

# Trends in teenage termination of pregnancy and its risk factors: a population-based study in Finland, 1987–2009

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**STUDY QUESTION:** What are the current trends in teenage termination of pregnancy (TOP) and its risk factors?

**SUMMARY ANSWER:** The incidence of teenage TOP fluctuated substantially during the study period and the incidence of repeat TOP among adolescents increased markedly in the 2000s.

**WHAT IS KNOWN ALREADY:** Teenage pregnancy is associated with difficulties in psychological, sexual and overall health. The proportion of teenage pregnancies resulting in termination varies by country and time, but only few countries have reliable statistics on TOPs.

**STUDY DESIGN, SIZE, DURATION:** This nationwide retrospective register study included all the TOPs ( $n = 52\,968$ ) and deliveries ( $n = 58\,882$ ) in Finland between 1987 and 2009 among girls <20 years of age at the beginning of pregnancy.

**PARTICIPANTS/MATERIALS, SETTING, METHODS:** The cohorts were divided into three subgroups; 13–15- ( $n = 6087$ ), 16–17- ( $n = 18\,826$ ) and 18–19- ( $n = 28\,055$ ) year-olds.

**MAIN RESULTS AND THE ROLE OF CHANCE:** After an initial steady decline, the incidence of teenage TOP increased by 44% between 1993 (8.0/1000) and 2003 (11.5/1000), and thereafter declined by 16% until 2009 (9.7/1000). The incidence was higher in older adolescents, but the trends were alike in all age groups. Early TOPs (performed at <56 days of gestation) more than tripled from 11 to 36% during the study period. However, the proportion of second-trimester TOPs remained steady at ~7%. Young age [13–15 years: odds ratio (OR) 1.75 (95% confidence interval (CI) 1.57–1.94), 16–17 years: OR 1.13 (1.05–1.23), 18–19 years: OR 1 (reference category)] and non-use of contraception [OR 1.16 (1.05–1.27)] were related to a higher risk of second-trimester TOP. The incidence of repeat TOP increased by 95% from 1.9/1000 to 3.7/1000 in 18–19-year-olds and by 120% from 0.5/1000 to 1.1/1000 in 16–17-year-olds between 1993 and 2009. Increasing age [13–15 years: OR 0.16 (95% CI 0.14–0.19), 16–17 years: OR 0.49 (0.45–0.52), 18–19 years 1 (Ref)], living in an urban area [rural: OR 0.62 (0.56–0.67), urban: OR 1 (Ref)] and having undergone a second-trimester TOP [OR 1.46 (1.31–1.63)] were risk factors for repeat TOP. The planned use of intrauterine contraception for post-abortual contraception increased from 2.6 to 6.2% and among girls with repeat TOP from 10 to 19%.

**LIMITATIONS:** The retrospective nature of the study remains a limitation and the quality of the data is reliant on the accuracy of reporting. We were not able to link repeat TOPs of the same woman in our data set. However, the share of repeat abortions was moderate.

**WIDER IMPLICATIONS OF THE FINDINGS:** The rate of teenage TOP seems to rapidly reflect changes in national sexual and reproductive health services and policy. The rising rate of repeat TOP is alarming and may represent a sign of marginalization among these girls. All efforts to maintain a low rate of teenage pregnancy are welcomed.

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**Key words:** adolescent / abortion / induced / risk factors / pregnancy

## Introduction

Pregnancy during adolescence is rarely planned (Chandra *et al.*, 2005; Finer and Henshaw, 2006). Moreover, teenage pregnancies resulting in delivery have been associated with poorer health, increased social and economic burdens and sexually transmitted infections (Moffitt and E-Risk Study, 2002; Meade and Ickovics, 2005; Boden *et al.*, 2008; Paranjothy *et al.*, 2009). The incidence of teenage pregnancy is thought partly to reflect overall progress in public health, especially sexual and reproductive health (Edgardh, 2002). However, few countries have reliable statistics on teenage pregnancy, capable of differentiating between delivery and termination of pregnancy (TOP) (Gissler *et al.*, 2012).

The proportion of teenage pregnancies ending in TOP varies by country. The incidence of teenage TOP is relatively low in Finland (13/1000 in 2009) (THL, 2012a) compared with the USA (15/1000) (Pazol *et al.*, 2011), Britain (24/1000) and Sweden (24/1000) (Gissler *et al.*, 2012). In recent years, 61% of all teenage pregnancies have resulted in TOP in Finland, the figures being 80% in Sweden and 23% in the USA (CDC, 2011; Pazol *et al.*, 2011; THL, 2012a,b).

Previous studies have revealed several risk factors associated with teenage pregnancy, such as disadvantaged socioeconomic background, disrupted family structure and low educational level (Vikat *et al.*, 2002; Imamura *et al.*, 2007). Other risk factors include limited use of contraception, alcohol and drug abuse, early initiation of intercourse and multiple sexual partners (Darroch *et al.*, 2001; Cavazos-Rehg *et al.*, 2011).

Reliable and comprehensive nationwide information on trends in teenage TOP and underlying factors remains sparse. Moreover, teenagers are often investigated as one group, neglecting different stages in sexual and psychological maturity and previous reproductive history. The purpose of the present study was to analyse and characterize trends in teenage TOP, and the proportion of induced TOPs among all the teenage pregnancies in Finland between 1987 and 2009. We focused specifically on the timing of TOP, the rate of repeat and second-trimester TOP and trends in contraceptive use before and after TOP by age.

## Materials and Methods

Data for the study were derived from the National Registry on Induced Abortions and Sterilizations, and from the Medical Birth Register maintained by the National Institute for Health and Welfare (THL, 2012c). We used data on all registered induced TOPs (52 968) and deliveries (58 882) in Finland between 1987 and 2009 among girls and young women below 20 years of age at the beginning of pregnancy.

According to Finnish legislation, TOP is allowed at up to 20 weeks of gestation for medical, ethical and social reasons and up to 24 weeks in relation to a medical condition of the foetus. Medical reasons include severe illness or handicap of the foetus or the woman, pregnancy being a risk to the woman's health and a mother not being able to take care of the child. Ethical reasons include rape and incest and other reasons defined by Penal Law. Social reasons include notable strain on the mother's living conditions, age below 17 or above 40 years at conception and birth of four children or more.

The legislation obliges physicians to report each TOP to the Abortion Registry within 1 month of the procedure; the Registry includes at least 99% of TOPs performed in Finland (Gissler *et al.*, 1996, Heikinheimo

*et al.*, 2008). Aggregated Medical Birth Register data were used to obtain information on teenage pregnancies, beginning at the age of <20 years and continuing to birth.

Age at the beginning of pregnancy was an explanatory variable, and the cohorts were divided into three subgroups: 13- to 15-, 16- to 17- and 18- to 19-year-olds. The type of a woman's area of residence at the end of pregnancy was divided into three categories on the basis of population density according to national classification by Statistics Finland: urban, densely populated and rural (Statistics Finland, 2012). The number of previous TOPs, duration of gestation at termination (confirmed by ultrasonography increasingly during the 1990s and universally in the 2000s), reported contraception used at the time most probably leading to unwanted pregnancy, planned contraception following TOP and marital status (divided into married/cohabiting and single) were derived from the Abortion Registry. The data collection form was changed in 1997 and 2009. Different alternatives on contraception and method of termination were matched to allow best possible comparison.

## Statistical analysis

The annual incidence of TOPs (1/1000) in different age groups was calculated by using age-specific population figures for each year.

The incidence of teenage TOP fluctuated substantially during the study period, and therefore, we focused on the extremities to investigate temporal trends in teenage TOP. The three chosen 3-year time periods were the years of lowest incidence (1993–1995), highest incidence (2001–2003) and latest available data (2007–2009). Differences between these time periods were assessed by chi-square tests. Relative risks (RRs) and odds ratios (ORs) were calculated to evaluate changes in the overall incidence of teenage TOP, and repeat and second-trimester teenage TOP. Logistic regression was used to identify the risk factors of repeat and second-trimester TOPs. Age, living in a relationship (married/cohabiting), type of residence (urban, densely populated and rural), repeat TOP, second-trimester TOP and the use of contraception when becoming pregnant were used as confounding factors. The data were analysed with the SAS 9.1 software. A value of  $P < 0.05$  was considered significant.

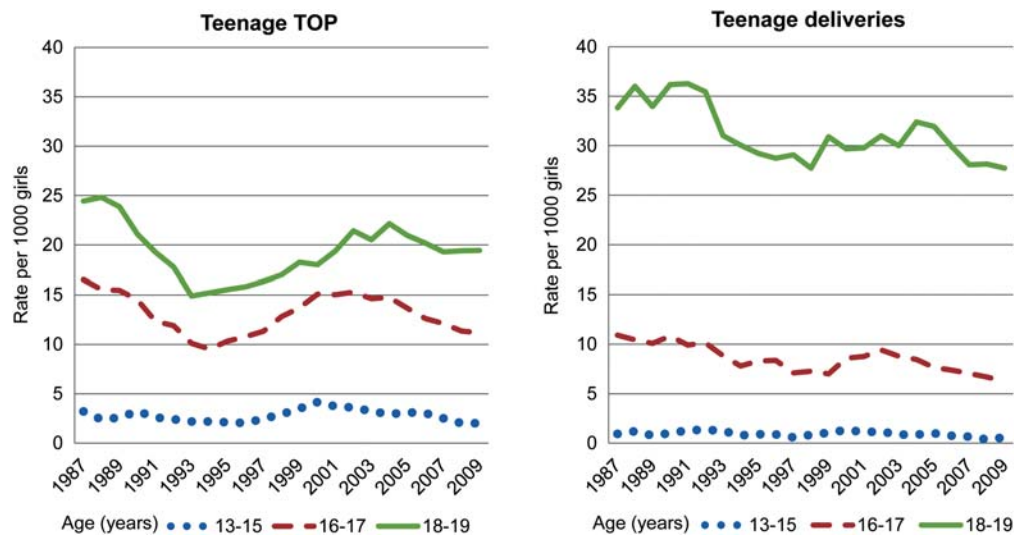
## Results

The incidence of teenage TOP in Finland varied greatly during the study period. After a steady decline, the incidence of teenage TOP increased by 44% between 1993 and 2003 and thereafter declined by 16% until 2009 (Fig. 1). The trend was similar in different age groups. The latest decline in the TOP rate, however, was most substantial among 13- to 15-year-olds (Table I).

The proportion of TOPs among all registered teenage pregnancies remained steady throughout the study period. In 2007–2009, the proportion of TOPs was 82% among 13- to 15-year-olds, 63% among 16- to 17-year-olds and 41% among 18- to 19-year-olds.

Throughout the study period, teenage TOP rates were highest in urban and lowest in rural areas. In 2007–2009, the incidence of teenage TOP was 13.2/1000 in urban areas, 10.8/1000 in densely populated areas and 8.6/1000 in rural areas; the proportions of TOPs among all teenage pregnancies were 50.7, 47.0 and 44.3%, respectively. The rising and declining trends were similar throughout the country.

The demographic characteristics of teenagers seeking TOP during different time periods are shown in Table II. The proportion of



**Figure 1** Teenage TOP and delivery rates in Finland according to age, from 1987 to 2009.

**Table 1** Risk of TOP and second-trimester and repeat TOP among adolescents in Finland according to time period.

TOP	1993–1995 (n = 5413)		2001–2003 (n = 7848)		2007–2009 (n = 6668)	
Age (years)	RR	(95% CI)	RR(95% CI)		RR	(95% CI)
13–15	<b>0.61</b>	<b>(0.55–0.68)</b>	I (Ref)		<b>0.64</b>	<b>(0.58–0.71)</b>
16–17	<b>0.68</b>	<b>(0.64–0.72)</b>	I (Ref)		<b>0.78</b>	<b>(0.74–0.83)</b>
18–19	<b>0.71</b>	<b>(0.68–0.75)</b>	I (Ref)		<b>0.91</b>	<b>(0.87–0.95)</b>
Second trimester TOP	(n = 402)		(n = 88)		(n = 491)	
Age (years)	OR	95% CI	OR(95% CI)		OR	(95% CI)
13–15	0.82	(0.58–1.15)	I (Ref)		1.07	(0.78–1.47)
16–17	1.2	(0.97–1.49)	I (Ref)		1.08	(0.88–1.33)
18–19	0.91	(0.75–1.11)	I (Ref)		0.93	(0.78–1.11)
Repeat TOP	(n = 477)		(n = 897)		(n = 956)	
Age (years)	OR	(95% CI)	OR(95% CI)		OR	(95% CI)
13–15	1.09	(0.56–2.12)	I (Ref)		1.07	(0.55–2.07)
16–17	<b>0.58</b>	<b>(0.46–0.74)</b>	I (Ref)		1.06	(0.87–1.28)
18–19	<b>0.78</b>	<b>(0.68–0.90)</b>	I (Ref)		<b>1.32</b>	<b>(1.17–1.48)</b>

Statistically significant differences are highlighted using bold font. OR, odds ratio; Ref, reference category; RR, relative risk; TOP, termination of pregnancy.

teenagers living in a relationship (married + cohabiting) almost doubled from a total of 7.6–14.1%. The proportion of adolescents with at least one previous pregnancy increased from 9.3 to 14.4%.

The reported method of contraception used at the time of unplanned pregnancy remained similar throughout the study period. Approximately 40% reported not having used any method of contraception (Table II). The proportion of girls reporting the use of emergency contraception (EC) increased from 1.5 to 2.6% between 2001 and 2009.

Regarding the planned method of post-abortion contraception, the combined oral contraceptive pill was the most popular, although its planned use declined (Table II). In contrast, planned use of alternative

hormonal contraception, i.e. progestin-only pills, implants, injections, vaginal rings and patches, increased markedly (Table II). Planned use of intrauterine contraception [including the levonorgestrel-releasing intrauterine system (LNG-IUS) and a copper-releasing intrauterine device (Cu-IUD)] increased from 2.6 to 6.2%. Until the late 1990s, Cu-IUDs were the sole IUDs used, whereas during 2007–2009 the LNG-IUS represented 44% of all planned methods of post-abortion intrauterine contraception.

In the repeat TOP group, planned future use of intrauterine contraception increased from 10% in 1993–1995 to 19% in 2007–2009. Use of the LNG-IUS constituted nearly half of all planned forms of intrauterine contraception in 2007–2009 among teenagers.

**Table II** Demographics and contraceptive practices before and after TOP during the study period in Finland.

	1987–1989 (n = 8151)	1993–1995 (n = 5413)	2001–2003 (n = 7848)	2007–2009 (n = 6668)	P for change 1993– 1995/2001–2003	P for change 2001– 2003/2007–2009
Age (years)						
Median (mean)	17 (18.1)	17 (17.9)	17 (17.3)	17 (17.4)		
13–15	9.0	11.4	12.5	<b>9.4</b>	0.055	< <b>0.001</b>
16–17	34.3	35.6	36.2	<b>34.1</b>	0.479	<b>0.009</b>
18–19	56.7	53.0	51.3	<b>56.4</b>	0.054	< <b>0.001</b>
Marital status						
Married	1.5	1.5	<b>1.0</b>	1.1	<b>0.009</b>	0.548
Cohabiting	6.1	8.5	8.8	<b>13.0</b>	0.537	< <b>0.001</b>
Single	92.3	89.3	90.1	<b>85.4</b>	0.137	< <b>0.001</b>
Type of residence						
Urban	64.1	64.8	<b>67.2</b>	<b>71.6</b>	<b>0.004</b>	< <b>0.001</b>
Densely populated area	16.2	16.3	15.2	15.3	0.089	0.837
Rural	19.7	18.9	<b>17.5</b>	<b>13.1</b>	<b>0.039</b>	< <b>0.001</b>
Previous abortions/deliveries	9.3	8.8	<b>11.4</b>	<b>14.4</b>	< <b>0.001</b>	< <b>0.001</b>
Duration of gestation (weeks)						
Median (mean)	10 (10.4)	9 (10.1)	9 (9.6)	8 (9.3)		
6–7	10.5	15.1	<b>28.7</b>	<b>35.8</b>	< <b>0.001</b>	< <b>0.001</b>
8–9	36.1	41.3	37.4	37.6	< <b>0.001</b>	0.846
10–11	46.4	36.1	<b>26.4</b>	<b>19.3</b>	< <b>0.001</b>	< <b>0.001</b>
12–20/24	7.0	7.4	7.5	7.4	0.835	0.752
Contraception <sup>a</sup>						
Condom	47.9	49.4	<b>51.4</b>	<b>46.9</b>	<b>0.023</b>	< <b>0.001</b>
Contraceptive pill	6.5	5.7	<b>8.3</b>	<b>9.4</b>	< <b>0.001</b>	<b>0.016</b>
No contraception	40.9	39.2	40.3	39.2	0.203	0.166
Emergency contraception	—	—	<b>1.5</b>	<b>2.6</b>	< <b>0.001</b>	< <b>0.001</b>
Planned contraception after TOP						
Contraceptive pill	88.7	89.0	88.1	<b>77.0</b>	0.107	< <b>0.001</b>
LNG-IUS	—	—	<b>1.0</b>	<b>2.7</b>	< <b>0.001</b>	< <b>0.001</b>
Cu-IUD	3.0	2.6	2.8	<b>3.5</b>	0.490	<b>0.017</b>
Condom	1.5	1.9	1.9	1.8	0.986	0.662
No contraception	0.7	0.5	0.4	0.4	0.373	0.623
Other contraceptive methods <sup>b</sup>	0.3	0.2	0.3	<b>13.6</b>	0.258	< <b>0.001</b>

Data expressed as % unless otherwise stated.

P-values for trends were assessed by chi-square tests.

Statistically significant differences are highlighted using bold font.

Cu-IUD, copper-releasing intrauterine device; LNG-IUS, levonorgestrel-releasing intrauterine system.

<sup>a</sup>Contraception at the time leading to pregnancy.

<sup>b</sup>Progestin-only pills, implants, injections, vaginal ring and patch.

As regards timing, the proportion of TOPs performed at 6–7 weeks of gestation tripled between 1987–1989 and 2007–2009 (Table II). The change was similar in all age groups. However, the proportion of second-trimester TOPs (12–20/24 weeks of gestation) of all teenage terminations remained stable at ~7%. The proportion of second-trimester TOPs was highest among the youngest adolescents, i.e. 11.6% among 13- to 15-year-olds, versus 7.9% among 16- to 17-year-olds and 6.3% among 18- to 19-year-olds in 2007–2009.

We identified several risk factors as regards second-trimester TOP (Table III). Non-use of contraception at the time leading to pregnancy

was the most substantial risk [OR 11.2, 95% confidence interval (CI) 10.2–12.3]. Younger age was also a risk factor and the OR among the youngest age group increased from 1.5 (95% CI 1.0–2.1) in 1993–1995 to 1.9 (1.2–3.2) in 2007–2009 compared with 18- to 19-year-olds. Among the 16- to 17-year-olds, the risk was small and remained stable. A history of TOP or pregnancy was a risk factor of second-trimester TOP, and living in a densely populated or rural area also increased the risk, although the excess risk was relatively small.

The incidence of repeat TOP per 1000 women increased significantly among the 18- to 19-year-olds starting from the mid-1990s:

**Table III Risk and protective factors for second-trimester and repeat TOP among adolescents in Finland from 1987 to 2009.**

	Adj. OR <sup>a</sup>	(95% CI)
Second-trimester TOP (n = 3803)		
Age (years)		
13–15	1.75	(1.57–1.94)
16–17	1.13	(1.05–1.23)
18–19	1	(Ref)
Marital status		
Cohabiting or married	0.96	(0.85–1.09)
Single	1	(Ref)
Type of residence		
Densely populated area	1.11	(1.01–1.23)
Rural	1.11	(1.01–1.22)
Urban	1	(Ref)
Previous abortions		
One or more	1.46	(1.31–1.62)
None	1	(Ref)
Contraception at the time leading to pregnancy		
No	11.16	(10.15–12.27)
Yes	1	(Ref)
Repeat TOP (n = 5423)		
Age (years)		
13–15	0.16	(0.14–0.19)
16–17	0.49	(0.45–0.52)
18–19	1	(Ref)
Marital status		
Cohabiting or married	1.64	(1.51–1.78)
Single	1	(Ref)
Type of residence		
Densely populated area	0.69	(0.63–0.76)
Rural	0.62	(0.56–0.67)
Urban	1	(Ref)
Second-trimester abortion		
Yes	1.46	(1.31–1.63)
No	1	(Ref)
Contraception at the time leading to pregnancy		
No	1.05	(0.90–1.21)
Yes	1	(Ref)

<sup>a</sup>Logistic regression adjusted for all variables given in the table.

1.9/1000 in 1993–1995, 3.1/1000 in 2001–2003 and 3.7/1000 in 2007–2009 (Fig. 2). A similar increase was seen among the 16- to 17-year-olds, which ended in the early 2000s (Fig. 2, Table I): 0.5/1000 in 1993–1995, 1.4/1000 in 2001–2003 and 1.1/1000 in 2007–2009. This increase can also be seen in the proportion of repeat TOPs among all teenage TOPs. In 18- to 19-year-olds the proportions were 12.4, 15.3 and 19.2% and in 16- to 17-year-olds 5.3, 9.0 and 9.2% in 1993–1995, 2001–2003 and 2007–2009, respectively.

This rising trend in repeat TOPs was seen throughout the country regardless of the type of residence. Repeat TOPs were more common in urban areas throughout the study period. The proportion was 13.2% in urban areas, 11.0% in densely populated areas and 8.9% in rural areas among all teenagers in 2007–2009.

The risk and protective factors as regards repeat teenage TOP are shown in Table III. As expected, younger age was associated with a significantly lower risk of repeat TOP. Compared with 18- to 19-year-olds, the OR for repeat TOP among 13- to 15-year-olds decreased from 0.2 (95% CI 0.1–0.3) in 1993–1995 to 0.1 (0.0–0.2) in 2007–2009. For other age groups, the OR remained similar throughout the study period. Living in a rural or densely populated area was also a protective factor, while living in a relationship and having undergone a second-trimester TOP were risk factors for repeat teenage TOP.

The method of TOP shifted dramatically from surgical to medical termination during the study period. The proportions of the two methods were: surgical TOP in 89, 59 and 21%, and medical TOP in 10, 42 and 78% in 1993–1995, 2001–2003 and 2007–2009, respectively. First-trimester medical TOPs constituted 4, 36 and 71% of all TOPs during 1993–1995, 2001–2003 and 2007–2009, and second-trimester medical TOPs, 6, 6 and 7%, respectively.

## Discussion

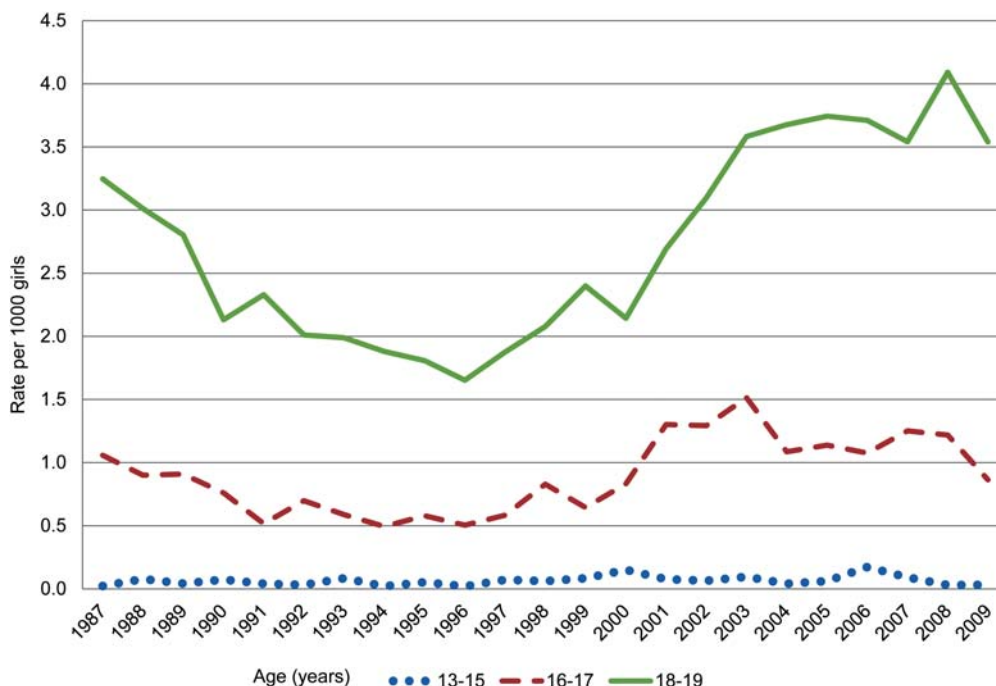
We find that the incidence of teenage TOP fluctuated considerably during the last 20 years in Finland. This is in contrast to the overall incidence of TOP, which remained steady at 8 to –10 per 1000 women aged 15–49 years between 1987 and 2009. Reassuringly, a declining trend was seen in the 2000s. The timing of TOP shifted to earlier weeks in all teenagers following the introduction of medically induced abortion, yet second trimester abortions were more common in younger adolescents. Repeat abortions were on the rise in 16–19-year-olds, and the incidence was highest in urban areas and among girls with a history of second-trimester TOP.

According to the results of a Finnish study, risky sexual behaviour increased in parallel with rising adolescent TOP rates from the mid-1990s until the early 2000s (Falah-Hassani *et al.*, 2009). The new downward turn thereafter was accompanied by a decline in reported sexual activity and increased use of contraception in adolescents. Among sexually active girls, however, the number of sexual partners increased (Falah-Hassani *et al.*, 2009). These girls may be a risk group as regards further problems in sexual health and well-being in general.

Nationwide data, covering all TOPs and deliveries in Finland during the study period, were used for the study. Both registers include information on the duration of gestation, enabling the use of age at the beginning of pregnancy in the analyses. This makes comparison between groups more reliable, since age is an important factor when studying adolescent TOPs and pregnancies ending in TOP are shorter than those ending in birth.

The retrospective nature of the study remains a limitation and the quality of the data is reliant on the accuracy of reporting. However, it is unlikely that the reporting quality would have drastically changed over time, thus having a minimal, if any, effect on the comparisons. Therefore, the reliability of our results and conclusions remains high. It should be recognized that we were not able to link repeat





**Figure 2** Repeat teenage TOP rates in Finland according to age, from 1987 to 2009.

TOPs of the same woman. Because we concentrated on teenage years only, the share of repeat abortions was, however, moderate, with a highest of 14% among all teenagers in 2007–2009.

There were notable changes in health services and sex education offered to adolescents during the study period. In the mid-1990s, during a period of severe economic recession in Finland, cuts in adolescent health services in schools and family planning clinics were made (Koponen et al., 1998; Hassani et al., 2006). In addition, great variation in the number of hours and quality of sex education between different schools was seen after the local municipalities gained the right to decide on content in 1994. Health education returned to being a compulsory subject in school curricula in 2004 (FINLEX, 1998). Many schools began teaching the subject in the early 2000s, resulting in an increase in teenagers' knowledge of human reproduction and sexuality (Liinamo, 2005). Diverse, good-quality sex education is known to result in a decrease in risky sexual behaviour among adolescents (Kirby et al., 2007). It was predictable that the changes in health services in the 1990s and again in the 2000s partly influenced adolescents' risky sexual behaviour, which was reflected in the TOP rates.

Health services in Finland are generally well-organized and equally offered to all residents but only a few municipalities offer services specifically directed at adolescents (Sannisto and Kosunen, 2009). Access to contraception and to health services in rural areas could be considered to be difficult for a teenager, but our data did not support this concept. The trends in teenage TOP did not vary according to the type of area, but the rates were higher in urban areas.

The reported use of contraception at the time of conception did not change among teenagers seeking TOP. After EC became available over-the-counter for women aged 15 years or more in Finland in 2002, its reported use increased to 2.6% among teenagers seeking

TOP. However, easier access to EC has not had much of an effect on TOP rates (Falah-Hassani et al., 2007). The proportion of adolescents reporting non-use of contraception remained steady at ~40%. Concerning planned post-abortion contraception, the use of combined oral contraceptives has been, to some degree, replaced by other forms of contraception. Planned use of an IUD/IUS in post-abortion contraception has increased and is becoming a realistic option for adolescents. The use of IUDs after repeat TOP was already significantly becoming more common in the 1990s and it continues to rise. According to a recent study, long-acting contraception was found superior to other forms in preventing unwanted pregnancies also in adolescents (Winner et al., 2012). The use of IUDs/IUSs may be helpful in bringing down the number of repeat TOPs (Heikinheimo et al., 2008). Also, the increasing number of contraceptive options allows more individual planning of post-abortion contraception, which may further decline the number of TOPs. All forms of contraception have been found cost-effective when publicly funded. However, most cost-effective ones are the long-acting reversible methods (Sonnenberg et al., 2004; Foster et al., 2009). Contraceptives are not reimbursable in Finland and the reimbursement of contraceptives did not change during the study period.

The timing of teenage TOPs shifted to earlier weeks at a steady rate in all age groups after the introduction of medical TOP in 2000. At the end of the study period, 73% of all teenage TOPs were performed at gestational weeks 6–9. Medical TOP has rapidly become the dominant method of pregnancy termination, and it has been found to be safe for adolescents (Niinimäki et al., 2011). Nevertheless, the proportion of second-trimester TOPs, performed at 12–20/24 weeks of gestation, did not decline.

Young age was an important risk factor associated with second-trimester TOP. Thus, the proportion of second-trimester TOPs of all

TOPs was almost twice as high among girls aged 13–15 years compared with those aged 18–19 years. It seems that among the youngest girls in particular, there is a group that is unreachable even after improved education programmes were provided by schools in the 2000s. Although small in number, this group can be seen as the most problematic, as initiation of sexual activity is combined with an unstable stage of puberty and a relatively weak knowledge of sexual health. Young women may have difficulties in decision-making concerning TOP because of, fear of the reactions of parents or partner and denial of pregnancy (Ingham *et al.*, 2008; Rowlands, 2008). It may be speculated that younger teenagers face such conflicts even more often. The decision on abortion can be the first important decision in a teenager's life (Rowlands, 2008). These matters, along with other circumstances, may then result in delayed contact with health services.

It can also be speculated that girls seeking second-trimester TOP are more prone to have social and psychological problems and depression, leading to risky sexual behaviour. Neglect of contraception could be one sign of such problems (Kosunen *et al.*, 2003). Non-use of contraception before pregnancy was the most substantial risk factor for late TOP among adolescents in our study.

Second-trimester TOP and young age (below 20 years) were also risk factors for repeat TOP and repeat second-trimester TOP (Mentula *et al.*, 2010). Second-trimester TOPs are associated with a higher risk of complications (Grossman *et al.*, 2008). Further studies are needed to identify girls at risk of second-trimester TOP so that targeted health services can be provided. Nevertheless, sexual health and contraceptive services with easy access are of great importance for adolescent girls and may reduce the number of unintended pregnancies (Swann *et al.*, 2003).

One of our key findings was the increasing number of repeat TOPs among teenagers. The rise in the rate of repeat TOPs began in the late 1990s. In the 18- to 19-year-olds this increase continued until 2009, whereas in the 16- to 17-year-olds the rate stabilized in the early 2000s, although it did not return to the level in the 1990s. Similarly, repeat teenage TOPs are increasing in Britain (Collier, 2009).

Beside age, living in a relationship (married or cohabiting) was a risk factor for repeat TOP. Earlier studies have shown that adolescents who do not live with their parents are at an increased risk of unplanned pregnancy (Narring *et al.*, 1996; Vikat *et al.*, 2002). They also display more health and socioeconomic problems and risky behaviour than those living in their childhood homes (Rimpelä *et al.*, 1990; White and Lacy, 1997) and they have the higher mortality (Valkonen *et al.*, 1993). Thus, the growing number of repeat TOPs among adolescents may be a sign of marginalization. Psychiatric disorders (Fergusson and Woodward, 2000; Kosunen *et al.*, 2003), dating violence and use of alcohol, tobacco and drugs (Cavazos-Rehg *et al.*, 2011; Walton *et al.*, 2011) are known to be associated with an increase in risky sexual behaviour and may partly underlie this phenomenon.

Our results have practical implications. Special attention should be paid to 13- to 15-year-old girls with signs of risk-taking behaviour, to prevent unplanned pregnancies, and especially second-trimester TOPs. Reducing the growing number of repeat TOPs is of great importance. Girls with risk factors may benefit from service provision, such as free access to intrauterine contraception following their first TOP. This is likely to be cost-beneficial in the long term (Sonnenberg *et al.*, 2004; Foster *et al.*, 2009). High-quality sex education in schools

and easy access services directed at adolescents should be available in all municipalities in order to reduce the number of repeat and second-trimester TOPs and to improve sexual and reproductive health (Swann *et al.*, 2003).

In conclusion, although the rate of teenage TOP is relatively low in Finland, it has fluctuated greatly in the last decades. In addition, despite the recent decline in the incidence of teenage TOP, the significant rise in the rate of repeat TOP may represent a sign of marginalization and negligence. Trends in adolescent TOP seem to be very sensitive indicators of changes in society, such as the introduction of various cut-backs. This must be kept in mind when making decisions on health care services and allocation of health expenditure.

## Authors' roles

All the authors have equally participated in study design, data analysis, manuscript drafting and critical discussion.

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## Conflict of interest

None declared.

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