 for the age distribution). Hence, it is unsurprising that many youths continue to be placed in out-of-home care even after their first NBIC placement has ended (see Figure A2). On average, 52.8% of these youths live in a foster family, group home, or NBIC facility 12 months after the end of their first placement spell. Unfortunately, 5.2% of NBIC youths enter adult prisons and addiction treatment facilities within 12 months of their first placement. Among those who leave NBIC after having turned 18 (20), 11.7% (16.4%) are placed in an adult prison or addiction treatment facility within 12 months.

2.2 The Swedish Education & Healthcare Systems

In Sweden, education is free at all levels, from preschool to university. Ten years of schooling (ages 6 to 16, grades 0-9) are compulsory. After grade 9, Swedes can choose to attend high school (*gymnasiet*) if they are eligible. High school typically lasts for three years, and there are both vocational and academic high school tracks. To be able to enroll in a vocational track, the student must have attained passing grades in at least eight subjects, including Swedish, English, and mathematics. To enroll in an academic track, students must achieve a passing grade in three

additional subjects. Students who are not eligible for high school after grade 9 can attend the so-called introduction program to attain passing grades in the required subjects. Hence, a person can become eligible for high school after the year they turn 16.

The Swedish healthcare system is primarily tax-funded, with low out-of-pocket costs and a cap on annual expenses. To promote efficient use of resources and ensure appropriate care, the system relies heavily on gatekeeping. Patients typically access specialist or hospital care through referrals from general practitioners, and hospital admissions are generally reserved for cases that require urgent or complex treatment that cannot be managed in outpatient settings.

2.3 Cross-Country Comparison

According to the United Nations (2020), around 2-3 children per 1,000 live in institutions without parental care in Sweden each year. This rate is lower than in most European countries. In France, Germany, Italy, and the UK, the rate is estimated to be 5-10 children per 1,000.[9] Not all of these children have behavioral problems. However, many European countries share a similar approach to Sweden and prioritize treatment in residential facilities over incarceration when children and youths abuse drugs, engage in prostitution, or commit crimes. In the US, on the other hand, imprisonment is much more common. Specifically, the child imprisonment rate in the US is over 10 times as high as in Western Europe (United Nations, 2020). For overviews of the systems employed in several Western countries, see Whittaker et al. (2022).

3 Data

3.1 Data Description

The primary data source is the administrative records kept by NBIC on the universe of youths admitted to residential care during 2000-2020 in Sweden. The full sample contains 27,683 youth-by-spell observations and 16,461 unique youths. The records include placement reasons (as specified on the placement application submitted by the SWC) as well as information on facility assignments and dates related to admission, discharge, moves within NBIC, and episodes of isolation and absconding.

Statistics Sweden linked the administrative records on youths placed at NBIC with register data using the youths' personal identity numbers. These personal identity numbers are unique and given to all Swedish residents, including foreign-born. I have accurate personal identity numbers for 93% of the youths. The reason for missing an accurate personal identity number is almost

[9] This difference in rate of child institutionalization cannot be explained by the informal sector since there is, in practice, no informal sector in Sweden. All residential child and youth facilities must be registered with the Health and Social Care Inspectorate.

always recent immigration to Sweden. Statistics Sweden matched the youths to their parents and added data on, e.g., gender, birth date, immigration/emigration dates, foreign background, labor income, marital status, and education of both youths and parents.

Information on all hospitalizations at Swedish hospitals (private and public) comes from the National Inpatient Register (1998-2022) kept by the National Board of Health and Welfare. Via the National Board of Health and Welfare, I also obtain data on all deaths (date and cause) from the National Cause of Death Register (1998-2022), adult addiction treatment from the Register of Compulsory Care Under the Act on Care of Substance Abusers (2000-2022), and out-of-home placements from the Register on Service Provision to Children and Young Persons (2000-2022). Lastly, I obtain data on all legal proceedings (date of crime, section of the law, and sanction) from the National Council for Crime Prevention (1998-2022).

The main explanatory variables are measured *before* placement. History of substance abuse takes the value 1 if the current placement application lists substance abuse as a reason for placement or the youth (i) is hospitalized from substance abuse, (ii) commits a narcotic crime, or (iii) is placed in an NBIC facility because of substance abuse at any point during the 24 months before placement. I use the date of the crime, not the date of conviction or reporting. History of self-harm takes the value 1 if the youth is hospitalized for self-harm at least one time during the 24 months before placement.

The main outcomes are hospitalization due to substance abuse and self-harm, respectively, by month 12 *after* the placement ends (i.e., after the youth is discharged from NBIC). Throughout this paper, I classify the reason for hospitalization based on the primary cause of illness or injury. Hence, if a youth accidentally harms themselves while being under the influence, my measure of substance abuse would not capture the incident. To assess the effect of peers on educational attainment, I use a binary outcome variable taking the value 1 if the youth attains sufficient grades to be eligible for high school.

3.2 Measuring Peer Exposure

To measure the peer composition on a particular day, I start with the full sample of youths (N=27,683). I define the peer group at the facility level: peers on day d are the other youths living in the same facility on day d as youth i. I exclude youths in isolation or on the run on day d.[10] Peer exposure on a given day ($Peer\ exposure_{i,f,h,d}$) is defined as the share of peers in facility f

[10]One-third of youths run away or get put in isolation at least once during their first placement spell. Among those who run away or get put in isolation, the median number of days on the run or in isolation is 11.

with pre-placement history h (e.g., substance abuse):

$$Peer\ exposure_{i,f,d,h} = \frac{1}{N_{f,d} - 1} \sum_{j \neq i} H_{j,f,d,h}, \tag{1}$$

where $H_{j,f,h,d}$ is an indicator taking the value 1 if peer j in facility f on day d has pre-placement history h and $N_{f,d}$ is the number of available peers in facility f on day d. Since a youth can have a history of multiple behaviors, the shares do not sum to one.

First-day peer exposure is defined as the peer exposure on the youth's first day of arrival (*d=0*). Total peer exposure is defined as the sum of daily peer exposure over all days youth i was present in any NBIC facility during their first placement spell. Days in isolation and on the run are excluded. The start date of a placement spell is the day of arrival at NBIC while the end date is the day the youth's placement at NBIC ends.

Naturally, own history and total peer exposure are measured with error. As discussed in Angrist (2014), measurement error can lead to overestimation of peer effects. Fortunately, as clarified in Feld and Zölitz (2017), quasi-random assignment of agents to peer groups ensures that measurement error only biases estimates toward zero.

3.3 Sample Creation and Descriptive Statistics

In the analysis, I limit the sample (N=27,683) to the first placement spell per youth (N=16,461). Since I only observe youths admitted from January 1, 2000, I cannot observe the full peer group at the start of 2000. While the median placement length is only three months, over 10% of the sample are placed for longer than 1 year (see Figure A3). As only 2.5% are placed longer than 2 years, I drop the first two years and restrict the sample to youths admitted during 2002-2020 (N=14,648). I then drop 36 youths who did not have a placement end date by the end of 2021 (which is when my data from NBIC ends). I also drop youths without any peers on their first day (5 observations) and youths in facility-by-year cells with less than 10 youths after imposing the previous restrictions (535 observations). The final sample consists of 14,072 unique youths assigned to one of 36 facilities (referred to as the '2002-2020 Sample').

When studying outcomes based on register data obtained from a source other than NBIC, I further restrict the sample to youths who are observable in Statistics Sweden's register data during the 24 months before their NBIC placement (N=1,180 dropped). Almost all of the excluded youths immigrated to Sweden too recently to have been given their personal identity number. I also restrict to youths in facility-by-year cells with at least 10 observations (N=60 dropped). This sample (N=12,832) is referred to as the 'Main Analysis Sample'.

To study the effect of peer substance abuse and self-harm on high school eligibility by the year

the youth turns 21 years old, I restrict the 'Main Analysis Sample' to youths who (i) were not yet eligible for high school before their NBIC placement (N=2,089 dropped), (ii) turn 21 before 2023 (N=1,602 dropped), (iii) start their placement before the year they turn 21 (N=11 dropped), and (iv) are in facility-by-year cells with at least 10 observations after imposing the previous restrictions (N=438 dropped). I refer to this sample (N=8,692) as the 'Education Sample'.

Table 1. *Descriptive Statistics*

	All First-Time Placements	2002-2020 Sample	Main Analysis Sample	Education Sample
A: Youth Characteristics				
Female	0.34	0.34	0.35	0.34
Foreign	0.29	0.30	0.24	0.24
Age	15.78	15.76	15.76	15.50
<15 y.o.	0.22	0.22	0.23	0.26
≥18 y.o.	0.13	0.13	0.13	0.09
Placement type:				
Involuntary	0.90	0.92	0.92	0.92
Sentenced	0.05	0.04	0.04	0.04
Voluntary	0.05	0.04	0.04	0.05
Required to attend school	0.43	0.43	0.44	0.51
Attended 9th grade	0.41	0.41	0.45	0.34
Missing, yrs t to t-2	0.08	0.08	0.00	0.00
History of:				
Substance abuse	0.58	0.58	0.59	0.53
Self-harm	0.06	0.06	0.06	0.05
Crime	0.76	0.76	0.76	0.77
Neurodevelopmental disorder	0.03	0.03	0.04	0.03
Depression	0.02	0.02	0.02	0.02
Other mental illness	0.07	0.07	0.07	0.07
Any birth parent:				
Dead	0.04	0.04	0.05	0.05
<18 y.o. at birth of child	0.02	0.02	0.02	0.02
Married, yr t-1	0.49	0.50	0.49	0.49
No labor income, yr t-1	0.50	0.50	0.50	0.52
Hosp. d.t. mental health, yr t-1	0.03	0.03	0.03	0.03
Hosp. d.t. substance use, yr t-1	0.03	0.03	0.03	0.03
Any crime, yr t-1	0.10	0.09	0.09	0.10
Missing any X, yr t-1	0.31	0.31	0.25	0.26

Table 1 displays descriptive statistics at the youth level (Panel A), placement level (Panel B), and peer level (Panel C) for all first-time placements, the '2002-2020 Sample', the 'Main Analysis Sample', and the 'Education Sample'. See Appendix B for variable definitions. The descriptive statistics reported in the first and second columns are very similar. In the last two columns, the share of youths missing in the register data during the two preceding years is (naturally) zero, and the share of youths with missing background information on any birth parent is smaller. However, the share is still large. The reason for the high share of youths with missing information on at least

one birth parent during the year before placement is that a quarter of the youths have a foreign background, and, in this subgroup, it is common that at least one birth parent is unobservable at some point during the previous year.

Table 1. *Continued*

B: Placement Characteristics				
Days in institutional care during spell	151.62	146.50	148.52	152.22
Total days in institutional care	254.30	246.66	254.62	271.96
Number of spells	2.30	2.35	2.34	2.27
First facility is in new county	0.71	0.72	0.70	0.67
C: Peer Characteristics on First Day				
Peer substance abuse	0.63	0.63	0.63	0.58
Peer self-harm	0.07	0.07	0.07	0.06
Peer crime	0.82	0.83	0.82	0.83
Peer NDD	0.04	0.04	0.04	0.04
Peer depression	0.02	0.02	0.02	0.02
Peer other mental illness	0.08	0.08	0.08	0.08
Peer female	0.32	0.31	0.33	0.32
Peer foreign	0.27	0.27	0.27	0.25
Peer <15 y.o.	0.21	0.21	0.21	0.23
Peer missing, yrs t to t-2	0.05	0.05	0.04	0.03
Peer size	19.44	19.81	19.65	19.67
Above median peer size	0.38	0.38	0.38	0.38
Unique facilities	47	36	36	34
Unique birth parents	26021	22149	21955	14869
Observations	16461	14072	12832	8692

Note: This table presents descriptive statistics on youth, placement, and first-day peer characteristics for all first-time placements at NBIC and each analysis sample as described in Section 3.3. Youth characteristics are measured by the start of the youth's first NBIC placement. Statistics are shown for observations with non-missing information.

Figure A4 depicts the number of admission events by facility and year using data on all NBIC admissions during 2000-2020. Because NBIC can move youths across facilities, a youth can enter and leave multiple facilities during their placement at NBIC. The total number of unique facility admissions is 50,191, while the median number of admissions per facility and year is 90.

4 Empirical Methodology

4.1 Instrumental Variable Model

The goal is to identify the effect of exposure to peers with a history of substance abuse or self-harm on youth outcomes. Consider an adapted version of Bayer et al. (2009)'s model:

$$\begin{aligned} Y_i = &\beta_0(Own\ history_{i,h} * Total\ peer\ exposure_{i,h}) \\ &+ \beta_1(No\ own\ history_{i,h} * Total\ peer\ exposure_{i,h}) \\ &+ \alpha(Own\ history_{i,h}) + \delta_{f,t} + \eta_{i,h,f,t} \end{aligned} \tag{2}$$

where Y_i is an outcome measured for youth i who was first admitted in year t to facility f, *Own history*$_{i,h}$ is an indicator taking the value 1 if the youth has a certain history h (e.g., history of substance abuse), *No own history*$_{i,h}$ indicates the opposite, *Total peer exposure*$_{i,h}$ is youth i's total exposure to peers with history h during the placement spell, $\delta_{f,t}$ are facility-by-year FEs, and $\eta_{i,h,f,t}$ is an error term.

In line with Bayer et al. (2009) and Damm and Gorinas (2020), I interact total peer exposure with own history to distinguish between introductory and reinforcing peer effects, which is essential for understanding the mechanisms at play. In addition, since the baseline probabilities of experiencing a future hospitalization are vastly different for youths with versus without a certain history (see Table A1), it is useful to estimate separate effects to gauge the effect magnitude.

Estimates of β_0 and β_1 are likely plagued by omitted variable (OV) bias because unobservable characteristics of the youth may affect (i) the future peer composition at facility f, (ii) the number of days the youth spends in a particular facility, and (iii) the youth's total placement length. For example, a youth with severe prior substance abuse problems likely spends more time at NBIC than a youth with minor prior issues, even after controlling for any history of substance abuse. The youth with severe problems presumably has a higher likelihood of being hospitalized for substance abuse post-placement (regardless of peer exposure). In that case, I may wrongly attribute the difference in post-placement behavior to greater peer exposure.

To address this issue, the peer composition on the first day of youth i's arrival interacted with own history are used as instruments for total peer exposure by own history in a two-stage least squares (2SLS) procedure. The first-stage equations in the 2SLS model are:

$$\begin{aligned} Own\ history_{i,h} * Total\ peer\ exposure_{i,h} =& \pi_1(Own\ history_{i,h} * FD\ peer\ exposure_{i,h}) \\ &+ \pi_2(No\ own\ history_{i,h} * FD\ peer\ exposure_{i,h}) \\ &+ \pi_3(Own\ history_{i,h}) + \delta_{f,t} + \epsilon_{i,h,f,t} \end{aligned} \tag{3}$$

$$\begin{aligned} No\ own\ history_{i,h} * Total\ peer\ exposure_{i,h} =& \lambda_1(Own\ history_{i,h} * FD\ peer\ exposure_{i,h}) \\ &+ \lambda_2(No\ own\ history_{i,h} * FD\ peer\ exposure_{i,h}) \\ &+ \lambda_3(Own\ history_{i,h}) + \delta_{f,t} + \epsilon_{i,h,f,t} \end{aligned} \tag{4}$$

where *FD peer exposure*$_{i,h}$ is the share of peers in facility f on the first day of youth i's arrival with history h and $\epsilon_{i,h,f,t}$ is an error term. Facility-by-year FEs ($\delta_{f,t}$) are included to account for systematic differences in own and peer characteristics between facilities and over time. By including such FEs, I only exploit variation in first-day peer composition within facility-by-year cells. Since the instruments (first-day peer exposure) is assigned to all youths who enter the same facility on the same day, I cluster the standard errors at the facility-by-day level (see Abadie et al., 2023).

4.2 Instrument Relevance

First-day peer exposure by own history must be relevant instruments for total peer exposure by own history to identify β_0 and β_1. The shaded bars in Figure 2 illustrate the identifying variation after residualizing and mean-standardizing each instrument using facility-by-year FEs. Among youths with a history of substance abuse (Panel A), youths at the 10th percentile are placed on their first day in a peer group consisting of 58% substance abusers, while youths at the 90th percentile are exposed to 77% substance abusers (mean: 0.680, std. dev.: 0.081). Among youths with a history of self-harm (Panel C), youths at the 10th percentile are exposed on their first day to peers where 9% have a history of self-harm compared to 11% for youths at the 90th percentile (mean: 0.099, std. dev. 0.023).[11]

The plots in Figure 2 also include flexible regressions of total peer exposure on first-day peer exposure by own history. In each plot, the endogenous variable appears to increase in the instrument monotonically.

To formally examine the relevance of own-history-specific first-day peer exposure, I regress

[11]Figure A5 displays the available variation in additional first-day peer measures (without interacting with own history) after accounting for facility-by-year FEs.

Figure 2. *Relationship Between First-Day and Total Peer Exposure*



Note: This figure depicts the relationship between total and first-day peer exposure when each peer exposure variable is interacted with own history (plots A and C) and no own history (plots B and D). The histogram in each plot depicts the distribution of own-history-specific first-day peer exposure (leaving out the top and bottom 5%). The solid lines show Kernel-weighted local polynomial regressions of *Own history*Total peer exposure* on *Own history*FD peer exposure* (or interacted with an indicator for no own history in plots B and D). The plotted values are mean-standardized residuals from regressions on facility-by-year FEs, *Own history*, and *No own history*FD peer exposure* (or *Own history*FD peer exposure* in plots B and D). The dashed lines show 90% confidence bands. The 'Main Analysis Sample' is used (see Section 3.3).

total peer exposure by own history on first-day peer exposure interacted with own history. Table 2 presents these first-stage estimates. Irrespective of the relevant history category and whether peer controls are included, the estimates are positive, large, and highly significant with Sanderson-Windmeijer Multivariate F-statistics around 40-100. The point estimate of 36.4 in column 1, Panel A, implies that if the share of peers with a history of substance abuse on the first day of youth i's arrival is 1 percentage point higher, the total peer exposure measure rises by 0.6% relative to the mean among youths with a history of substance abuse.

Table 2. *First-Stage Estimates*

	Own History* Total Peer Exposure		No Own History* Total Peer Exposure	
	(1)	(2)	(3)	(4)
A: History of Substance Abuse				
Own history*FD peer exposure	36.3854***	34.9794***		
	(4.9647)	(5.1295)		
No own history*FD peer exposure			48.0844***	48.3477***
			(5.4331)	(5.4526)
Dep. mean if own hist.=1	59.43	59.43	0.00	0.00
Dep. mean if own hist.=0	0.00	0.00	53.37	53.37
Δ% (per 1 s.d.)	12.88	12.39	18.09	18.19
Sanderson-Windmeijer *F*-statistic	48.52	43.87	43.27	40.85
B: History of Self-Harm				
Own history*FD peer exposure	59.1350***	59.4866***		
	(7.8934)	(7.8983)		
No own history*FD peer exposure			24.8581***	24.3951***
			(2.0110)	(2.0606)
Dep. mean if own hist.=1	9.47	9.47	0.00	0.00
Dep. mean if own hist.=0	0.00	0.00	5.95	5.95
Δ% (per 1 s.d.)	62.75	63.12	34.32	33.68
Sanderson-Windmeijer *F*-statistic	92.14	90.00	99.49	91.39
Peer controls	No	Yes	No	Yes
Observations	12832	12832	12832	12832

Note: In columns 1-2, *Own history*Total peer exposure* is regressed on *Own history*FD peer exposure*. In columns 3-4, *No own history*Total peer exposure* is regressed on *No own history*FD peer exposure*. All estimations control for own history, the alternative instrument, and facility-by-year FEs. Whether controls for first-day peer characteristics (as listed in Table 1) are included is indicated at the bottom of the table. Sanderson and Windmeijer (2016)'s conditional *F*-statistics are reported. The 'Main Analysis Sample' is used. Δ% (per 1 s.d.) gives the change in the dependent variable when the instrument increases by 1 standard deviation relative to the dependent mean. Standard errors are clustered at the facility-by-day-of-entry level. * $p < .1$. ** $p < .05$. *** $p < .01$.

4.3 Conditional Random Assignment

The facility at which a youth is placed and the timing of placement are not random. To circumvent the issue of non-random assignment, I rely on natural variation in peer composition within facility-by-year cells as youths are discharged and new ones are admitted. This approach has been employed by Bayer et al. (2009), followed by Stevenson (2017) and Damm and Gorinas (2020). It relies on the central assumption that the variation in peer characteristics is as good as random after netting out facility-by-year FEs. A concern is that there can be within-year shocks to substance abuse and self-harm. Suppose a supply shock of a potent drug lasts for 3 months. Such a shock would likely increase the share of substance abusers on the first day and directly impact the risk of hospitalization after discharge.

To examine whether first-day peer exposure is plausible exogenous within facility-by-year cells, I use the diagnostic testing procedure proposed in Bayer et al. (2009). First, I predict each

outcome (substance abuse and self-harm post-placement) based on the full set of youth characteristics listed in Table 1, Panel A, as well as home county and facility-by-year FEs. I then regress predicted outcomes on the first-day peer characteristics listed in Table 1, Panel C. In line with facility specialization, Table 3 shows that there is a strong correlation between own and peer characteristics when no facility-by-year FEs are included. Hence, estimations of peer effects that do not account for such specialization would likely yield biased estimates. Fortunately, when facility-by-year FEs are included, the correlations between own and peer characteristics are close to zero, lack individual significance, and are not jointly significant. These results provide strong empirical evidence that first-day peer exposure is plausibly as-if-randomly assigned within facility-by-year cells.

Table 3. *Test of Conditional Random Assignment of First-Day Peer Composition*

	Predicted Substance Abuse Post-Exit		Predicted Self-Harm Post-Exit	
	(1)	(2)	(3)	(4)
Peer substance abuse	0.0680***	0.0025	0.0035	-0.0008
	(0.0048)	(0.0041)	(0.0027)	(0.0016)
Peer self-harm	0.0094	0.0003	0.0225***	0.0014
	(0.0135)	(0.0078)	(0.0075)	(0.0026)
Peer crime	-0.0281***	0.0008	-0.0252***	-0.0005
	(0.0079)	(0.0047)	(0.0047)	(0.0017)
Peer NDD	-0.0085	-0.0088	0.0217**	0.0021
	(0.0151)	(0.0098)	(0.0094)	(0.0036)
Peer depression	0.0091	-0.0022	0.0210	0.0043
	(0.0208)	(0.0128)	(0.0129)	(0.0042)
Peer other mental illness	0.0304***	0.0078	-0.0145**	0.0007
	(0.0113)	(0.0070)	(0.0074)	(0.0026)
Peer female	0.0066	-0.0025	-0.0089***	-0.0018
	(0.0044)	(0.0070)	(0.0026)	(0.0028)
Peer foreign	-0.0586***	-0.0028	-0.0093***	0.0002
	(0.0060)	(0.0048)	(0.0032)	(0.0016)
Peer <15 y.o.	-0.0141***	-0.0032	-0.0059**	-0.0018
	(0.0037)	(0.0044)	(0.0024)	(0.0018)
Peer missing, yrs t to t-2	-0.0239**	-0.0009	0.0129**	-0.0024
	(0.0118)	(0.0106)	(0.0060)	(0.0038)
Facility*year FEs	No	Yes	No	Yes
F-statistic	59.322	0.360	8.924	0.430
p-value	0.000	0.964	0.000	0.933
Observations	12832	12832	12832	12832

Note: Test of exogenous peer variation using the 'Main Analysis Sample'. Outcomes are predicted using OLS and the youth characteristics in Table 1, home county FEs, and facility-by-year FEs. In each regression, the predicted outcome is regressed on the listed peer measures and the corresponding own characteristics with and without facility-by-year FEs (as indicated in the table). Reported *F*-statistic (*p*-value) of joint significance is for the displayed variables. Standard errors are clustered at the facility-by-day-of-entry level. * $p < .1$. ** $p < .05$. *** $p < .01$.

In Table A2, I present further evidence in support of conditional random assignment. Specif-

ically, I regress the first-day share of peers with a history of substance abuse (self-harm) on own history of the corresponding behavior with and without facility-by-year FEs. Following Guryan et al. (2009), I control for the leave-out mean of the relevant history category within the population at risk of being the youth's peers (i.e., the leave-out mean within the facility-by-year cell) in all regressions. The leave-out mean within the randomization cell is included to account for the mechanical negative correlation between individual and peer characteristics. In line with the validity of the central assumption, the estimated coefficients are small and lack statistical significance when facility-by-year FEs are included.

While the outlined strategy allows for a causal analysis of peer effects, the estimated effect might reflect the influence of other peer characteristics than the characteristic of interest. For example, if own depression increases the risk of engaging in self-harm, and peer depression affects own depression, the estimated effect of peer self-harm on own self-harm is likely subject to omitted variable bias. To alleviate such concerns, I follow Altonji et al. (2005) and examine the stability of my estimates to the inclusion of additional peer characteristics. In the peer effects literature, concerns about omitted variable bias have been addressed in a similar fashion by Golsteyn et al. (2020).

4.4 Exclusion Restriction

Conditional random assignment is sufficient to estimate the reduced-form effect of first-day peer exposure on youth outcomes. However, to estimate the effects of total peer exposure during the youth's time at NBIC, the instruments must satisfy the exclusion restriction. In this context, the assumption implies that own-history-specific first-day peer exposure must exclusively affect youth outcomes through own-history-specific total peer exposure, either by affecting the daily peer composition or the total time spent at NBIC.

Among youths with severe prior behavioral problems, the placement length might be so long (regardless of first-day peer exposure) that the influence of first-day peer exposure on total peer exposure might be close to zero. However, first-day peer exposure may still impact post-placement behavior, thereby violating the exclusion restriction. In particular, suppose a youth enters a facility on a day with a low share of substance-abusing peers but a high share of violent peers. If the youth is victimized, that experience may have a persistent effect on the youth's behavior even after placement.

To this end, I present regressions in which I control for a host of first-day peer characteristics, including the share of first-day peers with a history of crime. I also conduct a robustness test in which I drop youths with placement spells longer than 100 days.

4.5 Multi-Valued Treatment & Heterogeneous Treatment Effects

The canonical IV design has one binary treatment, while mine involves two continuous treatment variables. Specifically, I interact total peer exposure with own history. I chose this design before gaining access to the data to distinguish between introductory versus reinforcing peer effects and exploit the full richness of the data. Under homogeneous treatment effects, 'multivariate' 2SLS can be used to identify such separate effects (Chyn et al., 2025). However, identifying policy-relevant parameters in models with multiple treatments and heterogeneous effects requires additional assumptions (Heckman et al., 2008; Bhuller and Sigstad, 2024; Humphries et al., 2024). In particular, the 2SLS-estimated effect of the first treatment variable (β_0 in Equation 2) can be contaminated by the effect of the second treatment (β_1). To interpret the 2SLS estimate of β_0 as a positively weighted average of the reinforcing peer effect across youths, the 2SLS estimand must assign non-negative weight on β_0 and zero weight on β_1 for each youth.

Using a model with multiple binary treatments, Bhuller and Sigstad (2024) identify two conditions beyond the standard IV assumptions that are necessary and sufficient for 2SLS to assign proper weights: average conditional monotonicity and no cross effects. The former is a generalization of Frandsen et al. (2023)'s average monotonicity condition and implies that, for each agent, instrument 1 does not, on average, induce them out of treatment 1, conditional on instrument 2. The no cross effects condition implies that each instrument can only affect future outcomes through *one* treatment variable. In other words, there is a one-to-one mapping between instruments and treatments.

In an early draft, Bhuller and Sigstad (2024) clarify that in models where the treatments and instruments are constructed by interacting a pre-determined characteristic with the original treatment and instrument variables, the no cross effects assumption will mechanically hold. In such models, it is necessary and sufficient that the usual IV assumptions for a univariate model hold in both subsamples (i.e., when the pre-determined characteristic is turned on and off, respectively).

In my model, the pre-determined characteristic is *Own history*. Since it is mechanically the case that *Own history*FD peer exposure* only affects *Own history*Total peer exposure* and *No own history*FD peer exposure* only affects *No own history*Total peer exposure*, the main concern is whether univariate 2SLS is valid in the subsamples of youths with history *h* and without history *h*, respectively.

The univariate version of my main model uses *FD peer exposure* as an instrument for *Total peer exposure*. Angrist and Imbens (1995) show that, under independence and monotonicity assumptions, 2SLS can be used in models where the treatment varies in intensity across agents. Specifically, Angrist and Imbens (1995)'s monotonicity condition (sometimes referred to as strong monotonicity) implies that, for each youth, total peer exposure never decreases with first-day peer exposure. 2SLS can then identify a weighted average of agent-level responses to a one-unit

increase in the treatment among compliers, where compliers are those youths whose total peer exposure is influenced by the first-day peer exposure.

Strong monotonicity is not met if, for example, there are youths who would have a medium level of total exposure to substance-abusing peers if the first-day peer exposure is of medium level, but who would have a low level of exposure if the first-day peer exposure is high. Such a problem can arise if NBIC responds to some youths being placed in a facility with a high, *but not a medium*, share of substance abusers by relocating the youth so quickly to a low-exposure facility that the total peer exposure becomes lower than the medium level.

Intuitively, such situations should be rare or non-existent since (i) placement is determined by a central placement unit (not by local staff, the SWC, or the youth), (ii) spots and resources are scarce, and (iii) group composition is not among the top five criteria NBIC considers when assigning youths to facilities.[12] Moreover, none of the subgraphs in Figure 2 indicate that the relationship between first-day and total peer exposure switches signs depending on the intensity of first-day peer exposure. Last, I explore the robustness of the main results to excluding youths who ever switch facilities during their placement spell.

If Angrist and Imbens (1995) monotonicity holds, average conditional monotonicity should hold as well. Hence, I apply the testing procedure described in Bhuller and Sigstad (2024): I slice the subsample along observable dimensions and estimate the first stages in each subsample. In line with average conditional monotonicity, each estimate is positive, large, and significant (Table A3). This means that, in these subsamples, *Own history*Total peer exposure* does not, on average, decrease with *Own history*FD peer exposure*, conditional on *No own history*FD peer exposure*. The corresponding is true for the other treatment variable.

4.5.1 Compliers

In my setting, a complier is a youth whose total peer exposure is influenced by the first-day peer exposure. Since total peer exposure is the sum of daily exposure (including the peer exposure on the first day) there are no youths who will have zero total peer exposure regardless of the first-day peer exposure. Hence, there are no never-takers. However, there can be youths whose placement duration is so long (independent of the first-day peer exposure) that the contribution of the first-day exposure to total peer exposure is close to zero. Effectively, these youths would be the non-compliers in the population.

Under the assumptions outlined in this section, the 2SLS estimand of β_0 captures the average treatment effect among youths with history h whose total peer exposure is affected by the first-day peer exposure, while the 2SLS estimand of β_1 is the average treatment effect among youths

[12] Gender, availability of beds, special needs, security class, and age should be considered before taking into account group composition.

without history h whose total peer exposure is affected by the first-day peer exposure.

5 Peer Effects in Substance Abuse and Self-Harm

5.1 Baseline Results

Table 4 presents the estimated effects of peer substance abuse and self-harm, respectively, on the risk of youth i being hospitalized from substance abuse or self-harm during the 12 months after placement exit. Separate effects are estimated for youths with versus without a history of each behavior. The sample size is slightly smaller compared to Table 1 due to emigration and death.[13]

Simple OLS regression of cause-specific hospitalization on total peer exposure by own history returns estimates close to zero. However, these estimates are likely biased because youth characteristics influence the length of placement and future peer composition. Addressing this issue by using first-day peer exposure by own history as instruments for total peer exposure by own history reveals large, reinforcing peer effects in both substance abuse and self-harm.

For youths with a history of substance abuse, the point estimate of 0.24 percentage points in column 1 implies that a 1-standard-deviation increase in total peer exposure (74.0) increases the risk of a future hospitalization for substance abuse by 17.9 percentage points (or 82.7% relative to the dependent mean among compliers). This coefficient is significant at the 1% level. I also report the p-value of a joint Anderson-Rubin (AR) test as well as identification-robust AR confidence sets for each regressor. Reassuringly, the joint AR-test returns a p-value below 1%. The AR confidence sets are obtained using the projection method. Even though the project method is known to suffer from poor power (see Andrews et al., 2019), the AR confidence set in column 1 still implies a significant reinforcing peer effect in substance abuse at the 95% level.

For youths without a history of substance abuse, the estimated peer effect is positive but not statistically significant. Tests of equality reveal a significant difference in the IV estimated coefficients at the 1-5% level.

A similar pattern is observed for self-harm (columns 3-4, Table 4): a large reinforcing peer effect is found (significant at the 5-10% level), while the estimated introductory peer effect is small and lacks statistical significance. The difference in IV-estimated effects is significant at the 5% level. The point estimate of 0.60 percentage points in Column 3 implies that a 1-standard-deviation increase in exposure to peer self-harm during placement (20.2) increases the risk of

[13] To test for selective sample attrition, I regress dummies for missing in Statistics Sweden's register data, missing in the 'Main Analysis Sample', and missing in the 'Education Sample', respectively, on my main first-day peer measures. The results in Table A4 suggest that selective attrition is negligible. Reduced-form estimated effects of all peer measures interacted with own history on the main outcomes (substance abuse and self-harm post-placement) are available in Table A5. In Table A6, I provide estimated peer effects in crime, depression, and any mental disorder (excluding substance abuse and self-harm).

Table 4. *Peer Effects in Substance Abuse and Self-Harm*

	Substance Abuse		Self-Harm	
	(1)	(2)	(3)	(4)
Ordinary Least Squares				
Own history*Total peer exposure	0.0001	0.0001	0.0008	0.0007
	(0.0001)	(0.0001)	(0.0007)	(0.0007)
No own history*Total peer exposure	-0.0000	-0.0000	-0.0003*	-0.0003**
	(0.0000)	(0.0000)	(0.0001)	(0.0001)
Ordinary Least Squares (Complier Reweighted)				
Own history*Total peer exposure	0.0000	0.0001	-0.0014	-0.0012
	(0.0001)	(0.0001)	(0.0012)	(0.0012)
No own history*Total peer exposure	-0.0000	-0.0000	-0.0001	-0.0001
	(0.0000)	(0.0000)	(0.0002)	(0.0002)
Reduced-Form Regression				
Own history*FD peer exposure	0.0976***	0.0867***	0.3291**	0.3120**
	(0.0272)	(0.0274)	(0.1432)	(0.1412)
No own history*FD peer exposure	-0.0051	-0.0007	-0.0106	-0.0045
	(0.0230)	(0.0238)	(0.0307)	(0.0320)
Instrumental Variable Model				
Own history*Total peer exposure	0.0024***	0.0022***	0.0060**	0.0058*
	(0.0007)	(0.0007)	(0.0031)	(0.0030)
No own history*Total peer exposure	0.0013	0.0013	0.0008	0.0010
	(0.0008)	(0.0008)	(0.0016)	(0.0017)
Complier dep. mean if own hist.=1	0.2168	0.2244	0.2947	0.2962
Complier dep. mean if own hist.=0	0.0365	0.0321	0.0350	0.0402
Δ% (per 1 s.d.) if own hist.=1	82.69	72.67	41.10	39.64
Δ% (per 1 s.d.) if own hist.=0	264.31	301.68	28.18	29.93
Test of equality (p-value)	0.0083	0.0313	0.0243	0.0340
Joint AR p-value	0.0000	0.0001	0.0602	0.0812
AR confidence set β_0 (95%)	[.0011,.0044]	[.0008,.0042]	[-.001,.014]	[-.0011,.0137]
AR confidence set β_1 (95%)	[-.0006,.0037]	[-.0006,.0038]	[-.0028,.0049]	[-.0029,.0053]
Youth & peer controls	No	Yes	No	Yes
Observations	12739	12739	12739	12739

Note: The dependent variable is an indicator equal to one if the youth is hospitalized due to substance abuse or self-harm (respectively) during the 12 months after exit from the first placement spell at NBIC. In *Ordinary Least Squares* and *Ordinary Least Squares (Complier Reweighted)*, the dependent variable is regressed on total peer exposure interacted with the youth's own history of the behavior indicated in the top row. In *Instrumental Variable Model*, *Own history*FD peer exposure* and *No own history*FD peer exposure* are used as instruments for *Own history*Total peer exposure* and *No own history*Total peer exposure*. All estimations control for own history and facility-by-year FEs. Whether controls for youth and first-day peer characteristics (as listed in Table 1) are included is indicated at the bottom of the table. The 'Main Analysis Sample' is used. Δ% (per 1 s.d.) if own hist.=1 gives the change in the likelihood of hospitalization when total peer exposure increases by 1 standard deviation relative to the mean risk among compliers with history h. Standard errors are clustered at the facility-by-day-of-entry level. * $p < .1$. ** $p < .05$. *** $p < .01$.

future self-harm by 12.1 percentage points (or 41.1% relative to the mean among compliers with a history of self-harm).

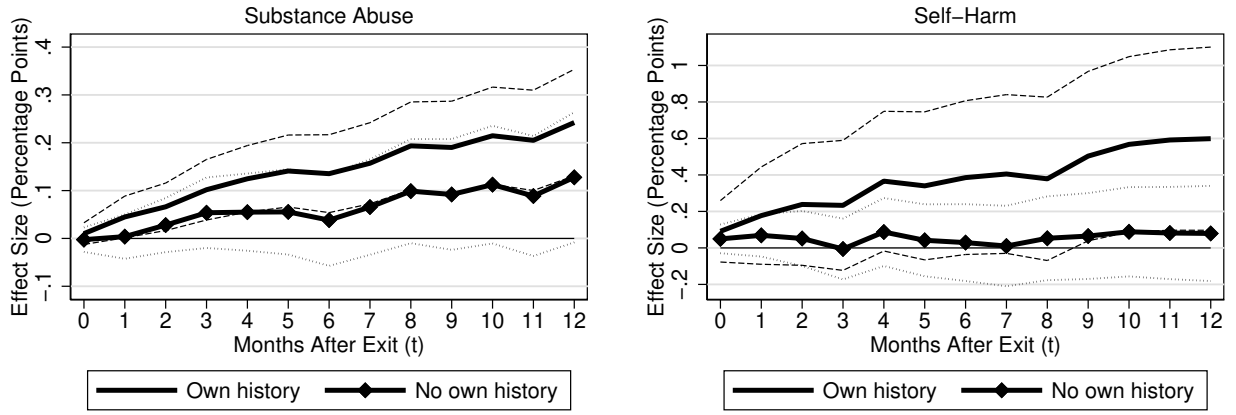
The estimated reinforcing peer effects are fairly unaffected by the inclusion of the full set of

youth and first-day peer controls (see Table 1). This suggests that omitted variable bias may be of limited concern (Altonji et al., 2005) and supports that it is the peer characteristic of interest, rather than some other peer characteristic such as gender composition, that is driving the estimated effects.

IV estimation provides the treatment effect for youths whose total exposure is affected by the peer composition on the first day. Hence, discrepancies between the OLS and IV estimates might be attributable to effect heterogeneity. Therefore, I also provide estimates from OLS regressions that use complier weights. Even though the complier groups are different from non-compliers along important dimensions (see Table A7), the OLS estimates are very similar, which indicates that the discrepancies between the OLS and IV estimates are driven by selection bias rather than treatment effect heterogeneity.

Figure 3 presents IV estimates of the effect of total peer exposure on the cumulative risk of hospitalization from substance abuse and self-harm by month t after the end of the NBIC placement (with 90% confidence intervals). Separate lines are shown for youths with and without a history of the relevant behavior. Among youths with a history of substance abuse, the estimated effect is positive for the full 12-month window and appears to be slightly increasing in size over time. The point estimates are statistically significant from the first month onward. For youths with no history of substance abuse, the point estimates are positive but lack statistical significance.

Figure 3. *IV Estimated Peer Effects in Substance Abuse and Self-Harm*



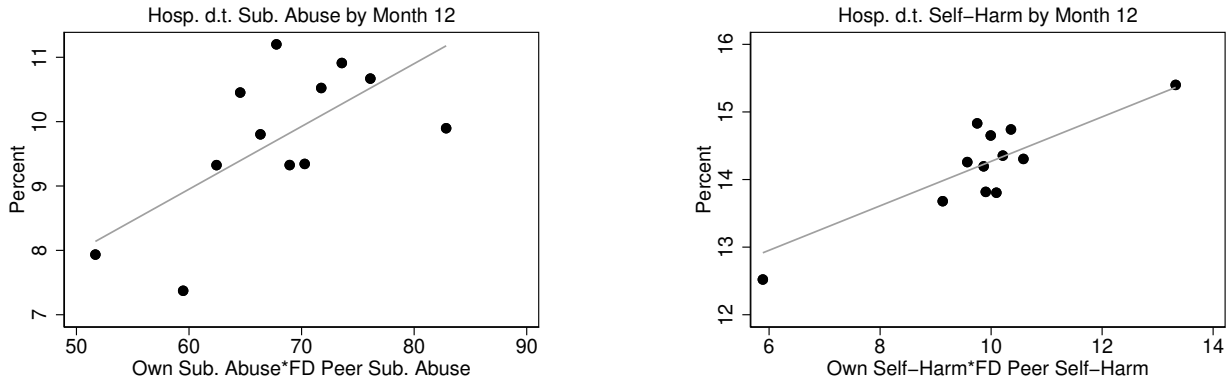
Note: Black lines show IV estimates of the effect of total peer exposure on the cumulative probability of the youth being hospitalized from substance abuse and self-harm (respectively) by month t post-exit. The relevant history category is stated in the subfigure heading. Dashed lines show 90% confidence bands. Effect estimates are presented in percentage points (i.e., scaled by 100). All specifications condition on being alive and in Sweden during months 0-t.

For self-harm, the effect is positive and increases over the months following placement exit among youths with a prior history of self-harm. The effect is statistically significant from month 9

onward. Among youths with no such history, the point estimates are close to zero during the year post-placement. These figures suggest that even temporary exposure to harmful peers can have persistent and escalating effects on youth substance abuse and self-harm. The absence of a decline in effect magnitude over time may reflect the self-reinforcing nature of these behaviors. Initial increases in substance abuse or self-harming behavior may set off a trajectory that perpetuates and intensifies the underlying issues.

In Table 4, I use classical 2SLS and impose linear models in the first and second stages. As shown in Figure 2, each endogenous variable increases approximately linearly with the relevant instrument. Since the IV estimator is the ratio of the reduced form to the first stage, probing the reduced-form relationships is also useful. Based on Figure 4, assuming a linear relationship between the risk of hospitalization and first-day peer exposure seems reasonable. Figure A6 provides the corresponding figure for youths with no history of substance abuse and self-harm. Figure A6 also illustrates the relationship between first-day peer exposure and future hospitalization when the number of peers (rather than the share) with a certain history is used.

Figure 4. *Reduced-Form Relationship Between First-Day Peer Exposure and Hospitalization*



Note: Black dots represent the risk of hospitalization (in percent) due to substance abuse and self-harm post-placement over the share of first-day peers with a history of the corresponding behavior interacted with own history. All values are residualized and mean-standardized using facility-by-year FEs, no own history interacted with first-day peer exposure, and own history.

Tables A8-A9 demonstrate that the main results are robust to changes in specification, sample selection, and instrument construction. The results are also robust to dropping each facility. Table A10 offers estimated effects when first-day peer exposure (without interacting with own history) is used as an instrument for a binarized version of total peer exposure. The results in column 1 imply that youths whose total exposure to peer substance abuse is above the 25th percentile are 11.3 percentage points more likely to be hospitalized for substance abuse within 12 months of leaving NBIC compared to youths with lower total peer exposure (significant at the 5% level).

It is not surprising that the effect of peer substance abuse is detectable even when I do not

allow for separate effects by own history since 59% of youths have a history of substance abuse. However, only 6% of youths have a history of self-harm. Hence, not allowing for separate effects by own history, and the lack of an introductory peer effect in self-harm, results in a positive but not statistically significant peer effect in self-harm (Table A10, columns 3-4).

5.2 Are there no introductory peer effects?

I cannot rule out the presence of introductory peer effects. The outcomes used as proxies for future substance abuse and self-harm (hospitalizations) are extreme. In Sweden, only individuals with severe injuries or illnesses that cannot be treated within the outpatient healthcare system are hospitalized. If there are introductory peer effects, it might take several years before the behavior has progressed to the point where I can observe an effect on hospitalizations.

In addition, a third of youths are readmitted to NBIC within one year of ending their first placement. Table A11 presents evidence that exposure to peers with a history of substance abuse increases the likelihood of being readmitted to NBIC within one year, even for youths with no history of substance abuse. By stopping incidents and (when needed) providing healthcare, NBIC staff may prevent some hospitalizations. Hence, I may fail to identify youths who engage in behavior that would result in hospitalization had the youth not been placed at NBIC.

Lastly, note that all youths at NBIC have some problematic behavior. Substance abuse and crime are the most common types. I may fail to identify an introductory peer effect in substance abuse if exposure to peer substance abuse increases the risk of future substance abuse at a similar rate as exposure to peer crime does.

5.3 Heterogeneity

Table A12 presents separate effects by youth characteristics (sex, foreign background, and age), while Table A13 presents separate effects by facility characteristics (occupancy, whether the youth had to move to a facility in a new county, and peer group size). A reinforcing peer effect is estimated in all subgroups, but the estimates are at times imprecise. Interestingly, the reinforcing effect of exposure to peer substance abuse is significantly larger for girls than for boys. While the estimate is still positive and significant for boys, the point estimate for girls is 2.5 times as large as that for boys.

6 Mechanisms for Peer Effects in Substance Abuse & Self-Harm

The main analysis reveals large reinforcing peer effects in substance abuse and self-harm. In this section, I explore the four groups of mechanisms through which peer exposure can impact the risk of future hospitalization (as outlined in Section 1).

I begin by decomposing the peer effects in substance abuse by distinguishing between soft and hard drugs (see Table A14). I define soft drugs as alcohol, cannabis, and tobacco, while hard drugs are all other drugs. As expected, the reinforcing effect of exposure to peer substance abuse predominantly affects the risk of being hospitalized for hard drugs. Indeed, greater exposure to peers who have a history of soft drugs does not significantly impact the risk of being hospitalized for substance abuse in the following year. In contrast, exposure to peers who have a history of hard drugs significantly increases the risk, regardless of the youth's own history. Interestingly, exposing youths with no history of hard drugs to peers with a history of hard drugs significantly increases (10% significance level) the risk of being hospitalized for abuse of a *soft* drug.

6.1 Social Influence

Does social influence drive the estimated effects of peer exposure? To explore this channel, I first examine the presence of peer effects while the youth is still placed at NBIC. Since there is staff around the clock at NBIC with medical training, and NBIC staff members have the right to use coercive measures such as body searches, youths are rarely hospitalized for substance abuse and self-harm during placement. Nevertheless, 1.0% (0.5%) of youths are hospitalized for substance abuse (self-harm) during the first three months of their NBIC placement.

Figure A7 presents OLS-estimated effects of first-day peer exposure on the risk of being hospitalized due to substance abuse and self-harm during the months after admission but before the youth leaves NBIC. I examine the reduced-form impact of first-day peer exposure rather than the effect of total peer exposure, as the outcome is measured during placement. Since the median placement length is three months, I use three months as the cutoff. Due to the smaller sample size, the confidence intervals are wide and the estimates are imprecise at times. Nevertheless, in line with the main results, the point estimates for peer substance abuse and self-harm are positive among youths with a prior history of the corresponding behavior by month 3 after arriving at NBIC.

Moreover, there appears to be considerable clustering of severe substance abuse and self-harm incidents: more than 1 in 5 youths who are hospitalized for substance abuse (self-harm) while placed at NBIC are hospitalized (at least once) in the same month as their peer is hospitalized for the same reason, i.e., with the same main diagnosis code.

Prior studies document that social influence tends to be stronger in groups with similar characteristics (Billings and Schnepel, 2022). To inspect whether peer effects increase with connectivity in the current context, I first calculate two new sets of instruments: (i) the first-day share of peers with history h and the same sex as the youth and (ii) the first-day share of peers with history h and the opposite sex as the youth. In Table A15, I use these variables as instruments for the total exposure to peers with history h and the same (or opposite) sex as the youth. The results

indicate that the reinforcing peer effects in substance abuse and self-harm are entirely driven by exposure to peers of the same sex. In fact, the point-estimated effects of opposite-sex peer history are negative, but only the effect of exposure to opposite-sex self-harm is statistically significant. In Table A16, I do the same type of exercise but focusing on connectivity in terms of age. Again, the reinforcing peer effects are driven by exposure to peers who exhibit the same characteristic.

Last, if peer behavior affects own behavior through direct exposure to substance abuse and self-harm incidents, exposure to peers with a history of substance abuse (but not self-harm) should increase the length of time the youth spends at NBIC because the SWC takes into account substance abuse but not self-harm when deciding to end the youth's NBIC placement. In Table A17, I regress the number of days spent at NBIC on first-day peer exposure by own history. As expected, exposure to peers with a history of substance abuse significantly increases (1% significance level) the time youths with a history of substance abuse spend at NBIC. Exposure to peers with a history of self-harm, on the other hand, does not significantly increase placement duration.

All in all, these results speak in favor of peers influencing youth substance abuse and self-harm through direct exposure to peer behavior.

6.2 Social Learning

If social learning is an important driver of the main effects, we should expect larger effects for youths with relatively low experience of the behavior. The lack of introductory peer effects (i.e., peer effects for youths with no history of the behavior) in the full sample speaks against social learning being a major driver of the harmful peer influences. If experience is correlated with age, we should expect larger peer effects in young subsamples. However, I do not find that the effects are significantly larger among youths aged below 15 (Table A12, columns 7-9).

6.3 Spread of Mental Illness

As shown in Table A5, there is no statistically significant effect of peer depression on the likelihood of hospitalization due to substance abuse or self-harm in the year following placement. Likewise, regressing an indicator for post-placement hospitalization due to depression on peer depression interacted with own history of depression does not yield significant estimates (Table A6). Hence, my results do not support the existence of depression contagion. Neither can I find any evidence that exposure to peers with a history of any other mental disorder (excluding substance abuse and self-harm) adversely affects own mental health (Table A6, Column 3).

6.4 Treatment Provision

A youth's treatment can be disrupted if the youth runs away from NBIC or must switch to a new facility. Even though the security of NBIC facilities is supposed to be high, it is common to escape: almost 1 in 5 manage to escape at least once during their first placement spell. In support of the treatment channel, there is suggestive evidence that exposure to peers with a history of substance abuse increases the number of days on the run if the youth has a history of substance abuse (Table A17, Column 7).[14] On the other hand, the reinforcing peer effect in substance abuse is still large and statistically significant in the subsample of youths who never ran away during their first placement spell (Table A18, Column 5). Moreover, as shown in columns 2-3 of Table A17, I find no statistically significant effects of first-day peer exposure on the likelihood of switching facilities or the number of facility switches during the placement spell.

Substance-abusing and self-harming peers may also affect the quality of the available care by being particularly resource-demanding. Hence, I consider other groups of youths who likely require high-intensity care: youths with neurodevelopmental disorders and youths who have committed violent crimes. In Table A19, I regress my main outcomes (hospitalization due to substance abuse and self-harm by month 12) on these alternative first-day peer measures interacted with own history of substance abuse and self-harm, respectively. There is no evidence that exposure to peers with such backgrounds increases the risk of hospitalization due to substance abuse and self-harm. While I cannot offer conclusive evidence, these results suggest that the main results are not driven by exposure to resource-demanding peers.

Moreover, substance-abusing peers may adversely affect the quality of care by increasing the availability of drugs within the NBIC facility. Drugs typically enter the facilities through visitors. Hence, youths who are placed far away from their original network of dealers and friends may be more reliant on the capacity of their NBIC peers to bring in illegal substances. We should thus see a greater effect of exposure to peers with a history of substance abuse among youths who are placed in a facility outside their home county. However, as shown in Table A13, there is no statistically significant difference in the reinforcing peer effect in substance abuse by whether the youth is moved to a new county.

[14] Treatment can also be affected by being placed in isolation, which implies that the youth is kept separate from the other youths and only has contact with staff members. However, it is not evident that exposure to substance-abusing or self-harming peers would influence time spent in isolation. Isolation is supposed to be used if staff members believe that the youth will benefit from receiving care alone. Isolation is sometimes (inaccurately) used as a punishment. As shown in Table A17, no statistically significant effects are found on the likelihood of being placed in isolation or the number of days spent in isolation.

7 Additional Results

7.1 Effect of Peer Substance Abuse & Self-Harm on Education

Given the large, reinforcing peer effects in substance abuse and self-harm, a natural follow-up question is whether exposure to peer substance abuse and self-harm impacts classical economic outcomes. Since the sample is comprised of youths, I focus on educational attainment. Specifically, since the sample is highly disadvantaged, I use the lowest step in the education ladder in Sweden as an outcome: whether the youth attains sufficient grades to be eligible for high school by age 21 (see Section 2 for details on the Swedish education system).

As seen in Table 5, simple OLS regression returns negative point estimates. When first-day peer exposure by own history are used as instruments for total peer exposure by own history, the estimated effects of total exposure to peer substance abuse become larger in absolute magnitude. In particular, among youths with a history of substance abuse, the estimate in the first column (-0.0026) implies that a 1-standard-deviation increase in total exposure to peer substance abuse (75.1) reduces the chance of being eligible for high school by age 21 by 19.2 percentage points. No statistically significant effect of exposure to peer self-harm on educational attainment is found.

To explore whether the effect on own substance abuse is an important channel for the effect of peer substance abuse on educational attainment, I use first-day peer exposure by own history as instruments for own substance abuse, where own substance abuse is measured as an indicator taking the value 1 if the youth is hospitalized due to substance abuse by month 12 after leaving NBIC. The IV results in Table A20 imply that, among compliers, youths who are hospitalized by month 12 are 87 percentage points less likely to be eligible for high school by age 21 compared to youths who are not hospitalized for substance abuse. Compliers are in this context youths whose hospitalization status depends on the first-day share of substance-abusing peers. Since the first-stage relationship between first-day peer composition and hospitalization is weak (effective F-statistic around 8-9), weak-instrument robust methods should be used for inference (Andrews et al., 2019). The AR test, which is robust to weak identification, yields a p-value below 5%.

All in all, the effect of peers on own substance abuse appears to be an important mechanism through which exposure to peer substance abuse impacts educational attainment. However, it is unlikely that this is the only channel since prior studies have found evidence of direct peer effects in education (see Sacerdote, 2011). In particular, if peers with a history of substance abuse tend to perform poorly in school, there is likely a direct effect of being exposed to low-achieving peers on youths' own educational performance.

Table 5. *Effect of Peer Substance Abuse and Self-Harm on Eligibility for High School*

	Substance Abuse		Self-Harm	
	(1)	(2)	(3)	(4)
Ordinary Least Squares				
Own history*Total peer exposure	-0.0001**	-0.0001*	-0.0010	-0.0010
	(0.0001)	(0.0001)	(0.0008)	(0.0008)
No own history*Total peer exposure	-0.0003***	-0.0003***	-0.0009**	-0.0008**
	(0.0001)	(0.0001)	(0.0004)	(0.0004)
Ordinary Least Squares (Complier Reweighted)				
Own history*Total peer exposure	-0.0001	-0.0000	-0.0011	-0.0007
	(0.0001)	(0.0001)	(0.0014)	(0.0014)
No own history*Total peer exposure	-0.0004***	-0.0003***	-0.0005	-0.0003
	(0.0001)	(0.0001)	(0.0004)	(0.0004)
Reduced-Form Regression				
Own history*FD peer exposure	-0.1206**	-0.1319**	-0.0206	0.0367
	(0.0505)	(0.0514)	(0.1985)	(0.1917)
No own history*FD peer exposure	-0.0437	-0.0662	0.0421	0.0822
	(0.0523)	(0.0534)	(0.0777)	(0.0806)
Instrumental Variable Model				
Own history*Total peer exposure	-0.0026**	-0.0029**	0.0004	0.0024
	(0.0011)	(0.0012)	(0.0042)	(0.0042)
No own history*Total peer exposure	-0.0019	-0.0025*	0.0017	0.0035
	(0.0013)	(0.0014)	(0.0032)	(0.0034)
Complier dep. mean if own hist.=1	0.0440	0.0649	0.1720	0.1702
Complier dep. mean if own hist.=0	0.0927	0.0955	0.1933	0.2113
Δ% (per 1 s.d.) if own hist.=1	-435.82	-330.13	4.60	24.77
Δ% (per 1 s.d.) if own hist.=0	-158.13	-199.42	10.41	19.72
Test of equality (p-value)	0.4144	0.6425	0.7183	0.7394
Joint AR p-value	0.0429	0.0326	0.8466	0.5965
AR confidence set β_0 (95%)	[-.0058,0]	[-.0064,-.0005]	[-.0105,.0114]	[-.0086,.0134]
AR confidence set β_1 (95%)	[-.0057,.001]	[-.0066,.0007]	[-.0058,.0091]	[-.0044,.0113]
Youth & peer controls	No	Yes	No	Yes
Observations	8502	8502	8502	8502

Note: The dependent variable is an indicator taking the value 1 if the youth attains sufficient grades to be eligible for high school by age 21. The 'Education Sample' is used. All regressions control for own history and facility-by-year FEs. Whether controls for youth and first-day peer characteristics (as listed in Table 1) are included is indicated at the bottom of the table. Standard errors are clustered at the facility-by-day-of-entry level. * $p < .1$. ** $p < .05$. *** $p < .01$.

7.2 Optimal Allocation of Youths

Given that the harmful peer effects are significantly larger if the youth has a history of the same behavior, the question arises whether it is optimal to separate youths with similar behavioral backgrounds. However, all youths placed in NBIC facilities have behavioral problems. After substance abusers, the main group is youths with a criminal background. A concern frequently raised in the public debate is that youths admitted to NBIC facilities are victimized by criminal peers. In Table 6, I examine the (reduced-form) impact of the first-day share of peers with a

criminal background on the risk of receiving in- or outpatient care for assault within 12 months of entering an NBIC facility. Indeed, being placed in a facility on a day with a higher share of criminal peers significantly increases the risk of receiving care for an injury sustained through assault (5% significance level).

Table 6. *Effect of Criminal Peers on Risk of Assault*

	(1)	(2)
FD peer crime	0.0456**	0.0499**
	(0.0207)	(0.0214)
Dependent mean	0.0327	0.0327
%Δ from 1 s.d. Δ	23.61	25.82
Youth & peer controls	No	Yes
Observations	12764	12764

Note: The dependent variable is an indicator taking the value 1 if the youth is hospitalized for injuries sustained through assault within 12 months of entering NBIC. FD peer crime is the share of peers on the youth's first day with a criminal background. The 'Main Analysis Sample' is used. All regressions include facility-by-year FEs. The bottom of the table indicates whether controls for the full set of youth and first-day peer characteristics (including peer substance abuse and self-harm) are added. Standard errors are clustered at the facility-by-day-of-entry level. * $p < .1$. ** $p < .05$. *** $p < .01$.

This exercise illustrates the existence of other adverse spillovers across youths beyond reinforcing peer effects in substance abuse and self-harm. Hence, spreading youths with substance abuse and self-harm across facilities, and thereby increasing the share of youths with other behavioral backgrounds, might not be optimal.

As shown in Tables A15-A16, the adverse peer effects in substance abuse and self-harm are driven by peers of the same sex and age. However, mixing boys and girls to a greater extent to reduce such adverse peer effects may result in, for example, higher rates of teen pregnancies and sexual victimization. Similarly, increased age heterogeneity may lead to more victimization. In addition, since NBIC has limited resources and the needs of a 10-year-old are very different from a 20-year-old, such an intervention could also adversely impact the quality of the care.

8 Conclusion

This paper examines how exposure to peers with a history of substance abuse and self-harm in residential treatment facilities affects youth outcomes. To identify causal effects, I exploit novel data and plausibly exogenous variation in first-day peer exposure within facility-by-year cells in an IV framework.

I find strong evidence of reinforcing and persistent peer effects in substance abuse and self-harm. Increased exposure to peers with a pre-placement history of substance abuse (self-harm)

greatly increases the risk of hospitalization due to substance abuse (self-harm) in the year after discharge, but only if the youth has a history of the same behavior. The strong effects persist even after controlling for a rich set of alternative peer characteristics (crime, neurodevelopmental disorder, depression, other mental disorder, gender, age, and foreign background).

Interestingly, I do not find significant introductory peer effects in substance abuse and self-harm. Compared to the reinforcing peer effects, the estimated effects on youths without a history of substance abuse and self-harm are significantly smaller.

The empirical evidence suggests that the adverse effects of exposure to peer substance abuse and self-harm are generated by peers reinforcing each other's addictive and self-harming behaviors through social influence. The effects are driven by peers who share similar characteristics.

Moving beyond the peer-to-peer spread of substance abuse and self-harm, I also show that increased exposure to peer substance abuse sharply decreases the likelihood of attaining sufficient grades to be eligible for high school. A key channel appears to be peers' effect on own substance abuse.

The findings of this paper do not imply that we should spread substance-abusing and self-harming youths across facilities. All else equal, such a change would mechanically increase these youths' exposure to peers who struggle with other types of problematic behaviors, where the largest group following substance abuse is criminal behavior. Exposure to such peers can also adversely affect youth outcomes. As an example, I show that increased exposure to criminal peers increases the likelihood of being hospitalized for injuries sustained through assault.

Given that previous literature shows that court-ordered placement of youths in NBIC facilities (and other forms of out-of-home care) has large adverse health effects, reducing the extent to which youths are placed in NBIC facilities might generate better outcomes. However, more research on 'what works' in child protection is needed. In particular, future studies that can credibly compare the effects of different placement types and the role of key features (such as staff education) are essential for the design of welfare-improving child protection policies.

This paper is limited to youths placed in residential facilities. The social spillovers of substance abuse and self-harm might be very different for other populations (e.g., adults), in other settings (e.g., schools), and for other types of relationships (e.g., parent-child interactions). Moreover, 95% of the youths in the studied sample are placed involuntarily. A study conducted using youths who are voluntarily admitted for treatment in residential facilities might yield different results. Future studies on spillovers in substance abuse and self-harm using other samples are needed.

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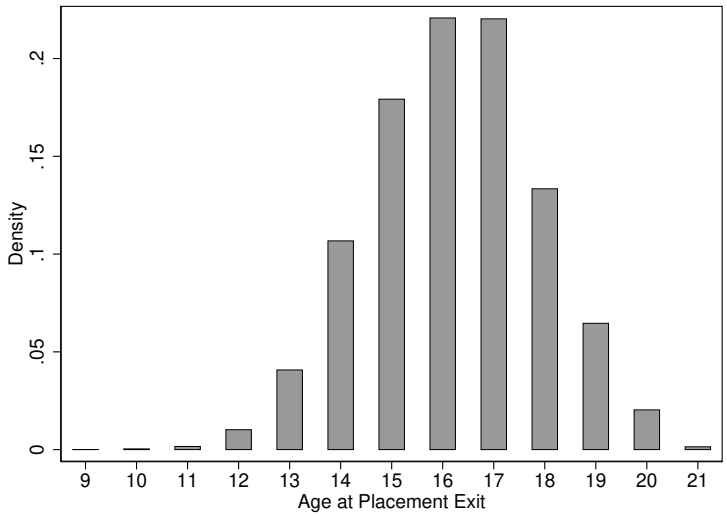
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Appendix

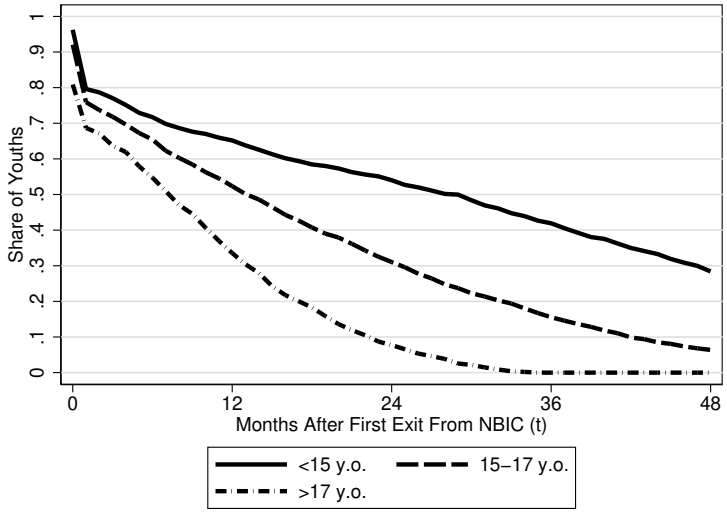
A Additional Results

Figure A1. *Age at Placement Exit*



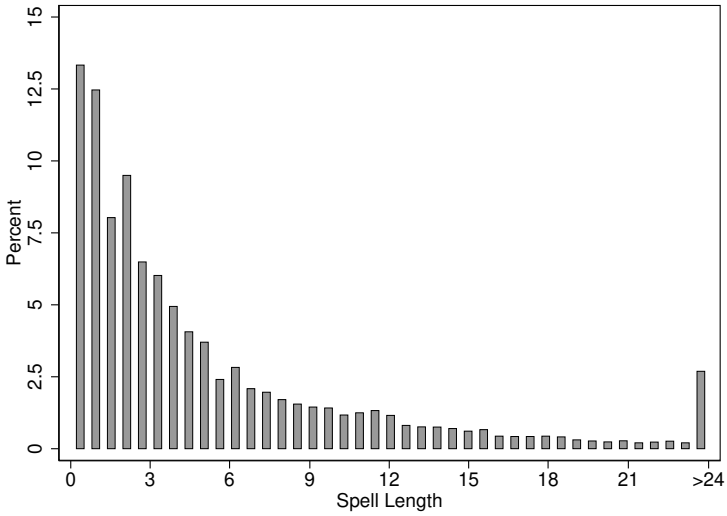
Note: This figure presents the distribution of youth age on the day the youth's first NBIC placement ends. The 'Main Analysis' sample is used.

Figure A2. *Share of Youths in Out-of-Home Care After First Exit*



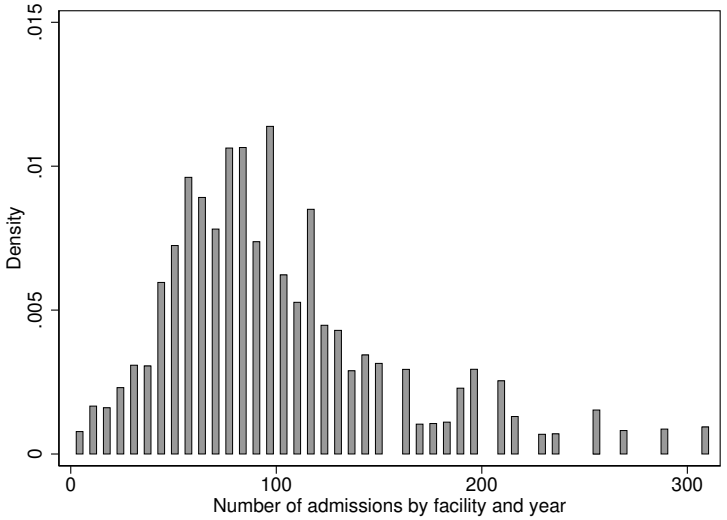
Note: This figure shows the share of youths (by age at admission) who are in any form of out-of-home care (including foster family, group home, and institution) for at least one day during month t after exiting NBIC at month 0. The 'Main Analysis Sample' is restricted to youths who exited care before 2013, because the non-NBIC placement data is known to suffer from underreporting from 2014 onward. N=7,572.

Figure A3. *Length of Placement Spell*



Note: This figure presents the distribution of placement spell lengths. I use the full sample of first-time placements but restricted to placements that start before 2020 since I only have information about exit dates until the end of 2021 (N=15,562).

Figure A4. *Number of Admissions by Facility and Year*



Note: This histogram shows the number of admissions by facility and year using data on all NBIC admissions during 2000-2020 (N=50,191). A youth can enter multiple facilities during a single placement spell if the NBIC placement unit decides to move the youth to a new facility.

Table A1. *Own History as Predictor of Hospitalization*

	Substance Abuse		Self-Harm	
	(1)	(2)	(3)	(4)
Own substance abuse	0.0635***	0.0453***		0.0063*
	(0.0042)	(0.0042)		(0.0036)
Own self-harm		0.0425***	0.1030***	0.0724***
		(0.0129)	(0.0122)	(0.0119)
Youth controls	No	Yes	No	Yes
Adjusted R-squared	0.0389	0.0601	0.0333	0.0537
Dependent mean	0.0673	0.0673	0.0341	0.0341
Observations	12739	12739	12739	12739

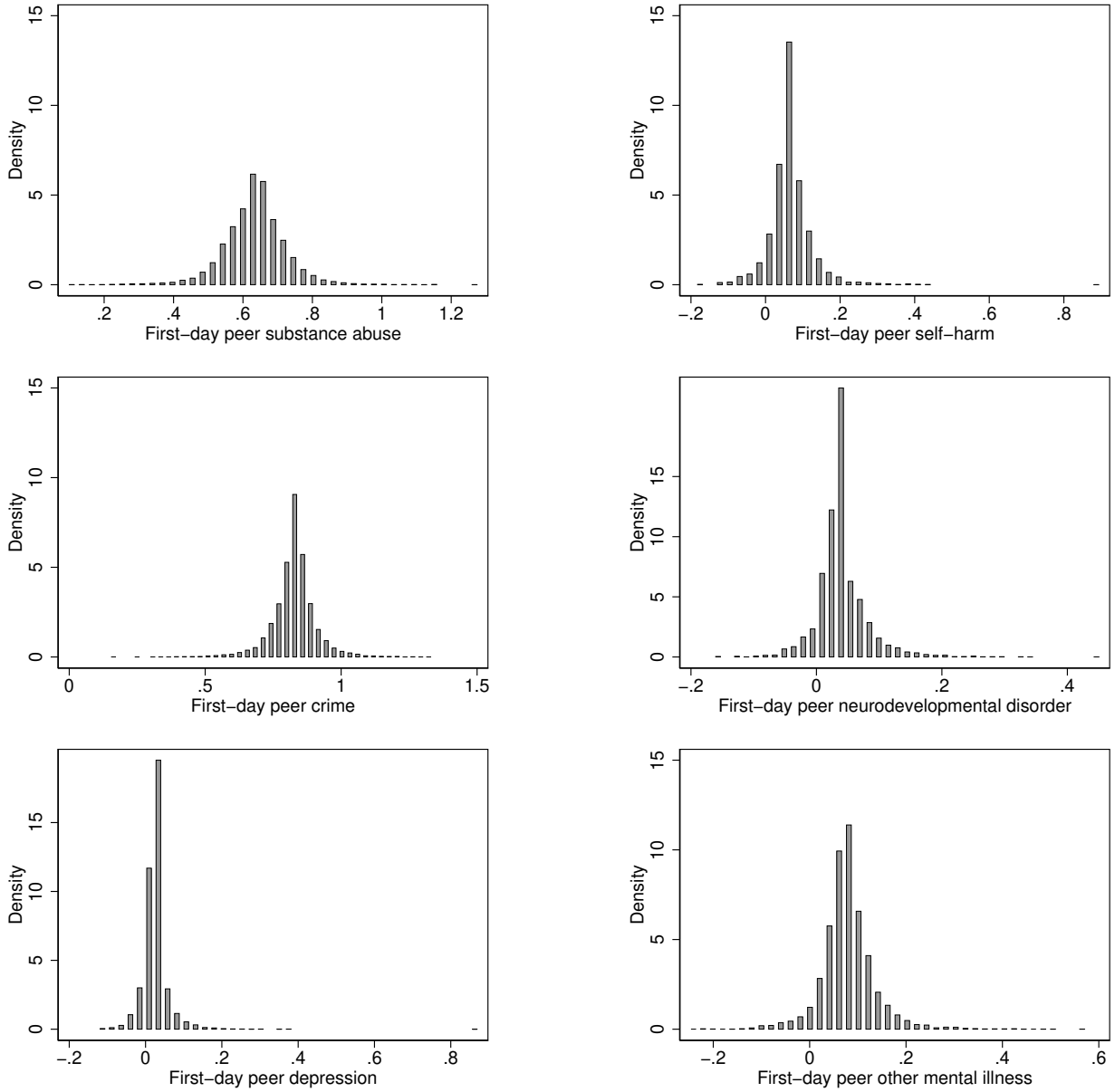
Note: The dependent variable is an indicator taking the value 1 if the youth is hospitalized due to substance abuse (columns 1-2) or self-harm (columns 3-4) by month 12 after exit from the first placement spell at NBIC. Each dependent variable is regressed on indicators that take the value 1 if the youth has a pre-placement history of substance abuse or self-harm. All specifications are estimated using OLS and include facility-by-year FEs. The full set of youth characteristics listed in Table 1 are included as controls in columns 2 and 4. The 'Main Analysis Sample' is used. Standard errors are clustered at the facility-by-day-of-entry level. * $p < .1$. ** $p < .05$. *** $p < .01$.

Table A2. *Additional Test of Conditional Random Assignment of First-Day Peer Exposure*

	2002-2020 Sample		Main Analysis Sample		Education Sample	
	(1)	(2)	(3)	(4)	(5)	(6)
A: First-Day Peer Substance Abuse						
Own substance abuse	0.0219***	-0.0019	0.0230***	-0.0009	0.0189***	-0.0046
	(0.0025)	(0.0039)	(0.0027)	(0.0044)	(0.0032)	(0.0059)
Dependent mean	0.6339	0.6339	0.6300	0.6300	0.5834	0.5834
B: First-Day Peer Self-Harm						
Own self-harm	0.0158***	0.0006	0.0157***	0.0010	0.0139***	0.0045
	(0.0031)	(0.0052)	(0.0032)	(0.0054)	(0.0038)	(0.0076)
Dependent mean	0.0658	0.0658	0.0676	0.0676	0.0629	0.0629
Facility*year FEs	No	Yes	No	Yes	No	Yes
Observations	14072	14072	12832	12832	8692	8692

Note: The dependent variable is the share of peers with a history of substance abuse (Panel A) or self-harm (Panel B) on the first day of the youth's placement. All models are estimated with OLS and control for the facility-by-year leave-out mean. Columns 2, 4, and 6 also include facility-by-year FEs. Standard errors are clustered at the facility-by-day-of-entry level. * $p < .1$. ** $p < .05$. *** $p < .01$.

Figure A5. *Variation in Residualized First-Day Peer Exposure*



Note: This figure displays the variation in the share of peers with a pre-placement history of substance abuse, self-harm, crime, neurodevelopmental disorder, depression, and other mental illness, respectively, on the first day of youth *i*'s arrival after accounting for facility-by-year FEs. The relevant peer variable is indicated on the x-axis. The '2002-2020 Sample' is used.

Table A3. *First-Stage Estimates of First-Day Peer Exposure on Total Peer Exposure in Subsamples*

	Gender		Background		Age	
	(1) Girl	(2) Boy	(3) Foreign	(4) Native	(5) <15	(6) ≥15
*A: Own History*Total Peer Exposure (Substance Abuse)*						
Own history*FD peer exposure	30.9499***	39.3863***	30.9902**	37.3454***	40.2309***	31.5664***
	(7.4059)	(6.9914)	(12.6537)	(5.5310)	(9.0559)	(6.1438)
Dep. mean if own hist.=1	56.58	60.89	64.89	58.08	53.78	60.32
Sanderson-Windmeijer *F*-statistic	23.12	20.18	9.75	35.36	23.22	16.46
*B: No Own History*Total Peer Exposure (Substance Abuse)*						
No own history*FD peer exposure	45.5887***	52.1570***	47.6037***	49.1755***	55.7212***	45.7262***
	(8.0979)	(7.5324)	(11.9382)	(6.4721)	(9.3137)	(6.8883)
Dep. mean if own hist.=0	49.78	55.38	54.91	52.75	50.33	55.06
Sanderson-Windmeijer *F*-statistic	27.28	18.13	8.99	31.61	34.34	15.00
*C: Own History*Total Peer Exposure (Self-Harm)*						
Own history*FD peer exposure	55.7416***	38.6284***	65.6066***	58.6764***	42.8697***	63.2265***
	(9.2605)	(7.6380)	(18.1759)	(9.4666)	(14.1868)	(8.8291)
Dep. mean if own hist.=1	12.10	4.55	6.56	10.04	10.35	9.28
Sanderson-Windmeijer *F*-statistic	40.11	65.05	10.62	74.84	15.50	67.58
*D: No Own History*Total Peer Exposure (Self-Harm)*						
No own history*FD peer exposure	23.0560***	25.4344***	27.8453***	23.4578***	26.5640***	23.7371***
	(2.8495)	(2.1259)	(7.4691)	(2.1437)	(4.2842)	(2.3163)
Dep. mean if own hist.=0	9.98	4.01	5.26	6.17	6.63	5.75
Sanderson-Windmeijer *F*-statistic	39.24	126.85	9.55	78.84	28.95	68.04
Observations	4429	8389	2995	9812	2842	9931

Note: First-stage estimates in subsamples of the 'Main Analysis Sample'. The subsample used when re-estimating the first stage is indicated in the column heading. All estimations include controls for own history, the alternative instrument, and facility-by-year FEs. Standard errors are clustered at the facility-by-day-of-entry level. Sanderson-Windmeijer *F*-statistic is for the displayed instrument. * $p < .1$. ** $p < .05$. *** $p < .01$.

Table A4. *Test of Selective Attrition*

	(1) Missing in Statistics Sweden's Register Data	(2) Missing in Main Analysis Sample	(3) Missing in Education Sample
FD peer substance abuse	0.0095	-0.0017	0.0158
	(0.0218)	(0.0073)	(0.0181)
FD peer self-harm	-0.0056	0.0103	-0.0027
	(0.0302)	(0.0176)	(0.0275)
Dependent mean	0.0826	0.0072	0.0219
Observations	14621	12832	8692

Note: I use the '2002-2020 Sample' and regress indicators for youth missing in (i) Statistics Sweden's register data, (ii) the 'Main Analysis Sample', and (iii) the 'Education Sample' on first-day peer substance abuse and self-harm. All regressions include facility-by-year FEs. Standard errors are clustered at the facility-by-day-of-entry level. * $p < .1$. ** $p < .05$. *** $p < .01$.

Table A5. *Effect of All First-Day Peer Characteristics by Own History on Hospitalization*

	(1) Substance Abuse	(2) Self-Harm
Substance abuse*Peer substance abuse	0.0967***	0.0166
	(0.0274)	(0.0216)
Not substance abuse*Peer substance abuse	-0.0121	0.0129
	(0.0239)	(0.0213)
Self-harm*Peer self-harm	0.1489	0.2822**
	(0.1409)	(0.1405)
Not self-harm*Peer self-harm	0.0301	-0.0031
	(0.0484)	(0.0322)
Crime*Peer crime	-0.0372	-0.0209
	(0.0334)	(0.0237)
Not crime*Peer crime	0.0663	-0.0064
	(0.0422)	(0.0307)
NDD*Peer NDD	-0.0678	0.4224
	(0.2674)	(0.2676)
Not NDD*Peer NDD	-0.0124	0.0022
	(0.0630)	(0.0444)
Depression*Peer depression	0.1619	-0.0986
	(0.4646)	(0.3981)
Not depression*Peer depression	-0.0715	-0.0340
	(0.0734)	(0.0576)
Other mental illness*Peer other mental illness	0.0165	0.0526
	(0.1186)	(0.1123)
Not other mental illness*Peer other mental illness	-0.0159	-0.0594*
	(0.0452)	(0.0327)
Female*Peer female	0.0550	-0.0277
	(0.0421)	(0.0357)
Not female*Peer female	0.0421	-0.0735**
	(0.0393)	(0.0334)
Foreign*Peer foreign	-0.0528*	0.0220
	(0.0274)	(0.0240)
Not foreign*Peer foreign	-0.0006	0.0287
	(0.0262)	(0.0228)
<15 y.o.*Peer <15 y.o.	-0.0002	0.0051
	(0.0274)	(0.0261)
Not <15 y.o.*Peer <15 y.o.	0.0348	-0.0139
	(0.0273)	(0.0258)
Peer missing, yrs t to t-2	0.1067*	-0.0696
	(0.0573)	(0.0432)
Dep. mean if own hist.=1	0.0973	0.1423
Dep. mean if own hist.=0	0.0237	0.0269
Observations	12739	12739

Note: The dependent variable in column 1 (2) is an indicator for hospitalization by month 12 due to substance abuse (self-harm). Each dependent variable is regressed on all first-day peer exposure variables interacted with the youth's own history of the corresponding behavior. Both specifications are estimated using OLS and control for the full set of own history variables and facility-by-year FEs. The dependent mean is conditional on the youth's own history of substance abuse (column 1) and self-harm (column 2). The 'Main Analysis Sample' is used. Standard errors are clustered at the facility-by-day-of-entry level. * $p < .1$. ** $p < .05$. *** $p < .01$.

Table A6. *Peer Effects in Criminality, Depression, and Any Other Mental Disorder*

	(1)	(2)	(3)
	Crime	Depression	Any Mental Disorder Excl. Sub. Abuse & Self-Harm
Own history*FD peer exposure	0.0546	0.0983	-0.0741
	(0.0600)	(0.2412)	(0.0748)
No own history*FD peer exposure	-0.0981	-0.0044	-0.0613**
	(0.0645)	(0.0218)	(0.0256)
Dep. mean if own hist.=1	0.3284	0.0608	0.1419
Dep. mean if own hist.=0	0.1686	0.0055	0.0206
Test of equality (p-value)	0.0139	0.6710	0.8565
Observations	9851	12739	12739

Note: The dependent variable in column 1 is an indicator equal to one if the individual commits a crime for which guilt is established or is readmitted due to their criminal behavior by month 12 after exit from the first placement spell at NBIC. The 'Main Analysis Sample' is restricted to youths who were at least 15 when they were admitted to NBIC. The dependent variable in column 2 (3) is an indicator equal to one if the individual is hospitalized due to depression (any mental disorder excluding substance abuse and self-harm) by month 12 after exit. The 'Main Analysis Sample' is used. Each dependent variable is regressed on first-day peer exposure interacted with the youth's history of the behavior indicated in the top row. All specifications are estimated using OLS and control for own history of the behavior indicated in the top row and facility-by-year FEs. Standard errors are clustered at the facility-by-day-of-entry level. * $p < .1$. ** $p < .05$. *** $p < .01$.

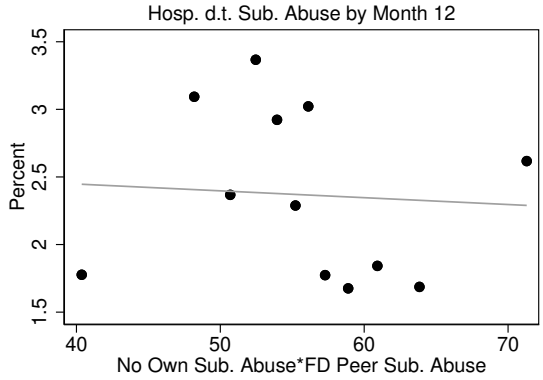
Table A7. *Descriptive Statistics by History and Complier Status*

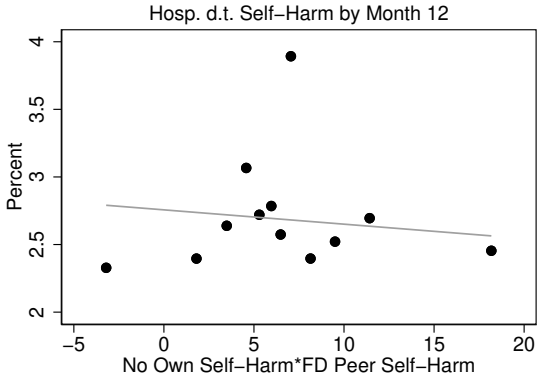
		Substance Abuse				Self-Harm			
		Hist.=1		Hist.=0		Hist.=1		Hist.=0	
	All	All	Compliers	All	Non-Compliers	All	Compliers	All	Non-Compliers
Female	0.35	0.34	0.36	0.36	0.48	0.65	1.00	0.33	0.62
Foreign	0.24	0.20	0.19	0.29	0.25	0.16	0.12	0.24	0.22
Age	15.76	16.24	17.31	15.06	15.35	16.13	16.10	15.73	15.58
History of:									
Substance abuse	0.59	1.00	1.00	0.00	0.00	0.74	0.67	0.58	0.63
Self-harm	0.06	0.08	0.13	0.04	0.03	1.00	1.00	0.00	0.00
Crime	0.76	0.75	0.80	0.77	0.68	0.58	0.49	0.77	0.69
Neurodevelopmental disorder	0.04	0.03	0.02	0.04	0.07	0.12	0.06	0.03	0.04
Depression	0.02	0.03	0.04	0.02	0.03	0.14	0.17	0.02	0.07
Other mental illness	0.07	0.07	0.08	0.08	0.06	0.29	0.47	0.06	0.09
Observations	12832	7608	12832	5224	12832	803	12832	12029	12832

Note: This table presents descriptive statistics on youth characteristics by the youth's history and complier status. To characterize the subpopulation of compliers, I follow Chyn et al. (2025) and adopt Abadie (2003)'s procedure. Specifically, the complier-weighted average of characteristic c among youths with history h is the coefficient of *Own history*Total peer exposure* in a 2SLS regression of the interaction term *c*Own history*Total peer exposure* on *Own history*Total peer exposure* and *No own history*Total peer exposure*, instrumented by *Own history*FD peer exposure* and *No own history*FD peer exposure*. Controls of own history and facility-by-year FEs are included. For youths without history h, the complier-weighted average is obtained by using *No own history* in the construction of the outcome variable. The 'Main Analysis' sample is used. The observation count reflects the number of observations used to construct the descriptive statistics, which is the full 'Main Analysis' sample when using Abadie (2003)'s procedure.

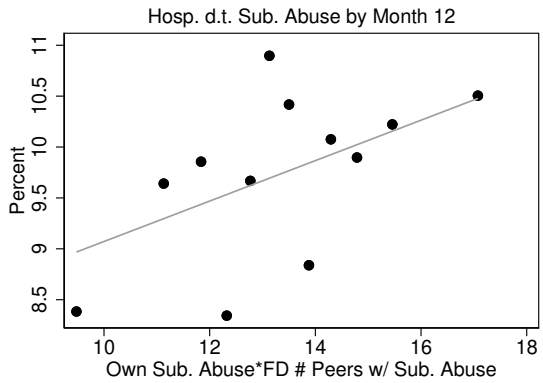
Figure A6. *Relationship Between First-Day Peer Exposure and Post-Exit Outcomes*

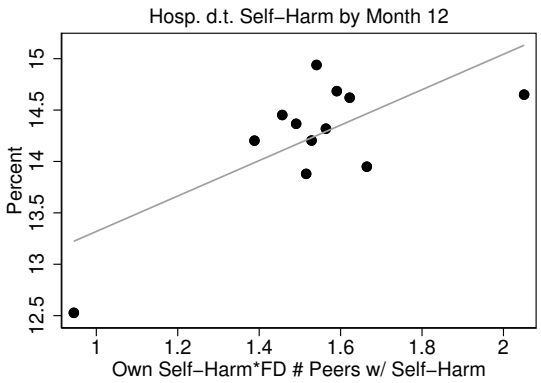
*Panel A. No Own Hist.*First-Day Share of Peers With Hist.*



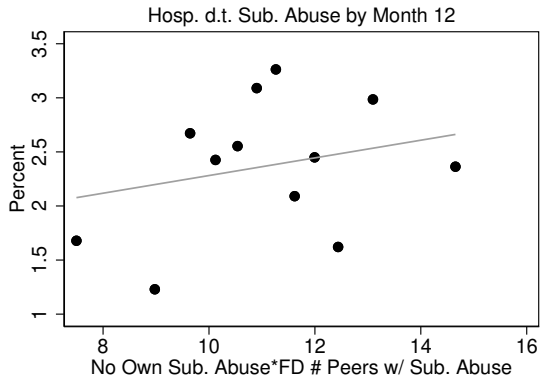


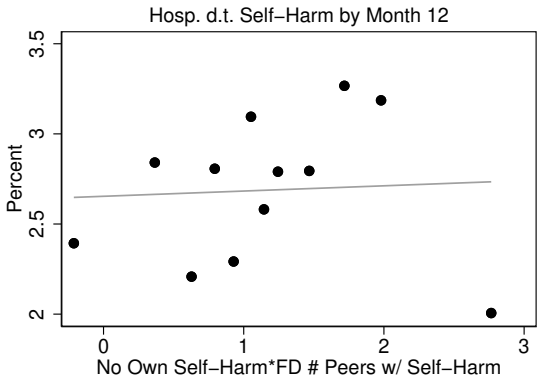
*Panel B. Own Hist.*First-Day Number of Peers With Hist.*





*Panel C. No Own Hist.*First-Day Number of Peers With Hist.*





Note: Black dots represent the risk of hospitalization due to substance abuse (left subfigures) and self-harm (right subfigures) post-placement over the share of first-day peers with history h among youths with no such history (Panel A), number of first-day peers with history h among youths with the same history (Panel B), and number of first-day peers with history h among youths without such history (Panel C). All values are residualized and mean-standardized using facility-by-year FEs, own history, and the alternative instrument.

Table A8. *Robustness Checks of Effect of Peers on Hospitalization I*

	Substance Abuse		Self-Harm	
	Coeff	Std err	Coeff	Std err
A: Baseline				
Own history*Total peer exposure	0.0024***	0.0007	0.0060**	0.0031
No own history*Total peer exposure	0.0013	0.0008	0.0008	0.0016
Observations	12739		12739	
B: With Youth, Peer History, and Crime Rate Controls				
Own history*Total peer exposure	0.0022***	0.0007	0.0058*	0.0030
No own history*Total peer exposure	0.0012	0.0009	0.0009	0.0017
Observations	12561		12561	
C: With Control for Leave-out Mean History Within Facility-by-Year Cell				
Own history*Total peer exposure	0.0024***	0.0007	0.0063*	0.0033
No own history*Total peer exposure	0.0013	0.0008	0.0007	0.0016
Observations	12739		12739	
D: Clustering at Facility-by-Year Level				
Own history*Total peer exposure	0.0024***	0.0007	0.0060**	0.0027
No own history*Total peer exposure	0.0013	0.0008	0.0008	0.0013
Observations	12739		12739	
E: Facility-by-Year FEs Replaced by Facility-by-Quarter FEs				
Own history*Total peer exposure	0.0034***	0.0011	0.0106**	0.0050
No own history*Total peer exposure	0.0025	0.0016	0.0041	0.0042
Observations	12688		12688	
F: Facility-by-Year FEs Replaced by Facility FEs & Year FEs				
Own history*Total peer exposure	0.0015***	0.0004	0.0063***	0.0024
No own history*Total peer exposure	0.0001	0.0004	0.0006	0.0006
Observations	12739		12739	

Note: Panel A is the baseline. Panel B includes controls for the full sets of youth and peer characteristics (see Table 1) and the crime rate in the youth's home municipality in the month before intake. Panel C controls for the leave-out mean history within the facility-by-year cell. Panel D clusters the standard errors at the facility-by-year level. In Panels E-F, the facility-by-year FEs included in the baseline are replaced by facility-by-quarter FEs and facility and year FEs, respectively. * $p < .1$. ** $p < .05$. *** $p < .01$.

Table A9. *Robustness Checks of Effect of Peers on Hospitalization II*

	Substance Abuse		Self-Harm	
	Coeff	Std err	Coeff	Std err
A: Placements > 14 Days				
Own history*Total peer exposure	0.0022***	0.0007	0.0065**	0.0028
No own history*Total peer exposure	0.0006	0.0007	0.0005	0.0015
Observations	11415		11415	
B: First-Day Peer Exposure Restricted to Within 5th-95th Percentiles				
Own history*Total peer exposure	0.0022***	0.0007	0.0081*	0.0045
No own history*Total peer exposure	0.0005	0.0010	0.0032	0.0024
Observations	11460		11461	
C: Placements Starting in 2003 or Later				
Own history*Total peer exposure	0.0021***	0.0006	0.0060*	0.0035
No own history*Total peer exposure	0.0010	0.0008	0.0005	0.0015
Observations	11994		11994	
D: Placements Starting Before 2019				
Own history*Total peer exposure	0.0026***	0.0008	0.0083**	0.0033
No own history*Total peer exposure	0.0016*	0.0009	0.0016	0.0017
Observations	11351		11351	
E: No Siblings Placed at Same Facility at the Same Time				
Own history*Total peer exposure	0.0024***	0.0007	0.0060**	0.0031
No own history*Total peer exposure	0.0013	0.0008	0.0008	0.0016
Observations	12711		12711	
F: No Facility Movers				
Own history*Total peer exposure	0.0021***	0.0008	0.0037	0.0034
No own history*Total peer exposure	0.0012	0.0009	0.0000	0.0019
Observations	9011		9011	
G: Placements ≤ 100 days				
Own history*Total peer exposure	0.0032**	0.0015	0.0085	0.0079
No own history*Total peer exposure	0.0005	0.0013	-0.0017	0.0023
Observations	6725		6725	
H: Only Youths With History h				
Own history*Total peer exposure	0.0015***	0.0005	0.0055*	0.0030
Observations	7545		794	
I: Only Youths With History h & Binary Endogenous				
Own history*High total peer exp.	0.1093***	0.0368	0.2077*	0.1121
Observations	7545		794	
J: Share of Peers with History h on Day After Entry as Instrument				
Own history*Total peer exposure	0.0021***	0.0007	0.0064**	0.0029
No own history*Total peer exposure	0.0009	0.0008	0.0014	0.0015
Observations	12737		12737	
K: Average Share of Peers with History h During First 0-2 Days After Entry as Instrument				
Own history*Total peer exposure	0.0021***	0.0007	0.0067**	0.0028
No own history*Total peer exposure	0.0007	0.0008	0.0016	0.0015
Observations	12376		12376	

Note: The following subsamples of the 'Main Analysis Sample' are used: placements longer than 14 days (Panel A), observations with residualized first-day peer exposure values within the 5th and 95th percentiles (Panel B), placements starting after 2002 (Panel C), placements starting before 2019 (Panel D), placements of youths with no full or half siblings placed at the same facility at the same time (Panel E), youths who never switch facilities (Panel F), placements shorter than 101 days (Panel G), and youths with history h (Panel H). In Panel I, I limit the sample to youths with history h and replace the treatment with a binary version that takes the value 1 if total peer exposure is higher than the 25th percentile. In Panels J-K, the instrument is replaced with: the share of peers with history h on the day after entry (Panel J), and the average share of peers with history h during the first 0-2 days after entry (Panel K). * $p < .1$. ** $p < .05$. *** $p < .01$.

Table A10. *Peer Effects in Substance Abuse and Self-Harm Using a Binary Endogenous Variable*

	Substance Abuse		Self-Harm	
	(1)	(2)	(3)	(4)
Ordinary Least Squares				
High total peer exposure	-0.0112**	-0.0098*	0.0028	0.0027
	(0.0053)	(0.0054)	(0.0046)	(0.0046)
Reduced-Form Regression				
FD peer exposure	0.0490**	0.0458*	0.0179	0.0219
	(0.0232)	(0.0237)	(0.0324)	(0.0335)
Instrumental Variable Model				
High total peer exposure	0.1126**	0.1087*	0.0096	0.0118
	(0.0549)	(0.0578)	(0.0173)	(0.0181)
Control complier mean	0.0054	0.0046	0.0350	0.0340
%Δ from 1 s.d. Δ	898.15	1020.45	11.83	15.03
AR p-value	0.0348	0.0541	0.5796	0.5135
AR confidence set (95%)	[.0105,.2234]	[.0012,.23]	[-.0239,.0431]	[-.0232,.0468]
First-stage coefficient	0.4344	0.4203	1.8826	1.8636
First-stage effective F-statistic	107.68	93.76	903.53	921.15
Youth & peer controls	No	Yes	No	Yes
Observations	12739	12739	12739	12739

Note: This table replicates Table 4 but, in all regressions, first-day peer exposure (without interacting with own history) is used as an instrument for a single binary version of total peer exposure. Specifically, *High total peer exposure* takes the value 1 if the total peer exposure is higher than the 25$^{\text{th}}$ percentile in the 'Main Analysis' sample. The first-stage coefficients and Olea and Pflueger (2013)'s Effective F-statistics are reported. * $p < .1$. ** $p < .05$. *** $p < .01$.

Table A11. *Effect of Exposure to Peer Substance Abuse and Self-Harm on Future Living Situation*

				Out-of-Home Care (Excl. NBIC)		
	(1) Readmission to NBIC	(2) Prison	(3) Adult Addic. Treatment	(4) Foster Care	(5) Group Home	(6) Other OOH Care Facility
A: History of Substance Abuse						
Own history*Total peer exposure	0.0029**	0.0003	0.0014	-0.0034*	0.0016	0.0024
	(0.0013)	(0.0034)	(0.0017)	(0.0018)	(0.0019)	(0.0016)
No own history*Total peer exposure	0.0033*	0.0030	0.0011	-0.0023	0.0011	0.0017
	(0.0017)	(0.0036)	(0.0018)	(0.0022)	(0.0024)	(0.0019)
Dep. mean if own hist.=1	0.3466	0.1081	0.0112	0.2406	0.5591	0.2536
Dep. mean if own hist.=0	0.2744	0.1103	0.0000	0.2601	0.4865	0.1983
B: History of Self-Harm						
Own history*Total peer exposure	-0.0055	0.0026	0.0011	0.0081*	0.0003	-0.0066
	(0.0041)	(0.0030)	(0.0017)	(0.0046)	(0.0046)	(0.0041)
No own history*Total peer exposure	-0.0033	0.0020	0.0018	0.0095**	0.0034	-0.0093**
	(0.0036)	(0.0034)	(0.0021)	(0.0045)	(0.0048)	(0.0042)
Dep. mean if own hist.=1	0.3203	0.0373	0.0207	0.2505	0.6044	0.2374
Dep. mean if own hist.=0	0.3168	0.1153	0.0078	0.2499	0.5193	0.2265
Test of equality (*p*-value)	0.4469	0.7365	0.4852	0.6797	0.3471	0.4008
Observations	12442	2750	2751	7519	7519	7519

Note: This table presents IV estimates of the effect of exposure to peers with a history of substance abuse (Panel A) and self-harm (Panel B) on the risk of being placed in various institutions. All dependent variables are measured as indicators taking the value 1 if the youth ever enters a placement of the form indicated at the top of the table during the 12 months post-placement. The 'Main Analysis Sample' is subject to restrictions depending on the outcome. Youths who die during the 12 months post-placement are excluded in all columns. Columns 2-3 exclude youths aged below 18 at the time of placement exit because being sentenced to prison and admission to adult addiction treatment are rare outcomes for youths aged below 18. Columns 4-6 exclude youths who exited their first NBIC placement in 2013 or later because the register on non-NBIC placements suffers from underreporting from 2014 onward. All estimations control for own history and facility-by-year FEs. Standard errors are clustered at the facility-by-day-of-entry level. * $p < .1$. ** $p < .05$. *** $p < .01$.

Table A12. *Heterogeneity of Peer Effects in Substance Abuse and Self-Harm I*

	Gender			Background			Age at Placement		
	(1) Girl	(2) Boy	(3) Δ	(4) Foreign	(5) Native	(6) Δ	(7) <15 yrs	(8) ≥15 yrs	(9) Δ
A: History of Substance Abuse									
Own history*Total peer exposure	0.0040***	0.0016**	0.0024**	0.0029**	0.0024***	0.0004	0.0025**	0.0019***	0.0005
	(0.0012)	(0.0007)	(0.0012)	(0.0014)	(0.0007)	(0.0012)	(0.0012)	(0.0006)	(0.0011)
No own history*Total peer exposure	0.0018	0.0007	0.0010	0.0015	0.0012	0.0003	0.0013	0.0011	0.0002
	(0.0011)	(0.0009)	(0.0010)	(0.0012)	(0.0008)	(0.0008)	(0.0009)	(0.0008)	(0.0006)
Dep. mean if own hist.=1	0.1269	0.0821		0.0574	0.1071		0.0531	0.1043	
Dep. mean if own hist.=0	0.0392	0.0150		0.0187	0.0257		0.0297	0.0203	
B: History of Self-Harm									
Own history*Total peer exposure	0.0040	0.0067	-0.0027	0.0068	0.0058*	0.0010	0.0113	0.0049*	0.0064
	(0.0037)	(0.0080)	(0.0085)	(0.0069)	(0.0031)	(0.0067)	(0.0103)	(0.0029)	(0.0102)
No own history*Total peer exposure	0.0003	0.0016	-0.0014	0.0023	0.0003	0.0020*	0.0013	0.0004	0.0009
	(0.0019)	(0.0015)	(0.0017)	(0.0017)	(0.0017)	(0.0012)	(0.0018)	(0.0015)	(0.0011)
Dep. mean if own hist.=1	0.1857	0.0614		0.1250	0.1456		0.1027	0.1512	
Dep. mean if own hist.=0	0.0490	0.0162		0.0220	0.0284		0.0361	0.0241	
Observations	12739	12739	12739	12739	12739	12739	12739	12739	12739

Note: This table presents IV estimates of peer effects in substance abuse and self-harm by youth characteristics. The dependent variable (indicated in the panel heading) is an indicator that takes the value 1 if the youth is hospitalized due to substance abuse or self-harm (respectively) by month 12 following the youth's exit from their first placement at NBIC. In column 1, I use *Own history*FD peer exposure*, *No own history*FD peer exposure*, *Own history*FD peer exposure*(1-Girl)*, *No own history*FD peer exposure*(1-Girl)* as instruments for *Own history*Total peer exposure*, *No own history*Total peer exposure*, *Own history*Total peer exposure*(1-Girl)*, *No own history*Total peer exposure*(1-Girl)*. I control for *Own history*, *(1-Girl)*, *Own history*(1-Girl)*, and facility-by-year FEs. In columns 2, 4-5, and 7-8, I replace *Girl* with the variable indicated at the top of the table. Columns 3, 6, and 9 report the difference between the estimates shown in the two preceding columns. The 'Main Analysis Sample' is used. Standard errors are clustered at the facility-by-day-of-entry level. * $p < .1$. ** $p < .05$. *** $p < .01$.

Table A13. *Heterogeneity of Peer Effects in Substance Abuse and Self-Harm II*

	High Share Occupied Beds			Across-County Move			Peer Count		
	(1) Yes	(2) No	(3) Δ	(4) Yes	(5) No	(6) Δ	(7) ≤20 peers	(8) >20 peers	(9) Δ
A: History of Substance Abuse									
Own history*Total peer exposure	0.0020***	0.0026***	-0.0007	0.0025***	0.0022***	0.0003	0.0029***	0.0020***	0.0009
	(0.0008)	(0.0007)	(0.0007)	(0.0007)	(0.0009)	(0.0007)	(0.0008)	(0.0007)	(0.0008)
No own history*Total peer exposure	0.0021	0.0010	0.0011	0.0012	0.0013	-0.0001	0.0011	0.0016	-0.0004
	(0.0014)	(0.0007)	(0.0009)	(0.0008)	(0.0010)	(0.0007)	(0.0008)	(0.0013)	(0.0010)
Dep. mean if own hist.=1	0.0927	0.1001		0.0999	0.0906		0.1108	0.0817	
Dep. mean if own hist.=0	0.0255	0.0226		0.0242	0.0226		0.0293	0.0173	
B: History of Self-Harm									
Own history*Total peer exposure	0.0070	0.0057*	0.0013	0.0051	0.0076*	-0.0025	0.0067*	0.0024	0.0043
	(0.0055)	(0.0031)	(0.0055)	(0.0036)	(0.0043)	(0.0049)	(0.0036)	(0.0041)	(0.0049)
No own history*Total peer exposure	0.0013	0.0006	0.0007	0.0011	0.0005	0.0005	0.0007	0.0008	-0.0001
	(0.0017)	(0.0016)	(0.0008)	(0.0017)	(0.0016)	(0.0010)	(0.0016)	(0.0018)	(0.0015)
Dep. mean if own hist.=1	0.1267	0.1514		0.1302	0.1701		0.1592	0.1151	
Dep. mean if own hist.=0	0.0258	0.0275		0.0278	0.0248		0.0314	0.0218	
Observations	12739	12739	12739	12739	12739	12739	12739	12739	12739

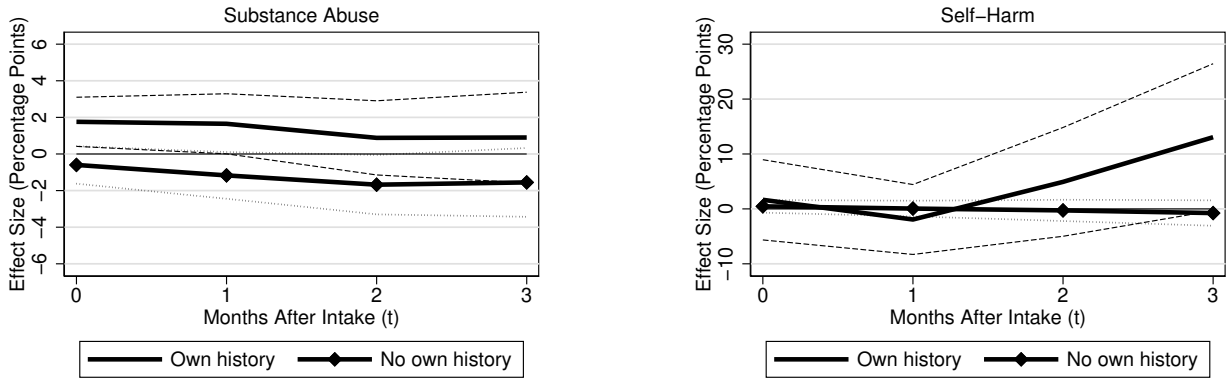
Note: This table presents IV estimates of peer effects in substance abuse and self-harm by facility characteristics. The dependent variable (indicated in the panel heading) is an indicator that takes the value 1 if the youth is hospitalized due to substance abuse or self-harm (respectively) by month 12 following the youth's exit from their first placement at NBIC. In column 1, I use *Own history*FD peer exposure*, *No own history*FD peer exposure*, *Own history*FD peer exposure*(1-Yes)*, *No own history*FD peer exposure*(1-Yes)* as instruments for *Own history*Total peer exposure*, *No own history*Total peer exposure*, *Own history*Total peer exposure*(1-Yes)*, *No own history*Total peer exposure*(1-Yes)*. I control for *Own history*, *(1-Yes)*, *Own history*(1-Yes)*, and facility-by-year FEs. In columns 2, 4-5, and 7-8, I replace *Yes* with the variable indicated at the top of the table. Columns 3, 6, and 9 report the difference between the estimates shown in the two preceding columns. The 'Main Analysis Sample' is used. Standard errors are clustered at the facility-by-day-of-entry level. * $p < .1$. ** $p < .05$. *** $p < .01$.

Table A14. *Decomposed Effect of Peers on Substance Abuse*

	(1) Any Substance Abuse	(2) Soft Drugs	(3) Hard Drugs
A: Any Substance Abuse			
Own history*Total peer exposure	0.0024***	0.0008*	0.0019***
	(0.0007)	(0.0004)	(0.0006)
No own history*Total peer exposure	0.0013	0.0008	0.0007
	(0.0008)	(0.0005)	(0.0007)
Dep. mean if own hist.=1	0.0973	0.0350	0.0691
Dep. mean if own hist.=0	0.0237	0.0144	0.0100
Test of equality (*p*-value)	0.0083	0.9544	0.0002
B: Soft Drugs			
Own history*Total peer exposure	-0.0007	0.0008	-0.0036
	(0.0036)	(0.0028)	(0.0028)
No own history*Total peer exposure	-0.0016	-0.0008	-0.0012
	(0.0017)	(0.0010)	(0.0015)
Dep. mean if own hist.=1	0.1633	0.0890	0.0936
Dep. mean if own hist.=0	0.0583	0.0208	0.0404
Test of equality (*p*-value)	0.7928	0.5202	0.3099
C: Hard Drugs			
Own history*Total peer exposure	0.0078***	0.0024	0.0064**
	(0.0030)	(0.0015)	(0.0028)
No own history*Total peer exposure	0.0047*	0.0028*	0.0025
	(0.0026)	(0.0016)	(0.0021)
Dep. mean if own hist.=1	0.2182	0.0470	0.1879
Dep. mean if own hist.=0	0.0550	0.0250	0.0334
Test of equality (*p*-value)	0.0957	0.6968	0.0239
Observations	12739	12739	12739

Note: This table presents IV estimates of the effect of total exposure to peers with a history of any substance abuse (Panel A), soft drugs (Panel B), and hard drugs (Panel C) on the risk of being hospitalized for any substance abuse (column 1), soft drugs (column 2), and hard drugs (column 3) within 12 months of leaving their first NBIC placement. The 'Main Analysis Sample' is used. All estimations control for own history of the type indicated in the panel heading and facility-by-year FEs. Standard errors are clustered at the facility-by-day-of-entry level. * $p < .1$. ** $p < .05$. *** $p < .01$.

Figure A7. *Peer Effects in Substance Abuse and Self-Harm While Placed at NBIC*



Note: Black lines show reduced-form estimates of the effect of first-day peer exposure on the cumulative probability of being hospitalized due to substance abuse (left subfigure) and self-harm (right subfigure) by month t post-intake. Dashed (dotted) lines show 90% confidence bands for youths with (without) a history of the behavior. All specifications condition on the NBIC placement ending after month t. The sample size in month 3 is 7,332.

Table A15. *Gender-Specific Peer Effects*

	(1) Substance Abuse	(2) Self-Harm
A: Exposure to Peers of Same Sex with History h		
Own history*Total peer exposure (same sex)	0.0013***	0.0067**
	(0.0003)	(0.0029)
No own history*Total peer exposure (same sex)	0.0005	0.0013
	(0.0004)	(0.0015)
Test of equality (*p*-value)	0.0002	0.0152
B: Exposure to Peers of Opposite Sex with History h		
Own history*Total peer exposure (opp. sex)	-0.0009	-0.0145**
	(0.0006)	(0.0065)
No own history*Total peer exposure (opp. sex)	-0.0004	-0.0020
	(0.0005)	(0.0013)
Test of equality (*p*-value)	0.2503	0.0461
Dep. mean if own hist.=1	0.0973	0.1423
Dep. mean if own hist.=0	0.0237	0.0269
Observations	12739	12739

Note: This table presents IV estimates of peer effects in substance abuse and self-harm. The dependent variable is an indicator equal to one if the youth is hospitalized due to substance abuse or self-harm (respectively) during the 12 months after exit from the first placement spell at NBIC. *Own history*FD peer exposure (same sex)* and *No own history*FD peer exposure (same sex)* are used as instruments for *Own history*Total peer exposure (same sex)* and *No own history*Total peer exposure (same sex). FD peer exposure (same sex)* is defined as the share of peers with history *h* and the same sex as the youth on the youth's day of entry, while *FD peer exposure (opp. sex)* is the share of peers with history *h* and the opposite sex on the youth's day of entry. The 'Main Analysis Sample' is used. All estimations control for own history, sex, and facility-by-year FEs. Standard errors are clustered at the facility-by-day-of-entry level. * $p < .1$. ** $p < .05$. *** $p < .01$.

Table A16. *Age-Specific Peer Effects*

	(1) Substance Abuse	(2) Self-Harm
A: Exposure to Peers of Similar Age With History h		
Own history*Total peer exposure (similar age)	0.0009***	0.0055**
	(0.0003)	(0.0025)
No own history*Total peer exposure (similar age)	-0.0003	0.0004
	(0.0002)	(0.0009)
Test of equality (*p*-value)	0.0000	0.0291
B: Exposure to Peers of Different Age With History h		
Own history*Total peer exposure (diff. age)	-0.0006	0.0018
	(0.0004)	(0.0089)
No own history*Total peer exposure (diff. age)	0.0005*	-0.0011
	(0.0003)	(0.0017)
Test of equality (*p*-value)	0.0007	0.7273
Dep. mean if own hist.=1	0.0973	0.1423
Dep. mean if own hist.=0	0.0237	0.0269
Observations	12739	12739

Note: This table presents IV estimates of peer effects in substance abuse and self-harm. The dependent variable is an indicator equal to one if the youth is hospitalized due to substance abuse or self-harm (respectively) during the 12 months after exit from the first placement spell at NBIC. *Own history*FD peer exposure (same age)* and *No own history*FD peer exposure (same age)* are used as instruments for *Own history*Total peer exposure (same age)* and *No own history*Total peer exposure (same age). FD peer exposure (same age)* is defined as the share of peers with history *h* on the youth's day of entry who are in the same age group as the youth. The two age groups are (i) younger than 15 and (ii) 15 or older at the time of placement. *FD peer exposure (diff. age)* is the share of peers with history *h* on the youth's day of entry who are in a different age group. The 'Main Analysis Sample' is used. All estimations control for own history, age group, and facility-by-year FEs. Standard errors are clustered at the facility-by-day-of-entry level. * $p < .1$. ** $p < .05$. *** $p < .01$.

Table A17. *Effect of First-Day Peer Exposure on Placement Outcomes*

	Total	Facility Switch		Isolation		Runaway	
	(1) Days	(2) Ever	(3) Count	(4) Ever	(5) Days	(6) Ever	(7) Days
A: History of Substance Abuse							
Own history*FD peer exposure	50.2738***	0.0351	0.0401	0.0669	1.6588	0.0593	3.3457*
	(19.5134)	(0.0453)	(0.0954)	(0.0415)	(3.4607)	(0.0395)	(1.9519)
No own history*FD peer exposure	-13.2429	0.0226	0.0412	-0.0134	-6.9537	-0.0235	-0.6436
	(20.1999)	(0.0457)	(0.0944)	(0.0408)	(5.9321)	(0.0375)	(1.8984)
Dep. mean if own hist.=1	144.6282	0.3212	1.5369	0.2413	5.8785	0.1974	4.6142
Dep. mean if own hist.=0	149.1072	0.2576	1.4141	0.1919	9.1124	0.1620	3.6335
B: History of Self-Harm							
Own history*FD peer exposure	77.2409	0.1026	0.2265	0.0754	3.3698	0.0587	8.5879
	(78.2855)	(0.1723)	(0.3540)	(0.1713)	(16.4536)	(0.1471)	(6.0712)
No own history*FD peer exposure	-30.3802	0.0721	0.0788	0.0632	-4.4038	-0.0426	-0.2028
	(24.5055)	(0.0697)	(0.1497)	(0.0640)	(5.2833)	(0.0574)	(2.4653)
Dep. mean if own hist.=1	144.63	0.32	1.54	0.24	5.88	0.20	4.61
Dep. mean if own hist.=0	146.21	0.30	1.49	0.22	7.02	0.18	4.26
Observations	14072	14072	14072	12590	12590	14072	14072

Note: Each dependent variable listed in the top row is first regressed on first-day peer substance abuse interacted with own history of substance abuse (Panel A) and then first-day peer self-harm interacted with own history of self-harm (Panel B). The '2002-2020 Sample' is used. The sample is smaller in columns 4-5 because the registration of isolation episodes did not start until 2004. All estimations control for own history and facility-by-year FEs. Standard errors are clustered at the facility-by-day-of-entry level. * $p < .1$. ** $p < .05$. *** $p < .01$.

Table A18. *Heterogeneity by Presence of Runaway and Isolation Episodes*

	Ever Isolation			Ever Runaway			Ever Isolation or Runaway		
	(1) Yes	(2) No	(3) Δ	(4) Yes	(5) No	(6) Δ	(7) Yes	(8) No	(9) Δ
A: History of Substance Abuse									
Own history*Total peer exposure	0.0042***	0.0016**	0.0026*	0.0037***	0.0023***	0.0015	0.0046***	0.0012*	0.0033**
	(0.0016)	(0.0007)	(0.0015)	(0.0013)	(0.0008)	(0.0011)	(0.0016)	(0.0007)	(0.0015)
No own history*Total peer exposure	0.0024	0.0007	0.0018	0.0013*	0.0015	-0.0002	0.0021	0.0007	0.0014
	(0.0022)	(0.0008)	(0.0022)	(0.0008)	(0.0010)	(0.0007)	(0.0013)	(0.0009)	(0.0011)
Dep. mean if own hist.=1	0.1232	0.0926		0.1328	0.0890		0.1211	0.0890	
Dep. mean if own hist.=0	0.0402	0.0200		0.0362	0.0213		0.0381	0.0185	
B: History of Self-Harm									
Own history*Total peer exposure	0.0029	0.0068	-0.0039	0.0061*	0.0063	-0.0002	0.0045	0.0072	-0.0027
	(0.0043)	(0.0044)	(0.0053)	(0.0034)	(0.0041)	(0.0049)	(0.0036)	(0.0053)	(0.0059)
No own history*Total peer exposure	0.0006	-0.0001	0.0007	0.0014	0.0006	0.0009	0.0008	-0.0003	0.0011
	(0.0015)	(0.0017)	(0.0012)	(0.0011)	(0.0016)	(0.0011)	(0.0013)	(0.0017)	(0.0010)
Dep. mean if own hist.=1	0.1744	0.1302		0.1667	0.1358		0.1579	0.1329	
Dep. mean if own hist.=0	0.0401	0.0237		0.0331	0.0256		0.0361	0.0232	
Observations	11299	11299	11299	12739	12739	12739	11299	11299	11299

Note: This table presents IV estimates of peer effects in substance abuse and self-harm by the presence of runaway and isolation episodes. The dependent variable is an indicator that takes the value 1 if the youth is hospitalized due to substance abuse (Panel A) or self-harm (Panel B) by month 12 following the youth's exit from their first placement at NBIC. The 'Main Analysis Sample' is restricted to the subsample indicated in the top row. Periods of isolation were not registered before 2004. Hence, youths who were admitted to NBIC before 2004 are dropped from the samples in columns 1-3 and 7-9. All estimations control for own history and facility-by-year FEs. Standard errors are clustered at the facility-by-day-of-entry level. * $p < .1$. ** $p < .05$. *** $p < .01$.

Table A19. *Effect of Resource-Demanding Peers on Hospitalization*

	(1) Substance Abuse	(2) Self-Harm
A: Peer History of Neurodevelopmental Disorder		
Own hist. of Y*FD peer NDD	-0.0340	0.0437
	(0.0756)	(0.1920)
No own hist. of Y*FD peer NDD	-0.0665	-0.0289
	(0.0670)	(0.0437)
B: Peer History of Violent Crime		
Own hist. of Y*FD peer violent crime	-0.0211	-0.1256**
	(0.0294)	(0.0565)
No own hist. of Y*FD peer violent crime	-0.0214	0.0254
	(0.0282)	(0.0193)
Observations	12739	12739

Note: The dependent variable is an indicator taking the value 1 if the youth is hospitalized due to substance abuse (column 1) and self-harm (column 2) by month 12 following placement exit. Each dependent variable is regressed on the first-day share of peers with the history indicated in the panel heading interacted with own history of substance abuse (column 1) and self-harm (column 2). The 'Main Analysis Sample' is used. All estimations control for own history of the behavior indicated in the column heading and facility-by-year FEs. Standard errors are clustered at the facility-by-day-of-entry level. * $p < .1$. ** $p < .05$. *** $p < .01$.

Table A20. *Effect of Own Substance Abuse on Eligibility for High School*

	(1)	(2)
Ordinary Least Squares		
Hosp. d.t. sub. abuse by month 12	-0.0136	0.0034
	(0.0166)	(0.0165)
Instrumental Variable Model		
Hosp. d.t. sub. abuse by month 12	-0.8689*	-0.8961*
	(0.4758)	(0.5151)
Control complier mean	0.8153	0.8398
%Δ from 1 s.d. Δ	-24.30	-24.34
AR *p*-value	0.0419	0.0318
AR confidence set (95%)	[-2.4326,-.0587]	[-2.7114,-.1415]
First-stage coeff. if own hist.=1	0.0776	0.0772
First-stage coeff. if own hist.=0	-0.0212	-0.0128
First-stage effective *F*-statistic	9.03	7.82
Youth & peer controls	No	Yes
Observations	8477	8477

Note: The dependent variable is an indicator taking the value 1 if the youth attains sufficient grades to be eligible for high school by age 21. *Own substance abuse*FD peer substance abuse* and *No own substance abuse*FD peer substance abuse* are used as instruments for hospitalization due to substance abuse by month 12 after leaving NBIC. Reduced-form estimates are provided in Table 5. The 'Education Sample' is used. All estimations control for own history of substance abuse and facility-by-year FEs. Whether controls for youth and first-day peer characteristics (as listed in Table 1) are included is indicated at the bottom of the table. Standard errors are clustered at the facility-by-day-of-entry level. * $p < .1$. ** $p < .05$. *** $p < .01$.

B Data Dictionary

Female: An indicator taking the value 1 if the youth is female.
Foreign: An indicator taking the value 1 if the youth is born in a country other than Sweden.
Age: The youth's age in years at the time of the placement based on date of birth.
< 15 *y.o.*: An indicator taking the value 1 if the youth is less than 15 at the time of placement.
≥ 18 *y.o.*: An indicator taking the value 1 if the youth is at least 18 at the time of placement.
Placement type: Involuntary: An indicator taking the value 1 if the youth is placed at NBIC following a court order to provide compulsory care on the basis that the youth's behavior (substance abuse, criminal behavior, or other destructive behavior) poses a significant risk to their health or development, i.e. under Section 3 of the Care of Young Persons Act.
Placement type: Sentenced: An indicator taking the value 1 if the youth is sentenced to serve time at NBIC for committing a crime punishable by prison.
Placement type: Voluntary: An indicator taking the value 1 if the youth is placed at NBIC voluntarily.
Required to attend school: An indicator taking the value 1 if the youth is required to attend compulsory schooling at the time of placement.
Attended 9th grade: An indicator taking the value 1 if the youth had attended the final year of compulsory schooling before the placement.
History of: Substance abuse: An indicator taking the value 1 if the SWC's placement application listed substance abuse as a reason for NBIC placement or the youth during any of the 24 months before placement: (1) was placed at NBIC because the youth abused substances; (2) was hospitalized with a mental or behavioral disorder caused by psychoactive substance use (ICD10-code F1) listed as the main diagnosis, (3) was hospitalized with accidental drug or alcohol poisoning (ICD10-code X4) listed as the main cause of harm; or (4) committed an offense under The Swedish Penal Law on Narcotics. The start date of the crime is used (not the conviction date).
History of: Self-harm: An indicator taking the value 1 if the youth was hospitalized in any of the 24 months before placement with intentional self-harm (ICD10-codes X60-X84) or possible self-harm (ICD10-codes Y10-Y34) listed as the main cause of harm.
History of: Crime: An indicator taking the value 1 if the SWC's placement application listed criminal behavior as a reason for NBIC placement or the placement type is 'Sentenced', or the youth during any of the 24 months before placement: (1) was placed at NBIC because of criminal behavior, (2) served time at NBIC for a criminal offense, or (3) committed an offense under The Swedish Criminal Code. The start date of the crime is used (not the conviction date).
History of: Neurodevelopmental disorder: An indicator taking the value 1 if the youth was hospitalized in any of the 24 months before placement with a neurodevelopmental disorder (ICD10-codes F7, F8, F90) listed as the main diagnosis.
History of: Depression: An indicator taking the value 1 if the youth was hospitalized in any of the 24 months before placement with depression (ICD10-codes F32-F33) listed as the main diagnosis.
History of: Other mental illness: An indicator taking the value 1 if the youth was hospitalized in any of the 24 months before placement with a mental or behavioral disorder listed as the main

diagnosis (ICD10-codes: F2-F9), excluding hospitalizations due to substance abuse, self-harm, neurodevelopmental disorders, and depression.

Missing, yrs t to t-2: An indicator taking the value 1 if the youth (i) does not have an accurate personal identity number or (ii) was not in Sweden during the 24 months preceding their NBIC placement.

Any birth parent: Dead: An indicator taking the value 1 if any birth parent was dead before placement.

Any birth parent: <18 y.o. at birth of child: An indicator taking the value 1 if any birth parent was under the age of 18 at the time of the youth's birth.

Any birth parent: Married, yr t-1: An indicator taking the value 1 if any birth parent was married at the end of the calendar year before placement.

Any birth parent: No labor income, yr t-1: An indicator taking the value 1 if any birth parent had no labor income during the full calendar year before placement.

Any birth parent: Hosp. d.t. mental health, yr t-1: An indicator taking the value 1 if any birth parent was hospitalized in the calendar year before placement with a mental and behavioral disorder (ICD10-codes F2-F9) or intentional self-harm (ICD10-codes X60-X84) listed as the main diagnosis or cause of harm.

Any birth parent: Hosp. d.t. substance use, yr t-1: An indicator taking the value 1 if any birth parent was hospitalized in the calendar year before placement with (1) a mental or behavioral disorder not caused by substance use (ICD10-codes F2-F9) listed as the main diagnosis or (2) intentional self-harm (ICD10-codes X60-X84) or cause of harm.

Any birth parent: Hosp. d.t. substance use, yr t-1: An indicator taking the value 1 if any birth parent was hospitalized in the calendar year before placement with (1) a mental or behavioral disorder caused by psychoactive substance use (ICD10-code F1) listed as the main diagnosis or (2) accidental drug or alcohol poisoning (ICD10-code X4) listed as the main cause of harm.

Any birth parent: Any crime, yr t-1): An indicator taking the value 1 if any birth parent committed an offense under The Swedish Criminal Code or The Swedish Penal Law on Narcotics in the calendar year before placement. The start date of the crime is used (not the conviction date).

Any birth parent: Missing Xs, yr t-1: An indicator taking the value 1 if data is missing for any birth parents in the calendar year before placement.

Peer substance abuse: Share of peers with a history of substance abuse.

Peer self-harm: Share of peers with a history of self-harm.

Peer crime: Share of peers with a history of crime.

Peer NDD: Share of peers with a history of a neurodevelopmental disorder.

Peer depression: Share of peers with a history of depression.

Peer other mental illness: Share of peers with a history of another mental illness than substance abuse, self-harm, neurodevelopmental disorder, or depression.

Peer female: Share of female peers.

Peer foreign: Share of peers born outside Sweden.

Peer <15 y.o.: Share of peers younger than 15 years old when they were placed at NBIC.

Peer missing, yr t to t-2: Share of peers without valid personal identity numbers or who were not in the country during all 24 months before placement.

Peer size: Number of peers living in the same facility.

Above median peer size: An indicator taking the value 1 if the peer size is above the median peer size within that facility-by-year cell.