

# The Risk of Psychiatric Morbidity Following Teenage Induced Abortion and Childbirth – A Longitudinal Study From Finland

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## Abstract

**Purpose:** Teenage motherhood is associated with an increased risk of psychiatric morbidity. However, the long-term consequences of teenage induced abortion on psychiatric morbidity remain unknown. We, therefore, examined the association between adolescent pregnancy and psychiatric morbidity according to pregnancy outcome (induced abortion vs. childbirth) and age (<20 or <18 years) at the beginning of a pregnancy.

**Methods:** We used Finnish health care registers to evaluate the risk of psychiatric morbidity following teenage induced abortion (n = 6,520) or childbirth (n = 6,806) using Poisson regression analysis. The mean follow-up time was 26.4 years. Age-matched girls without a teenage pregnancy (n = 39,429) served as the reference group.

**Results:** The risk of psychiatric morbidity was higher in the teenage abortion group compared with those without a teenage pregnancy, but this risk increased only at 5 years postabortion. We found no difference in psychiatric morbidity between the teenage pregnancy groups aged <20 years (induced abortion vs. childbirth). However, women who underwent an abortion at <18 years of age instead of childbirth faced a lower risk of psychiatric morbidity, particularly during the first 5 years postabortion.

**Conclusions:** Pregnant adolescents faced an increased risk of psychiatric morbidity in adulthood regardless of the outcome (induced abortion or childbirth) of the pregnancy. Among girls aged <18 years, the risk of mental disorders was lower following abortion compared with childbirth. This finding should be acknowledged when counseling pregnant adolescents and organizing family planning services for teenagers.

## IMPLICATONS AND CONTRIBUTION

Pregnant teenagers face an increased risk of mental health disorders regardless of the outcome of the pregnancy, and this risk persists in adulthood. This should be acknowledged when organizing contraceptive services or counseling pregnant teenagers to prevent adverse psychiatric outcomes.

Adolescent pregnancy rates have declined during the recent decades in many developed countries including Finland, where births per 1,000 girls aged 15 - 19 years have declined from 10.5 in 2000 [1] to 5.5 per 1,000 in 2016 [2] and similarly induced abortions from 14.8 in 2000 to 7.9 per 1,000 girls aged 15 - 19 years in 2016 [3]. Worldwide, the adolescent pregnancy rates in Finland are among the lowest with other Nordic countries (3.5 - 6.5 births and 8.3 - 14.4 induced abortions per 1,000 girls aged 15 - 19 years) [2], the Netherlands (five births and seven induced abortions per 1,000), Belgium (10 births and eight induced abortions per 1,000), and Switzerland (two births and five induced abortions/1,000) [4]. This declining trend in Finland reflects an increased use of contraception [2] as well as high-quality, mandatory sexual education provided at all Finnish schools since the beginning of 21st century [5].

Despite the declining teen abortion rates, the abortion legislation in Finland has not changed remarkably since 1970 when it became legal to have an induced abortion for social reasons [6]. The legislation of induced abortion for social reasons allows an induced abortion under 12 gestational weeks with consent of one or two physicians [6]. From gestational weeks 12 to 20, an induced abortion for social reasons can be performed with consent of National Supervisory Authority for Welfare and Health [6].

What possible consequences could follow teenage induced abortion? Undergoing an induced abortion instead of giving birth as a teenager might mitigate some of the negative effects of unintended teenage pregnancy [7]. Previous longitudinal studies from Finland and New Zealand have shown that teenagers who chose an induced abortion achieve higher education later in life compared with women with a history of teenage childbirth; 29.2% -

35.9% attended university or gained >15 years of education in the abortion group, and 11.7% - 19.0% in the childbirth group [7 - 9]. In addition, research has clearly established that adult women who undergo induced abortion face no increased risk of psychiatric morbidity later in life [10 - 14]. However, evidence on possible associations between abortion and future mental health problems among teenagers remain sparse.

In our previous study, we performed before and after conception analyses to examine psychiatric morbidity following adolescent pregnancy <18 years of age and found no difference in the risk of psychiatric morbidity up to 25 years of age in the abortion group <18 years of age compared with the childbirth group <18 years of age [9]. A U.S. study documented similar findings [15]. However, the long-term consequences of teenage pregnancy, especially those associated with teenage induced abortion, on psychiatric morbidity remain unknown.

In this study, therefore, we explored the long-term (maximum of 28 years follow-up time) psychiatric morbidity among women with a history of teenage pregnancy based on the pregnancy outcome – that is, induced abortion versus childbirth.

## Methods

In this nationwide Finnish retrospective register study, we explored the incidence of psychiatric diagnoses following a teenage induced abortion or childbirth compared with women without a teenage pregnancy. The cohort included all nulligravid teenage pregnancies in Finland between 1987 and 1989 collected from reliable and comprehensive Finnish national health registers that cover practically all teenage induced abortions and childbirths. Each cohort member with a history of teenage pregnancy was matched to three age-matched reference members without a teenage pregnancy from the same municipality. Study members were born in 1966 through 1975. Among cohort members, follow-up began at the time of the first teenage childbirth or induced abortion. For the reference group with no teenage pregnancy, the beginning of the follow-up period (referred to as the index day) was identified as the same day as the cohort member's date of childbirth or induced abortion. All study members were followed-up until the end of 2015 for a possible psychiatric diagnosis.

The psychiatric diagnoses were collected from the special health care (Hospital Discharge Register of National Institute for Health and Welfare), that is, all hospital in-patient (since 1987) and out-patient hospital visits (since 1998) were included in the study. Obstetrical or psychiatric in-patient care outside the public hospital system is not available in Finland.

A teenager was defined as one with a beginning of the pregnancy at an age of <20 years. Figure 1 provides a flowchart of the study population. Cohort members with no age-matched reference members from the same municipality were excluded (n = 9). Additional exclusion criteria consisted of an incorrect or incomplete personal identification number (n = 114), non-disclosure of personal information in the Central Population Register (n = 70), permanent emigration after the end of the pregnancy or the index day (n = 1,604), unknown municipality at the end of the pregnancy (n = 23), psychiatric diagnosis made before the teenage pregnancy or index day (n = 349), or death before the index day (n = 17). After all exclusions (n = 2,186; 4.0%), the total number of participants reached 52,755, including 13,326 cohort members with a history of teenage pregnancy and 39,429 reference members without a teenage pregnancy.

We divided the teenage pregnancy group into subgroups depending on the outcome of the first teenage pregnancy (childbirth: n = 6,806; induced abortion: n = 6,520) and age at the beginning of pregnancy (<20 or <18 years of age at the time of conception; Figure 1). In total, 1,499 girls had multiple teenage pregnancies at <20 years of age, that is, 11.2% of girls who had any pregnancy <20 years of age. We added these to the analysis according to the outcome of their first teenage pregnancy. However, we added the number of teenage pregnancies to the model as a confounding factor (>1 teenage pregnancy; Table 1). In addition, we took into account the duration of the pregnancy at the time of induced abortion (≤12 gestational weeks or >12 gestational weeks). Majority (n = 5,517 [84.6%]) of the induced abortions were performed at ≤12 gestational week. However, the gestational age did not affect the results when added into the model as a confounding factor, so we did not retain it in the model. The Finnish registers lack reliable information on miscarriages. Thus, we did not include miscarriages in our analysis presented here.

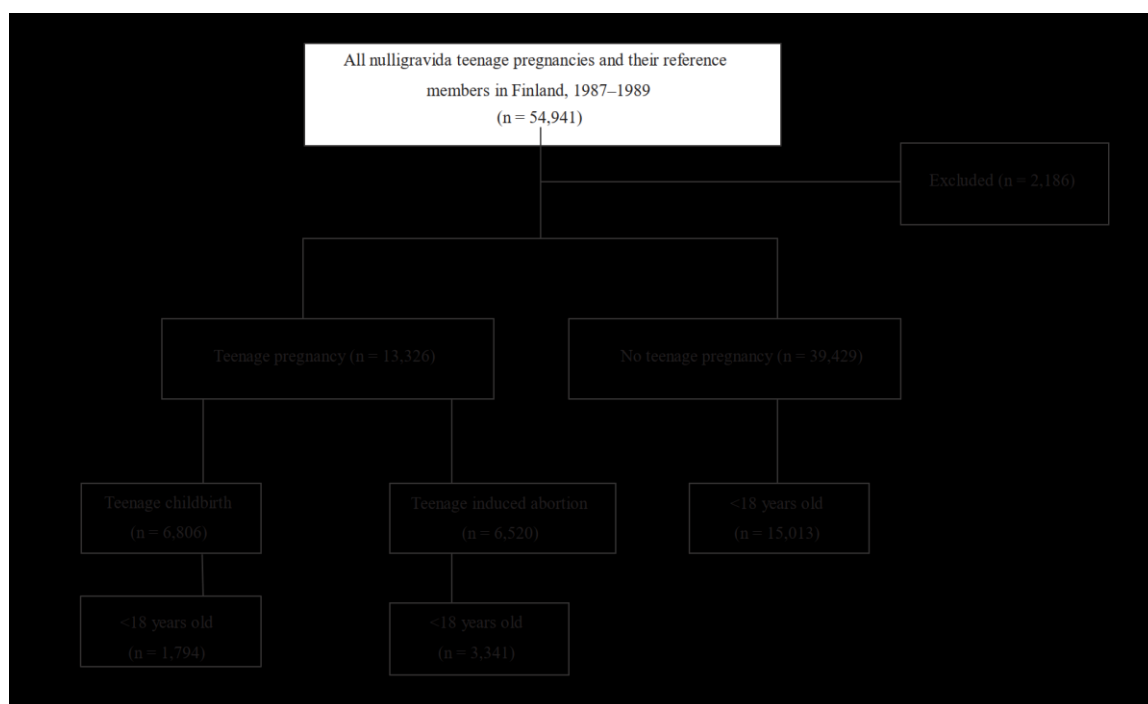


Figure 1. Flowchart of the study groups.

### Background factors and modifying factors

We obtained data on women's sociodemographic background and sociodemographic status (Table 1) from the National Institute for Health and Welfare, Statistics Finland, and Population Register Centre. The area of residence at the time of childbirth or induced abortion was determined according to the national classification (urban, semiurban, and rural) [16]. The highest achieved educational level was classified as high ( $\geq 15$  years), intermediate (11 - 14 years), or low ( $\leq 9$  years of education) and was determined in 2012 or during the year of death. Psychiatric diagnoses among parents of the study population relied on the International Classification of Diseases, Eighth Revision (ICD-8). Although the highest educational level served more like as an effect

modifier than a confounding factor, we retained it in the model since educational level serves as an important marker for both teenage pregnancy and psychiatric morbidity. First, especially teenage childbirth associates inversely with the highest achieved educational level in life [7 - 9]. Second, educational level associates with psychiatric morbidity [17].

### Psychiatric diagnoses as outcomes

The psychiatric diagnoses of the study population were coded according to the International Classification of Diseases, Ninth Revision (ICD-9) from 1987 to 1995 and the Tenth revision (ICD-10) from 1996 to 2015. We analysed the diagnoses using the primary ICD-10 sections. The incidence rates of psychiatric diagnoses according to these sections appear in Table 2.

**Table 1**  
Sociodemographic characteristics of the study groups

	Teenage induced abortion <20y of age (n = 6520)				Teenage childbirth <20y of age (n = 6806)			No teenage pregnancy (n = 39429)	
	n	%	p1	p2	n	%	p1	N	%
Type of residence <sup>a</sup>			<.001	.005			<.001		
Urban	4042	62.0			4394	64.6		27114	68.8
Semiurban	1270	19.5			1273	18.7		6928	17.6
Rural	1208	18.5			1139	16.7		5387	13.7
Educational level <sup>b</sup>			<.001	<.001			<.001		
High	2229	34.2			1169	17.2		22065	56.0
Intermediate	3063	47.0			3796	55.8		14437	36.6
Low	1228	18.8			184	27.0		2927	7.4
Parents with psychiatric morbidity	802	12.3	<.001	<.05	923	13.6	<.001	3506	8.9
>1 teenage pregnancy	884	13.6	<.001	<.001	615	9.0	<.001	-	-

p1: compared with the no teenage pregnancy group.

p2: compared with the teenage childbirth group.

<sup>a</sup> At the end of the pregnancy.

<sup>b</sup> Highest achieved educational level during the follow-up time.

Only the first psychiatric diagnosis made after the end of a pregnancy or the index day was taken into consideration in the final analysis because in cases of multiple contacts to the health care, we could not determine whether the contacts were controls or new contacts. To evaluate the association between teenage pregnancy and psychiatric morbidity more accurately, we determined the incidence of psychiatric diagnoses at different periods (0 - 4.99, 5 - 9.99, 10 - 14.99, 15 - 19.99, 20 - 24.99, and 25 - 28 years) following a teenage induced abortion or teenage childbirth for the cohort group and after the index day for the reference group (Figure 2).

### Statistical analyses

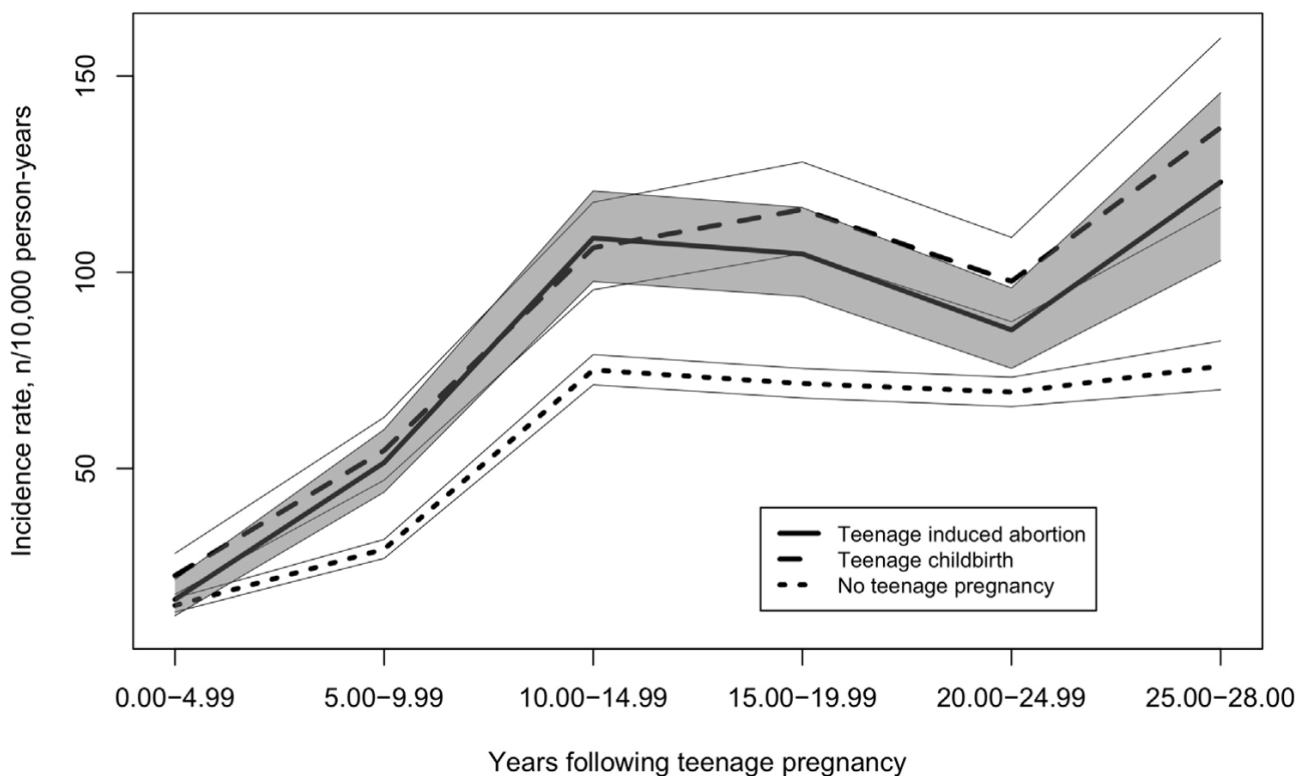
We used the chi-square test and the Fisher's exact test to assess differences in socio-demographic status between the study groups: teenage induced abortion group versus no teenage pregnancy, teenage childbirth group versus no teenage pregnancy, and teenage induced abortion group versus teenage childbirth group and considered  $p < .05$  as statistically

significant. The incidence rate ratios (IRRs) and 95% confidence intervals (CIs) were calculated for the ICD groups in the psychiatric section with the highest number of diagnoses given following a teenage pregnancy or the index day (F00 - F99 for all psychiatric diagnoses, F10 - F19 for mental and behavioral disorders because of psychoactive substance use, F30 - F39 for mood disorders, and F40 - F49 for anxiety disorders) using Poisson regression analysis (Table 3). The group with no teenage pregnancies served as the reference group for both the teenage induced abortion group and the teenage childbirth group (teenage induced abortion vs. no teenage pregnancy and teenage childbirth vs. no teenage pregnancy). We then calculated the IRRs for psychiatric diagnoses according to the teenage pregnancy group: teenage induced abortion versus teenage childbirth.

In addition, we adjusted IRRs for age at the beginning of pregnancy, residential area at the end of the pregnancy, highest achieved educational level during the entire follow-up period, and the psychiatric morbidity of the study members' parents. The psychiatric diagnoses of

**Table 2** Incidence rates for psychiatric diagnoses and 95% confidence intervals among women with a teenage induced abortion or a teenage childbirth based on the age at the beginning of the pregnancy (<20 y of age [upper panel] or <18 y of age [lower panel]) and among women with no teenage pregnancy

Psychiatric diagnosis	Induced abortion <20 y of age, n = 6520	Incidence, n/10000 person-years	Childbirth <20 y of age, n = 6806	Incidence, n/10000 person-years	No teenage pregnancy, n = 39429	Incidence, n/10000 person-years
Mental disorders because of psychoactive substance use (F10-F19)	181 (2.8%)	11.2 (9.6-12.9)	223 (3.3%)	13.0 (11.4-14.8)	399 (1.0%)	3.8 (3.5-4.2)
Schizophrenia and other psychotic disorders (F20eF29)	61 (.9%)	3.8 (2.9-4.8)	75 (1.1%)	4.4 (3.4-5.5)	444 (1.1%)	4.2 (3.8-4.6)
Mood disorders (F30-F39)	534 (8.2%)	33.0 (30.2-35.9)	604 (8.9%)	35.2 (32.5-38.1)	2290 (5.8%)	21.6 (20.8-22.5)
Anxiety disorders (F40-48)	418 (6.4%)	25.8 (23.4-28.4)	463 (6.8%)	27.0 (24.6-29.6)	1917 (4.9%)	18.1 (17.3-18.9)
Behavioral syndrome due to physical factor (F50-F59)	40 (.6%)	2.5 (1.8-3.4)	32 (.5%)	1.9 (1.3-2.6)	253 (.6%)	2.4 (2.1-2.7)
Personality disorder (F60-F69)	36 (.6%)	2.2 (1.6-3.1)	48 (.7%)	2.8 (2.1-3.7)	132 (.3%)	1.2 (1.0-1.5)
Unspecified mental disorder (F99)	29 (.4%)	1.8 (1.2-2.6)	36 (.5%)	2.1 (1.5-2.9)	136 (.3%)	1.3 (1.1-1.5)
All psychiatric diagnoses (F1-F99)	1318 (20.2%)	81.4 (77.1-85.9)	1498 (22.0%)	87.3 (83.0-91.9)	5690 (14.4%)	53.8 (52.4-55.2)
Psychiatric diagnosis	Induced abortion <18 y of age, n = 3341	Incidence, n/10000 person-years	Childbirth <18 y of age, n = 1794	Incidence, n/10,000 person-years	No teenage pregnancy, n = 15013	Incidence, n/10000 person-years
Mental disorders because of psychoactive substance use (F10-F19)	89 (2.7%)	10.8 (8.7-13.3)	77 (4.3%)	17.3 (13.6-21.6)	153 (1.0%)	3.8 (3.2-4.4)
Schizophrenia and other psychotic disorders (F20eF29)	28 (.8%)	3.4 (2.3-4.9)	18 (1.0%)	4.0 (2.4-6.4)	177 (1.2%)	4.4 (3.8-5.1)
Mood disorders (F30-F39)	289 (8.7%)	35.0 (31.1-39.3)	202 (11.3%)	45.3 (39.2-52.0)	859 (5.7%)	21.2 (19.8-22.7)
Anxiety disorders (F40-48)	217 (6.5%)	26.3 (22.9-30.2)	157 (8.8%)	35.2 (29.9-41.1)	756 (5.0%)	18.7 (17.4-20.1)
Behavioral syndrome due to physical factor (F50-F59)	29 (.9%)	3.5 (2.4-5.0)	5 (.3%)	1.1 (.4-2.6)	103 (.7%)	2.5 (2.1-3.1)
Personality disorder (F60-F69)	20 (.6%)	2.4 (1.5-3.7)	23 (1.3%)	5.2 (3.3-7.7)	57 (.4%)	1.4 (1.1-1.8)
Unspecified mental disorder (F99)	20 (.6%)	2.4 (1.5-3.7)	10 (.6%)	2.2 (1.1-4.1)	53 (.4%)	1.3 (1.0-1.7)
All psychiatric diagnoses (F1-F99)	705 (21.1%)	85.4 (79.2-92.0)	497 (27.7%)	111.4 (101.8-121.6)	2,206 (14.7%)	54.5 (52.2-56.8)



**Figure 2.** Unadjusted incidence rates of all psychiatric diagnoses following teenage pregnancy (induced abortion or childbirth) or the index day.

the parents were collected from the special health care (Hospital Discharge Register of National Institute for Health and Welfare) since 1969 through 1986. Sociodemographic status and educational level were treated as categorical variables, whereas age served as a continuous variable.

We calculated IRRs of psychiatric diagnoses separately for teenagers aged <18 years at the beginning of the pregnancy or the index day because among older teenagers, a larger proportion of pregnancies ending in childbirth were likely planned. For all statistical analyses, we used IBM SPSS Statistics V.24.0 for Mac OS (IBM Corp., Armonk, NY) and R statistical

software version 3.5.1. (RCore Team (2018). R: A language and environment for statistical computing. R Foundation for Statistical Computing, Vienna, Austria.). All the organizations from which data were collected (the National Institute for Health and Welfare, Statistics Finland, and Population Register Centre) granted permission to use these data in our study (register numbers THL/1726/5.05.00/2012, TK53-1173-12, and 3943/410/12). In addition, according to the Finnish legislation, an approval from The National Institute for Health and Welfare (THL/1726/5.05.00/2012) was obtained before initiation of the study.

**Table 3**

Incidence rate ratios (IRRs) and 95% confidence intervals of psychiatric morbidity following a teenage pregnancy or the index day during the entire follow-up period based on the age at the beginning of the pregnancy or the index day

	Abortion <20 y versus no teenage pregnancy <20 y		Childbirth <20 y versus no teenage pregnancy <20 y		Abortion <20 y versus childbirth <20 y	
	Unadjusted IRR	Adjusted <sup>a</sup> IRR	Unadjusted IRR	Adjusted <sup>a</sup> IRR	Unadjusted IRR	Adjusted <sup>a</sup> IRR
Any psychiatric diagnosis F01-F99	1.5 (1.4 - 1.6)	1.3 (1.2 - 1.3)	1.6 (1.5 - 1.7)	1.2 (1.2 - 1.3)	.9 (.9 - 1.1)	1.0 (.9 - 1.1)
Mental disorders because of psychoactive substance use F10-F19	3.0 (2.5 - 3.5)	1.9 (1.6 - 2.4)	3.4 (2.9 - 4.1)	1.7 (1.4 - 2.1)	.9 (.7 - 1.0)	1.1 (.9 - 1.3)
Mood disorders F30-F39	1.5 (1.4 - 1.7)	1.3 (1.2 - 1.4)	1.6 (1.5 - 1.8)	1.3 (1.2 - 1.4)	.9 (.8 - 1.1)	1.0 (.9 - 1.1)
Anxiety disorders F40-F49	1.4 (1.3 - 1.6)	1.3 (1.1 - 1.4)	1.5 (1.3 - 1.6)	1.3 (1.1 - 1.4)	1.0 (.8 - 1.1)	1.0 (.8 - 1.1)
	Abortion <18 y versus no teenage pregnancy <18 y		Childbirth <18 y versus no teenage pregnancy <18 y		Abortion <18 y versus childbirth <18 y	
	Unadjusted IRR	Adjusted <sup>a</sup> IRR	Unadjusted IRR	Adjusted <sup>a</sup> IRR	Unadjusted IRR	Adjusted <sup>a</sup> IRR
Any psychiatric diagnosis F01-F99	1.6 (1.4 - 1.7)	1.3 (1.1 - 1.4)	2.0 (1.9 - 2.3)	1.4 (1.3 - 1.6)	.8 (.7 - .9)	.9 (.8 - 1.0)
Mental disorders because of psychoactive substance use F10-F19	2.9 (2.2 - 3.7)	1.7 (1.2 - 2.8)	4.6 (3.5 - 6.0)	1.9 (1.3 - 2.6)	.6 (.5 - .8)	.8 (.6 - 1.1)
Mood disorders F30-F39	1.7 (1.4 - 1.9)	1.4 (1.2 - 1.6)	2.1 (1.8 - 2.5)	1.5 (1.2 - 1.9)	.8 (.6 - .9)	.9 (.7 - 1.1)
Anxiety disorders F40-F49	1.4 (1.2 - 1.6)	1.1 (1.0 - 1.4)	1.9 (1.6 - 2.2)	1.6 (1.3 - 2.0)	.7 (.6 - .9)	.8 (.6 - 1.0)

<sup>a</sup> Adjusted for age at the beginning of the pregnancy, residential area at the end of the pregnancy, the highest educational level achieved at the end of the follow-up period, number of teenage pregnancies and parental psychiatric morbidity.

## Results

The sociodemographic characteristics between the study groups differed significantly, particularly regarding the highest educational level achieved (Table 1). Women without a teenage pregnancy attained a higher educational level than women with a teenage childbirth or a teenage induced abortion. Among the teenage pregnancy groups, the educational level achieved remained higher during the entire follow-up period among the teenage induced abortion group compared with the teenage childbirth group.

Psychiatric morbidity rates were higher in both the teenage induced abortion group and the teenage childbirth group compared with the reference group (Table 2). In particular, the group of childbirth <18 years of age exhibited higher psychiatric morbidity rates compared with both the abortion and reference groups (Table 2). The most common psychiatric diagnoses in both teenage pregnancy groups consisted of mental and behavioral disorders because of psychoactive substance use (F10 - F19) and mood disorders (F30 - F39), as well as anxiety, dissociative, stress-related, somatoform, and other nonpsychotic mental disorders (F40 - F49). Similarly, in the reference group with no teenage pregnancy, mood disorders (F30 - F39) and anxiety disorders (F40 - F49) were the most common psychiatric reasons for healthcare service visits. Conversely, mental disorders because of psychoactive substance use in the control group were not as remarkable as in the teenage pregnancy groups.

When considering the overall psychiatric morbidity at different periods following a teenage childbirth, the incidence of psychiatric diagnoses remained lower in the reference group with no teenage pregnancy during the entire follow-up period (Figure 2). However, when comparing the teenage induced abortion group to the reference group, we observed a significant difference beginning only at 5 years following the induced abortion (Figure 2).

The risk of having a mental disorder because of psychoactive substance use was approximately three times higher among women with a teenage induced abortion or a teenage childbirth at <20 years of age compared with the reference group (Table 3). The risk ratios decreased somewhat after adjustment but remained significant (IRR 1.9, 95% CI 1.6 - 2.4 for the abortion group and IRR 1.7, 95% CI 1.4 - 2.1 for the childbirth group).

Furthermore, mood and anxiety disorders were more common following a teenage induced abortion or teenage childbirth than in the reference group. We found no difference in IRRs for different psychiatric diagnoses between the teenage induced abortion group and the childbirth group (Table 3).

However, when separately considering the abortion and childbirth groups <18 years of age at the beginning of a pregnancy, we found that IRRs for different psychiatric diagnoses were higher among the childbirth group compared with the reference group or the induced abortion group (Table 3). Specifically, the risk for anxiety disorders appeared higher in the childbirth group (adjusted IRR 1.6, 95% CI 1.3 - 2.0) compared with the abortion group <18 years of age (adjusted IRR 1.1, 95% CI 1.0 -1.4).

## Discussion

In this study, we found that the risk of psychiatric morbidity remained unchanged during the first 5 years following a teenage induced abortion when compared with the reference group with no teenage pregnancy. Furthermore, we found no difference in the risk of mental health disorders between the teenage pregnancy groups <20 years of age (induced abortion vs. childbirth) across the follow-up period. However, among the two groups <18 years of age, the risk of psychiatric morbidity was slightly decreased among the induced abortion group compared with the childbirth group.

When considering the psychiatric morbidity at different periods after teenage induced abortion, we found that the incidence of psychiatric diagnoses increased only after 5 years postabortion when compared with the reference group with no teenage pregnancy (Figure 2). This finding suggests that teenage induced abortion itself does not cause mental health disorders because the incidence of psychiatric diagnoses increased only after the first 5 years postabortion. Specifically, mental disorders because of psychoactive substance use more commonly occurred among women with a history of teenage induced abortion compared with the reference group with no teenage pregnancy (Table 3). Hence, substance use represents at least one amplifier for an increased risk of psychiatric morbidity among women with a history of teenage abortion. In addition, increased risk for mental disorders because of

psychoactive substance use represents a risk-taking and unstable lifestyle that presumably associates with the lower completed educational level compared with the reference group with no teenage pregnancy.

In the teenage childbirth group, by contrast, we found an increased incidence of psychiatric diagnoses as early as the first 5 years following childbirth when compared with the reference group with no teenage pregnancy. This finding agrees with previous studies suggesting that teenage mothers are more likely to suffer from postpartum depression than women who conceive at an adult age, although this likely results from social hardships these girls experienced already before pregnancy [18e20].

The present study relies on unique nationwide register-based data, covering nearly all teenage childbirths and induced abortions in Finland between 1987 and 1989. The Finnish health registers are reliable and comprehensive [21,22]. Because of the register-based study design, our results are not affected by selection or recall bias. Furthermore, the mean follow-up time of 26.4 years following the end of the pregnancy or the index day allowed us to study psychiatric morbidity over a long time period. In addition, to minimize the possible exaggeration of evaluated risks affecting results, we analyzed women with only one teenage pregnancy separately.

We must, however, acknowledge the weaknesses of this study. These registers lack information about the intentionality of the pregnancies included in our analysis. However, most pregnancies are unintended, particularly among younger teenagers. For instance, 88% of pregnancies among teenagers 16e19 years of age were identified as unplanned or ambivalent in Britain in 2013 [23]. Similar findings were reported in the U.S. in 2013, indicating that 68% of childbirths to girls aged  $\leq 17$  years were identified as unplanned [24]. The factors behind the desire to become a teenage mother are poorly understood, and additional research evaluating these factors is urgently needed. Furthermore, we only have information on the most severe psychiatric morbidity in childhood before a teenage pregnancy. The small number of psychiatric diagnoses among the study participants in childhood might partly result from a reluctance to diagnose psychiatric disorders in children and adolescents. Adolescence represents a developmental period when mood disorders

increase, especially among girls [25]. However, to decrease the effect of existing psychiatric morbidity, we excluded women diagnosed with a psychiatric disorder during childhood from the analysis. In addition, our data lacked information about the detailed socioeconomic status of the study participants at the time of the study. However, we were able to use the highest achieved educational level that reflects the socioeconomic status appropriately.

In conclusion, women with a history of teenage induced abortion or teenage childbirth appear at increased risk for psychiatric morbidity, a risk that persists into adulthood. However, teenage induced abortion in particular does not seem to associate with this increased risk during the immediate postabortion years, but rather represents a part of a larger phenomenon, likely to include other hardships and circumstances these women face in their lives. Furthermore, in Finland, pregnant adolescents giving birth meet the health care and social workers before and after the delivery more frequently than adolescents ending in induced abortions. These regular contacts to the health care presumably enable recognizing mental health problems earlier when compared with adolescents with induced abortion. Hence, our study carries practical implications. First, to maintain the declining trend in teenage pregnancy in developed countries, equitable access to high-quality reproductive services should be offered to all teenagers. According to previous studies, improvements in contraceptive use and sexual education in schools play a remarkable role in reducing teenage pregnancy [26,27]. In particular, providing long-acting reversible contraceptive methods free-of-charge reduces the rate of induced abortions among adolescents as well as adults [28,29]. Funding programs can serve an important role if state funding is limited [29]. Second, the health care system and social services should support the education of young mothers. Previous studies from Finland and New Zealand have indicated the gap in the educational level achieved following teenage childbirth compared with induced abortion [7,9]. As we show in the present study, the gap persists into adulthood, which is a remarkable finding although the causality remains uncertain. Third, in addition to focusing on preventing subsequent teenage pregnancy, health care providers and social workers should examine possible risk

factors for mental health problems when assessing and counseling pregnant adolescents. Identifying pregnant girls who are in need of additional support is likely essential to preventing adverse outcomes.

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