

BMJ Open Associations between hormonal contraception use, sociodemographic factors and mental health: a nationwide, register-based, matched case-control study

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ABSTRACT

Objectives Sociodemographic and mental health characteristics are associated with contraceptive choices. We aimed to describe the sociodemographic, reproductive and mental health characteristics of all fertile-aged women in Finland who used hormonal contraception (HC) in 2017.

Design A nationwide, register-based study.

Setting All women living in Finland in 2017; data from the Care Register of Health Care, Medical Birth Register, Population Register Centre, Prescription Centre, Register of Induced Abortions.

Participants All women aged 15–49 with one redeemed HC prescription in 2017 (n=294 356), and a same-sized, age-matched and residence-matched, control group of non-users.

Outcomes Rates of HC use; associations between HC use and mental disorders, sociodemographic and reproductive characteristics.

Results 25.8% of women aged 15–49 years used HC. Women with the lowest socioeconomic levels had lower odds of using HC than women with upper-level statuses (OR, 95% CI students: 0.97, 0.94 to 0.99; entitled to pension: 0.66, 0.63 to 0.69; other: 0.87, 0.85 to 0.89; unknown: 0.90, 0.85 to 0.90). Women with the highest education (secondary: 1.46, 1.43 to 1.48; tertiary: 1.64, 1.58 to 1.70; academic: 1.60, 1.56 to 1.63) and income (second quarter: 1.57, 1.54 to 1.60; third quarter: 1.85, 1.82 to 1.89; fourth quarter: 2.01, 1.97 to 2.06), and unmarried women had higher odds of using HC than women with the lowest education and income levels, and married (0.61, 0.60 to 0.62), divorced (0.86, 0.84 to 0.88), widowed (0.73, 0.65 to 0.83) or other marital status women (0.26, 0.22 to 0.30).

Parous women (0.70, 0.69 to 0.71), those with previous induced abortion(s) (0.91, 0.89 to 0.92) or recent eating (0.68, 0.62 to 0.75) or personality (0.89, 0.79 to 0.97) disorders had lower odds of HC use. Absolute risk differences between women with and without mental disorders ranged from 3.1% (anxiety disorders) to 10.1% (eating disorders).

Conclusions A quarter of the fertile-aged women use HC in Finland. Sociodemographic disparities persist in relation to HC use, although of small effect size. HC use is less

Strengths and limitations of this study

- Redeemed hormonal contraception (HC) prescriptions are recorded in Finnish registers from 2017 onwards, and this is the first study to examine these records for all women living in Finland.
- The studied population covers more than half of the female population of childbearing age in Finland.
- Register data with proven good validity and reliability have been used in the study.
- Records of redeemed HC prescriptions do not report on the actual HC use. It was not possible to retrieve information on young women who obtained free contraception.
- We were not able to examine contraceptive use in women with less severe psychiatric conditions.

common among women suffering from severe to moderate psychiatric disorders, especially eating disorders.

INTRODUCTION

Globally, a growing proportion of women has access to and uses contraception. While it is difficult to estimate the rates of use of less reliable methods, such as condoms and natural methods, figures based on sale records show that more than 40% of women aged 15–49 years used some type of hormonal contraception (HC) in the period 2010–2013 in the Nordic countries. Oral contraceptive (OC) pills were the preferred method (used by more than 20% of the women), followed by the levonorgestrel-releasing intrauterine system (15%).¹

Efficacy and availability of contraceptive methods, in addition to adequate policies of sexual and reproductive education and public health strategies, have resulted in a significant decline in the number of unwanted pregnancies and induced abortions in Finland,

especially among adolescents and young women. In 2015, Finland had the lowest abortion rate among the Nordic countries, with a decline from 19.7 per 1000 women in 1973 to 8.2 in 2015. Similarly, the birth and abortion rates among adolescents aged 15–19 years declined from 10 and 15 per 1000 women in 2000 to 6 and 8, respectively, in 2015.² Thus, the benefits of contraceptive use seem to be related to reduced public health costs, improved women's social and work functioning, as well as better physical and mental health.³

The Nordic countries traditionally have high rates of HC use. They are also among the countries with the highest levels of welfare and social equality, as well as easy access to healthcare services, including contraception. However, disparities in the use and types of contraception continue to exist between and within countries worldwide. For example, sociodemographic and cultural factors, misconceptions and practical barriers, along with professionals' knowledge and skills influence both the women's attitude and choice, whether to use contraception and which method, as well as the prescribers' attitude and beliefs about contraceptive options.^{4–6} In addition, other factors that seem to be related to contraceptive use and choices are mental disorders. Disorders such as depression and anxiety are related to unintended pregnancy and risky sexual behaviour.^{7–8} Other studies have reported that women with previous or ongoing psychological symptoms, mental disorders or impulsive or antisocial behaviours typically exhibit an inconsistent use of contraception.^{9–11} According to other studies, the risk of unintended pregnancy is also elevated in women with eating disorders.¹² However, systematic data on their HC use are still lacking, and the subject needs to be further studied. On the other hand, recent studies have reported a possible higher risk for depressive disorder and suicidal behaviour among HC users, especially adolescents.^{13–14}

Thus, given the recent availability (from 2017) of records of redeemed HC prescriptions in Finnish registers, we identified all women of childbearing age living in Finland and using HC in 2017, with the aim to better understand the pattern of use of HC, its underlying correlates, and its relationship to mental disorders (as indicated by a recent care episode for psychiatric disorders).

METHODS

Study population

Each individual living in Finland is given, at birth or immigration, a unique personal identification number. This number was used to select the groups of cases and controls for this study, and for the linkages between the different national registers. Cases were selected from the Prescription Centre, which is a centralised database for prescription data in the Kanta Services,¹⁵ and includes information on all prescribed and redeemed medications (including, from 2017, HC) of the population of Finland. Such information comprises the product Anatomical Therapeutic Chemical (ATC) code,¹⁶ date of

prescription, prescribed amount in defined daily dose, number of prescribed packages, amount per package and date(s) of purchase.

All women living in Finland on 31 December 2017, with a record in the Prescription Centre of at least one redeemed prescription with ATC codes G02B ('contraceptives for topical use'), G03A ('HC for systemic use') or G03HB ('antiandrogens and estrogens') as of the year 2017, were identified. Further, for each HC user, a control woman, matched by year of birth and municipality of residence, with no records of redeemed HC prescriptions in 2017, was randomly selected. Selection of the groups was performed by the Social Insurance Institution of Finland (SII) and by Statistics Finland. Of the original 304993 women with at least one redeemed HC prescription in 2017, only those aged 15–49 years ($n=294445$) were considered women of reproductive age,¹⁷ and were thus included. Since antiandrogen and oestrogen preparations, which are usually prescribed for reasons others than contraception, also exert a contraceptive effect, the 18281 women using ATC 'G03HB' preparations were included in the study. Because emergency contraception in Finland is available without prescription, the 89 women with a redeemed prescription with ATC code 'G03AD', and their matched controls, were excluded, resulting in a final population of 294356 HC users (figure 1).

Sociodemographic characteristics

Information on sociodemographic characteristics of all the study participants on 31 December 2017 (age, municipality of residence, civil status, family type, socioeconomic group, highest level of education, occupation and annual income) was obtained through Statistics Finland from the Population Register Centre, which includes basic information of all Finnish citizens and foreign citizens permanently residing in Finland.

Reproductive characteristics

Based on the Medical Birth Register, which includes data on all live births and stillbirths since 1987, and the Register of Induced Abortions, containing data on induced abortions in Finland since 1983, we defined the following reproductive factors: parity and number of delivered children at 31 December 2016; history and number of induced abortions before 2017; and recentness of induced abortions (before 2016, 2016–2017 or no induced abortions).

Women who gave birth during 2017 were identified through the Medical Birth Register. Women who underwent a sterilisation between 1987 and 2016 were identified through the Register of Sterilisations.

Mental health

Information on mental health was retrieved from the Care Register of Health Care, which includes data on inpatient care in hospitals, health centres, day surgeries and specialised outpatient care since 1994. Specifically, discharge diagnoses with International Classification of Diseases, 10th Revision codes F10–F19 (substance abuse),

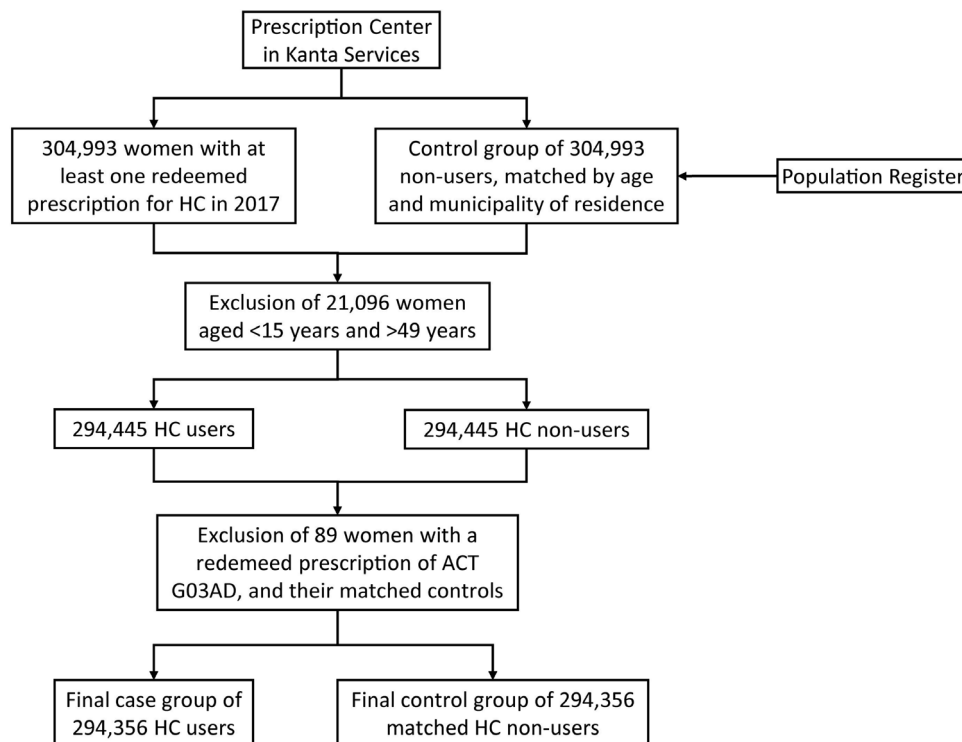


Figure 1 Selection of the study population. ATC, anatomical therapeutic chemical; HC, hormonal contraception.

F30–F39 (mood disorders), F40–F48 (anxiety disorders), F50 (eating disorders), F60 (personality disorders) and X60–X84 (intentional self-harm) in year 2016 were used to identify women with recent care episodes related to mental disorders.

Patient and public involvement

Patients and the public were not directly involved in the research process. Because this is a register-based study, no informed consent was needed.

Statistical analyses

We described the overall sample with respect to sociodemographic, reproductive and mental health characteristics using mean/median with SD/IQR and frequencies and percentages, respectively. The prevalence of HC use was explored across 70 regions as defined by Statistics Finland.¹⁸

We tested whether the odds of HC use differed by sociodemographic, reproductive and mental health characteristics using univariable and progressively adjusted multivariable logistic regression models using the ‘gmn’ R-package,¹⁹ which allows for handling parameters of stratification factors with a large number of levels (in our case, ‘municipality of residence’). Moreover, given that the use and type of contraception,¹ as well as the distribution and prevalence of most of the studied predictors (eg, psychiatric disorders),^{20 21} and their reciprocal associations, vary with age, we decided to additionally test the interaction between each predictor and age group.

Covariates in multivariable models for sociodemographic predictors consisted of all sociodemographic characteristics entered simultaneously, in addition to the age group. The interaction between each predictor and

age group was tested in separate unadjusted models; if a significant interaction was found, age-stratified multivariable analyses were performed.

Multivariable models for reproductive and mental health predictors were progressively adjusted for age group, education and income level, and marital and socioeconomic status. A separate fully adjusted model further tested the interaction between age group and reproductive/mental health characteristics; if a significant interaction was found, age-stratified multivariable analyses were performed.

In order to consider the groups of women with no need of HC, in sensitivity analyses, we excluded women who gave birth in 2017, and controlled for a history of sterilisation before 2017. Additionally, because contraception is commonly offered free-of-charge after an induced abortion, analyses were further controlled for a recent history (in 2016–2017) of abortion. The progressive adjustments for covariates are described in online supplemental table 1.

For all the analyses, the two-tailed p values of <0.05 were considered statistically significant. All the analyses were performed with R software V.3.5.1.²²

RESULTS

A total of 294 356 women aged 15–49 years (25.8% of the Finnish female population of that age range) were HC users. Their basic characteristics are reported in table 1. Their mean age was 28.9 years (SD 8.6); 24.0% were aged 20–24 years and 6.2% aged 45–49 years. The regional distribution of HC use by age groups is illustrated in online supplemental figure 1.

Table 1 Basic characteristics of women who used HC in Finland in 2017

	HC users (n=294 356)		HC non-users (n=294 356)
	Mean (SD)/n (%) /median (IQR range)		
Age, years	28.9 (8.6)		28.9 (8.6)
Age group*			% of the corresponding age population
15–19 years	38 699 (13.2)	26.9	38 699 (13.2)
20–24 years	70 524 (24.0)	44.2	70 524 (24.0)
25–29 years	63 824 (21.7)	37.1	63 824 (21.7)
30–34 years	44 220 (15.0)	25.9	44 220 (15.0)
35–39 years	33 654 (11.4)	19.8	33 654 (11.4)
40–44 years	25 181 (8.6)	15.6	25 181 (8.6)
45–49 years	18 254 (6.2)	11.3	18 254 (6.2)
Family type			
Married couple with children	74 065 (25.2)		96 573 (32.8)
Married couple without children	14 337 (4.9)		15 277 (5.2)
Children with mother	30 100 (10.2)		31 689 (10.8)
Children with father	2 146 (0.7)		2 346 (0.8)
Cohabiting couple with common children	21 364 (7.3)		26 727 (9.1)
Cohabiting couple with non-common children	5 756 (2.0)		5 213 (1.8)
Cohabiting couple without children	65 559 (22.3)		36 898 (12.5)
Other	141 (0.0)		842 (0.3)
Missing/single	80 888 (27.5)		78 791 (26.8)
Marital status			
Unmarried	211 461 (71.8)		192 428 (65.4)
Married	65 691 (22.3)		85 508 (29.1)
Divorced	16 507 (5.6)		15 239 (5.2)
Widowed/other	697 (0.2)		1 181 (0.4)
Highest education level			
Upper secondary/postsecondary non-tertiary	142 340 (48.4)		134 095 (45.6)
Short-cycle tertiary	8 187 (2.8)		7 229 (2.5)
Academic degree (bachelor's, master's, doctoral or equivalent)	94 498 (32.2)		83 077 (28.2)
Missing (including, eg, missing information on education other than of primary school level, school dropouts)	46 331 (16.8)		69 955 (23.8)
Occupation			
Employed	210 807 (71.6)		178 555 (60.7)
Unemployed	17 681 (6.0)		23 559 (8.0)
Student	50 519 (17.2)		59 973 (20.4)
Entitled to pension	3 629 (1.2)		6 162 (2.1)
Other	11 720 (4.0)		26 107 (8.9)
Socioeconomic group			
Self-employed	10 067 (3.4)		10 707 (3.6)
Upper-level employees	37 170 (12.6)		34 810 (11.8)
Lower-level employees	104 874 (35.6)		86 036 (29.2)
Manual workers	45 113 (15.3)		42 254 (14.4)
Students	56 580 (19.2)		63 920 (21.7)

Continued

Table 1 Continued

	HC users (n=294 356)	HC non-users (n=294 356)
	Mean (SD)/n (%) /median (IQR range)	
Pensioners	3741 (1.3)	6727 (2.3)
Others	22 342 (7.6)	28 764 (9.8)
Unknown	136 180 (4.6)	16 960 (5.8)
Missing	848 (0.3)	4178 (1.4)
Income, €	19 582 (14 755)	17 042 (16 254)
Parous (before 2017)	89 674 (30.5)	106 415 (36.2)
No of delivered children before 2017		
0	204 682 (69.5)	187 941 (63.9)
1	31 407 (10.7)	38 452 (13.1)
2	39 504 (13.4)	42 478 (14.4)
3–5	18 227 (6.2)	24 125 (8.2)
≥6	536 (0.2)	1360 (0.5)
Gave birth in 2017	9848 (3.4)	16 923 (5.8)
Induced abortions before 2017	35 189 (12.0)	37 853 (12.9)
Induced abortions before 2017, no		
0	259 167 (88.1)	256 503 (87.1)
1	27 269 (9.3)	28 118 (9.6)
2	5499 (1.9)	6652 (2.3)
3	1648 (0.6)	2021 (0.7)
≥4	773 (0.3)	1062 (0.4)
Recent induced abortion(s) (in 2016–2017)	7493 (2.6)	4872 (1.7)
Sterilisation before 2017	930 (0.3)	5587 (1.9)

*Because the case and control groups were matched by age, age group frequencies in HC users and non-users are the same. HC, hormonal contraception.

Sociodemographic characteristics

A greater proportion of unmarried or cohabiting women without children, compared with those of other marital statuses or family types, used HC. Additionally, a larger proportion of women with higher (upper secondary, tertiary or academic) compared with primary level education; employed as upper-level or lower-level employees or manual workers compared with self-employed people, students, those entitled to pension or of other/unknown socioeconomic status; and those with higher annual income used HC (table 1).

Women with the lowest socioeconomic levels (students, pensioners, and other and unknown levels) had lower odds of using HC compared with women with upper-level statuses in a multivariable model simultaneously adjusting for all sociodemographic characteristics and age group. In the same model, women with the highest education and income levels and those who were not married had higher odds of using HC compared with women with the lowest education and income levels, and to those who were married, divorced, widowed or of other marital status (figure 2, online supplemental figure 2). The results did not change in sensitivity analyses.

The age group significantly interacted with socioeconomic and marital status, and education and income levels ($p < 0.0001$). Specifically, in the younger age groups (15–29 years) the proportions of HC users were low among women entitled to pensions, but high among lower-level employees and manual workers. Additionally, the proportions of HC users were especially high among women with low/secondary and academic education in young adults (20–29 years). With increasing age, HC use increased among married and widowed women, but decreased among women in the lower income quarters (see online supplemental table 1).

Reproductive characteristics

Parous women were less likely to use contraception (OR 0.70, 95% CI 0.69 to 0.71, $p < 0.0001$, in a model adjusted for age group, education, income and marital and socioeconomic status), and the odds for HC use decreased with the increasing number of children (ranging from OR 0.70, 95% CI 0.69 to 0.72 for one child; to OR 0.33, 95% CI 0.30 to 0.37, $p < 0.0001$, for six or more children in the above-described adjusted

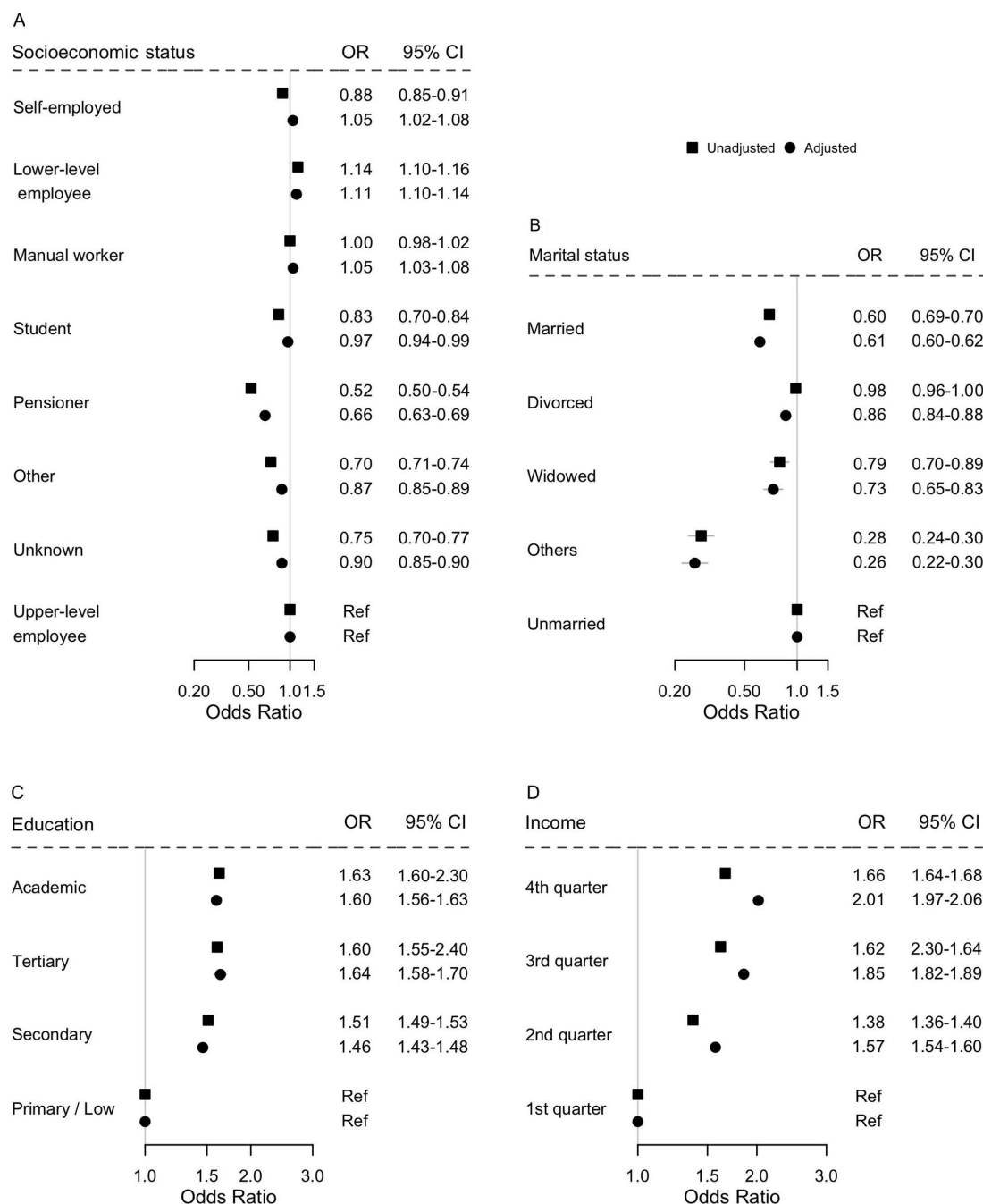


Figure 2 Associations of HC use with sociodemographic characteristics in simple and multivariable conditional regression models. All sociodemographic characteristics (marital and socioeconomic status and education and income levels) are simultaneously entered in the adjusted model, in addition to the age group. HC, hormonal contraception.

models). The proportion of HC users was especially low among young parous women (20–29 years: 37.8% vs 52.1% in non-parous women; p value for age \times parity interaction <0.0001) (see online supplemental table 2).

Women with a history of induced abortion(s) had slightly lower odds of HC use (OR 0.91, 95% CI 0.89 to 0.92, $p<0.0001$, in a model adjusted for age group, marital and socioeconomic status, and education and income levels); the odds decreased with increasing number of abortions, ORs ranging from 0.94 (95% CI

0.92 to 0.95) to 0.81 (95% CI 0.77 to 0.86, $p<0.0001$) for one to three or more abortions in the same fully adjusted model. The proportion of HC users was higher in teenagers and young women with a history of an induced abortion, while in the older age groups (35–49 years) it was lower among women with previous abortion(s) (p value for age \times abortion interaction <0.0001) (see online supplemental table 2 and figure 3). The results did not change after excluding women who gave birth in 2017. When examining the recency of abortion(s), the odds for using HC was higher

Table 2 Prevalence of recent care episodes for psychiatric disorders in women using and not using HC in Finland in 2017

Psychiatric diagnosis	HC users	HC non-users
	n (%)	
Manic episode/bipolar disorder	1030 (0.35)	1198 (0.41)
Depressive episode	4672 (1.59)	5291 (1.80)
Recurrent depressive disorder	2301 (0.78)	2721 (0.92)
Persistent mood disorder	278 (0.09)	319 (0.11)
Substance use	1045 (0.36)	1264 (0.43)
Anxiety disorders	6048 (2.06)	6817 (2.32)
Eating disorders	685 (0.23)	1032 (0.35)
Personality disorder	600 (0.21)	864 (0.29)
Intentional self-harm	16 (0.005)	19 (0.007)

HC, hormonal contraception.

among women with a recent abortion (in 2016–2017) (OR 1.60, 95% CI 1.54 to 1.66, $p < 0.0001$), but slightly lower among women with abortion(s) before 2016 (OR 0.97, 95% CI 0.96 to 0.99, $p = 0.0021$) compared with women with no such history in a fully adjusted model.

Mental health

The prevalence of care episodes due to psychiatric disorders in 2016 is reported in [table 2](#). Differences in absolute risks for not using HC between women with and without a recent psychiatric care episode ranged between 3.1% (anxiety disorders) and 10.1% (eating disorders), corresponding to a difference in relative risks between 6.1% and 20.3%.

Most of the associations suggestive of lower HC use among women with mental disorders were lost after adjustment for covariates (marital and socioeconomic status, education and income levels and age group). The only exception was the lower odds for HC use in women suffering from eating and personality disorders, in both unadjusted (OR 0.66, 95% CI 0.60 to 0.73; and OR 0.69, 95% CI 0.63 to 0.77, respectively) and fully adjusted models (OR 0.68, 95% CI 0.62 to 0.75; and OR 0.87; 95% CI 0.79 to 0.97) ([table 3](#)).

We found a statistically significant interaction between age and a recent care episode due to manic episode/bipolar disorder ($p = 0.0030$), depressive episode, recurrent depressive disorder, anxiety disorders and personality disorders ($p < 0.0001$), substance abuse ($p = 0.014$) and eating disorders ($p = 0.0087$). The proportions of women using HC were higher among women suffering from substance abuse and anxiety disorders in the younger age category (15–19 years), but lower in almost all the other age groups. The prevalence of HC users among women with a recent care episode due to bipolar, eating or personality disorders, depressive episode or recurrent

Table 3 Associations between a recent care episode for psychiatric disorders and HC use

	Model 1			Model 2			Model 3			Model 4		
	OR	95% CI	P value	OR	95% CI	P value	OR	95% CI	P value	OR	95% CI	P value
Manic episode/bipolar disorder	0.86	0.79 to 0.93	0.00037	0.86	0.79 to 0.93	0.00036	0.93	0.85 to 1.01	0.071	1.02	0.93 to 1.11	0.69
Depressive episode	0.88	0.85 to 0.92	<0.0001	0.88	0.85 to 0.92	<0.0001	0.95	0.91 to 0.99	0.0073	0.97	0.93 to 1.01	0.11
Recurrent depressive disorder	0.84	0.80 to 0.89	<0.0001	0.84	0.80 to 0.89	<0.0001	0.88	0.83 to 0.93	<0.0001	0.95	0.89 to 1.00	0.058
Persistent mood disorder	0.87	0.74 to 1.02	0.093	0.87	0.74 to 1.02	0.093	0.93	0.79 to 1.09	0.35	0.99	0.84 to 1.17	0.93
Substance abuse	0.83	0.76 to 0.90	<0.0001	0.83	0.76 to 0.90	<0.0001	0.94	0.87 to 1.03	0.18	0.99	0.91 to 1.08	0.88
Anxiety disorders	0.89	0.85 to 0.92	<0.0001	0.88	0.85 to 0.92	<0.0001	0.95	0.92 to 0.99	0.0031	0.97	0.94 to 1.01	0.13
Eating disorders	0.66	0.60 to 0.73	<0.0001	0.66	0.60 to 0.73	<0.0001	0.67	0.60 to 0.73	<0.0001	0.68	0.62 to 0.75	<0.0001
Personality disorders	0.69	0.63 to 0.77	<0.0001	0.69	0.63 to 0.77	<0.0001	0.79	0.71 to 0.88	<0.0001	0.89	0.79 to 0.97	0.014

Model 1 is the unadjusted model; model 2 is adjusted for age group; model 3 is model 2 further adjusted for education level and marital status; model 4 is model 3 further adjusted for income and socioeconomic status.
HC, hormonal contraception.

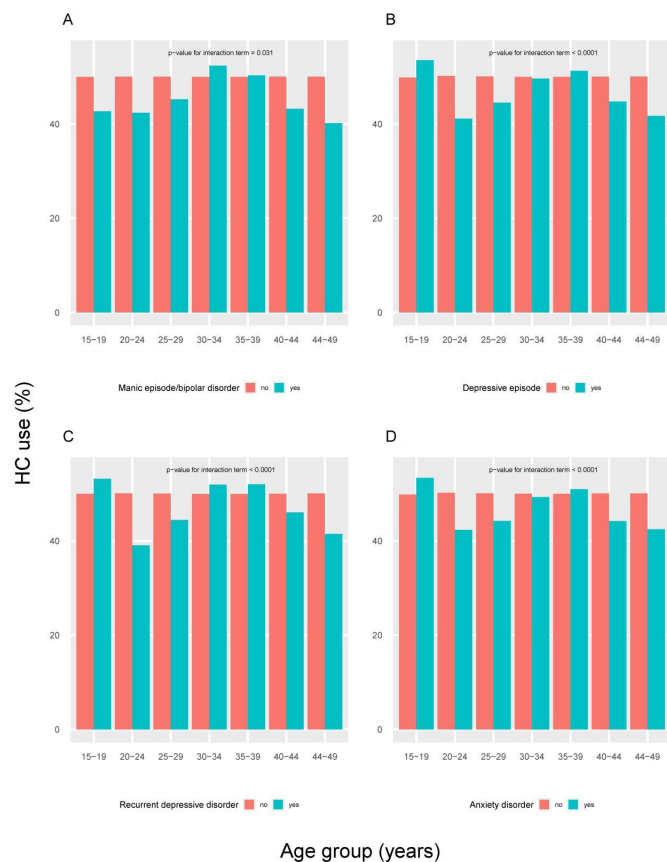


Figure 3 Proportions of HC use among women with and without manic episode/bipolar disorder (A), depressive episode (B), recurrent depressive disorder (C) and anxiety disorder (D) diagnosis, by age group. P values for the interaction term are from fully adjusted conditional models (controlled for marital and socioeconomic status and education and income levels). HC, hormonal contraception.

depressive disorder, was especially lower than in healthy women in the younger (15–29 years) age groups, but higher in the middle-age groups (30–39 years) for bipolar and recurrent depressive disorder (figures 3 and 4, and online supplemental table 3).

In sensitivity analyses, the associations between lower HC use and a recent care episode for recurrent depressive, personality or eating disorder remained in fully adjusted models (see online supplemental table 4). We found an interaction between the age group and a recent care episode for manic episode/bipolar disorder ($p=0.0031$), depressive episode and recurrent depressive disorder ($p<0.0001$), substance abuse ($p=0.0086$), anxiety disorders and personality disorders ($p<0.0001$) and eating disorders ($p=0.024$).

DISCUSSION

More than a quarter of the fertile-aged female population were using HC in Finland in 2017. HC users differed from non-users with respect to several sociodemographic and reproductive characteristics. Women with a recent care episode due to mental disorders tended to use HC less

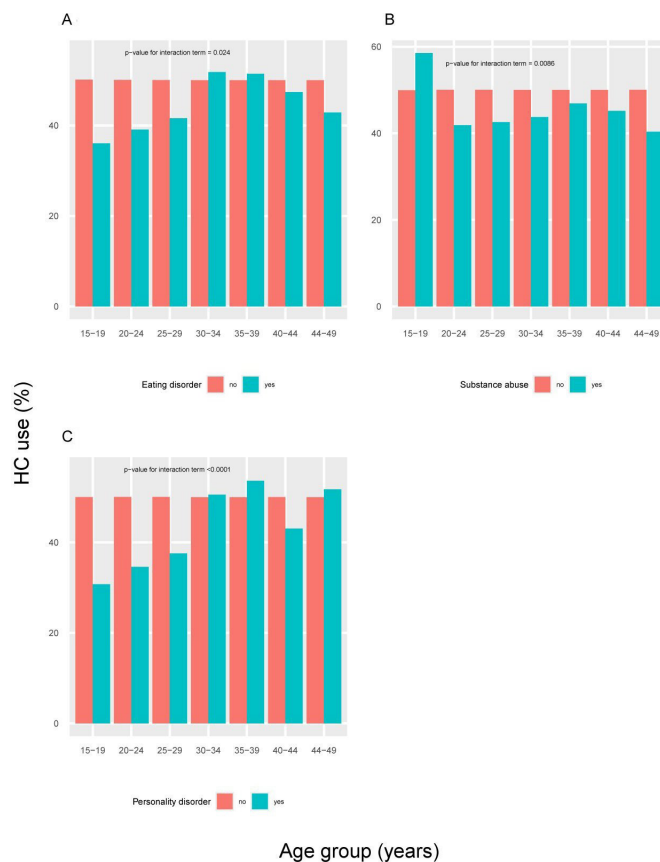


Figure 4 Proportions of HC use among women with and without eating disorders (A), substance abuse (B) and personality disorder (C) diagnosis, by age group. P values for the interaction term are from fully adjusted conditional models (controlled for marital and socioeconomic status and education and income levels). HC, hormonal contraception.

frequently than healthy women; specifically, HC use was especially low among women with a recent care episode for eating disorders and, to a lesser extent, personality disorders. However, all the observed differences were of small size, suggesting only a marginal relation to HC use.

The rate of HC use in Finland, as well as the proportion of HC users among teenage girls (27%), are in line with those reported in other countries.^{23 24} The use of HC seemed to decline with age, with almost 60% of all HC users being younger than 30 years. This figure is likely to underestimate the real proportion of teenagers and/or students using HC in Finland, since an increasing number of municipalities provide young women (<25 years) with free contraception for a period ranging from 3 months to 1 year or longer, which is not captured by our study. A possible reason explaining the apparently low prevalence of HC use among older women is the increasing proportion of women aged 30 years and over who opt for intrauterine contraception,¹ which can be used for several years after insertion, and thus are not captured by our study.

In Finland, HC users appeared to have higher median income and education levels, and to belong to higher socioeconomic groups compared with non-users. Low

education and income levels, as well as low occupational rate and lower socioeconomic status, are well-recognised indicators of non-use and inconsistent use of HC, as well as of use of less effective contraceptive methods, such as condoms.^{25–28} There are probably several reasons for this pattern, such as difficulties in accessing healthcare services, unemployment or instable family relations. On the other hand, the reverse association, that is, that non-use of contraception could lead to poorer educational attainment and lower income due to a higher risk of unintended pregnancy, is likewise plausible. Partly in line with previous studies,^{28 29} we found that married and parous women were less likely to use HC, and the association became stronger with the increasing number of children. Again, the use of long-acting reversible contraceptive methods may explain these figures. However, the small size of the observed differences suggests that all these factors have a fairly modest effect. In addition, the overall rate of contraceptive use in Finland, as well as the proportions of HC users among the most disadvantaged groups (eg, women with missing/primary education or belonging to the lower socioeconomic groups) were still rather high. Interestingly, we found that women with a recent abortion, and especially those who belong to the young age group, were more likely to use HC. This is an encouraging finding, as it suggests that successful policies, postabortion care and contraception provision may have been implemented.³⁰

Mental disorders such as depressive, substance abuse and anxiety disorders have been associated with poor contraceptive compliance, inconsistent use or non-use of contraception and use of less-effective and more user-dependent methods.^{8 31 32} Our study confirmed that the odds of HC use are lower among women with a recent care episode for mental disorders. People suffering from psychiatric morbidity have an elevated risk for engaging in risky sexual behaviour,³³ for unintended pregnancy,^{7 34} and having an induced abortion. A survey on outpatients with mental disorders reported that more than a quarter of the sexually active women did not use contraception and 61% of pregnancies were unintended.³⁵ In a sample of low-income women referred to family planning services, women with symptoms of depression, especially if comorbid with alcohol abuse, were more likely to choose less-effective methods or no method at all rather than hormonal methods.³⁶ In women aged 18–20 years, depressive, anxiety or stress symptoms were associated with further non-use of contraception or use of less-effective, user-dependent methods,⁸ as well as with lower proportions of consistent contraception use.³⁷ The rate of unintended pregnancy was higher among women with stress symptoms, as well as among women with perceived moderate/high social discrimination.^{38 39} In our study, age seemed to add to the associations between mental disorders and HC use. Indeed, teenage women with a recent care episode for anxiety disorders or substance abuse were using HC more often than their counterparts. However, this tendency reversed after 20 years of age. On

the one hand, this suggests that effective psychiatric and reproductive counselling are available for teenage girls, possibly through student welfare services. The finding might also reflect successful reproductive education in high schools. Further, we speculate that young women, especially those suffering from a mental disorder, are lacking easily accessible and long-lasting mental and reproductive support after high school. However, these results have to be taken with caution. For example, the health service access/user bias could explain at least part of the findings. Indeed, women with a diagnosed mental condition are more likely to use healthcare services and become HC users. Similarly, HC users are more likely to use healthcare services and have their mental disorders diagnosed. On the other hand, the possibility that HC use may be related, in a subgroup of susceptible women, to higher vulnerability to psychiatric disorders cannot be totally ruled out. However, the effect sizes were modest, with an absolute difference ranging between 3% and 10%, which suggests that psychiatric conditions are only marginally related to contraceptive use among Finnish women of childbearing age. Rather, it is plausible that a combination of sociodemographic-related, reproductive-related and mental health-related factors reciprocally contribute to women's contraceptive choice.

A novel finding of our study is the clearly low rate of HC use among women suffering from eating disorders. Women with eating disorders commonly have menstrual abnormalities, and may assume they are not fertile. Even if these women often have reduced fertility, they are also at higher risks of unplanned pregnancy and induced abortion compared with those with no (active) eating or other psychiatric conditions,^{12 40–43} possibly due to non-use of contraception.

Our findings have public health implications. Although Finland is a country with high levels of welfare and social equalities, socioeconomic health inequalities do exist.⁴⁴ Our study confirms this and calls for the implementation of strategies aimed to reduce barriers in access to contraception. Education regarding reproduction and contraception starting from primary school, easy access to family planning services for all women and couples, and refining national policies on uniform access to free contraception are some of the strategies that are being implemented. Our results point to unmet reproductive needs of women belonging to high-risk groups, such as young women with mental disorders, especially eating disorders. To date, no study has examined in detail HC use and consistency of use among these women, which highlights the importance of promoting reproductive care and contraception use among young women with these disorders. This might be done for example by strengthening the collaboration between reproductive and mental health professionals.

There are some limitations to the present study. First, a record of a redeemed HC prescription does not guarantee its actual use. However, because HC is not reimbursed by the SII, it is likely that the majority of those who purchased the drug did in fact use it. By using register



data on redeemed prescriptions rather than medical records of prescriptions, we were able to exclude primary non-compliance. Second, we were not able to identify women who had an intrauterine device inserted in 2017 but was removed or expelled soon after insertion. Similarly, we cannot exclude that a number of women in the control group were in fact using HC, for example because of prescriptions redeemed, or intrauterine devices or implants inserted during the previous years but were still in use in 2017. However, we were able to include in the HC user group women who had a prescription made before, but who redeemed it in 2017. Because the limitation relative to the HC-users and non-users definition similarly applies to both groups, it is likely that the introduced bias is minimal. Although pharmacy data and prescription registers are accurate and complete,⁴⁵ the completeness of the present data cannot be guaranteed, because the HC records were included in the Prescription Centre only recently. Further, it was not possible to retrieve information on the real purchase of contraceptive methods that do not require a prescription or on young women who obtained free contraception as part of municipal programmes. Because data on secondary and tertiary healthcare before 2016 were not available, women with no need of HC due to history of hysterectomy could not be accounted for in the sensitivity analyses. Another limitation arises from the definition of mental disorders that are based on hospital or outpatient clinic discharge diagnoses in 2016, and as such capture only recent moderate to severe disorders. Thus, we were not able to examine contraceptive use in relation to less severe and rather prevalent psychiatric conditions. Additionally, because of the cross-sectional design of the study, it was not possible to test any hypotheses on the causality of the associations between HC use and mental disorders. Moreover, because parity was defined on the basis of delivered children as recorded in the Medical Birth Register since 1987, information for the oldest members of our cohorts (born in 1968) may be incomplete. However, this limitation likely concerns only a small number of births/women.

Despite the above limitations, strengths of the study include the representativeness of the population, covering more than half of the female population of childbearing age, and the use of register data with proven good validity and reliability.⁴⁶ By using uniform criteria across the whole study population to identify HC users, we were able to reduce the potential for information bias. Further, the possibility of interlinking multiple social and healthcare registers guaranteed extensive, valid and reliable information of the study population.

CONCLUSIONS

In Finland more than 25% of fertile-aged women use HC (either OC or contraceptives for topical use). Sociodemographic and health disparities still exist in relation to HC use, although the size of their effect is rather small. New

public health strategies should promote access to effective contraception among more disadvantaged women and those with moderate to severe mental disorders, including eating disorders.

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REFERENCES

- 1 Lindh I, Skjeldestad FE, Gemzell-Danielsson K, *et al*. Contraceptive use in the Nordic countries. *Acta Obstet Gynecol Scand* 2017;96:19–28.
- 2 THL. Pohjoismaiset raskaudenkeskeytykset 2015. Aborter i Norden 2015 [online], 2015. Available: <http://www.julkari.fi/handle/10024/132062> [Accessed 20 Mar 2019].

- 3 WHO. Family planning/contraception methods. Available: <https://www.who.int/news-room/fact-sheets/detail/family-planning-contraception> [Accessed 1 Jul 2020].
- 4 Mosher W, Jones J, Abma J. Nonuse of contraception among women at risk of unintended pregnancy in the United States. *Contraception* 2015;92:170–6.
- 5 Black K, Lotke P, Buhling KJ, *et al.* A review of barriers and myths preventing the more widespread use of intrauterine contraception in nulliparous women. *Eur J Contracept Reprod Health Care* 2012;17:340–8.
- 6 Sweeney L-A, Molloy GJ, Byrne M, *et al.* A qualitative study of prescription contraception use: the perspectives of users, general practitioners and pharmacists. *PLoS One* 2015;10:e0144074.
- 7 Coverdale JH, Turbott SH, Roberts H. Family planning needs and STD risk behaviours of female psychiatric out-patients. *Br J Psychiatry* 1997;171:69–72.
- 8 Hall KS, Moreau C, Trussell J, *et al.* Role of young women's depression and stress symptoms in their weekly use and nonuse of contraceptive methods. *J Adolesc Health* 2013;53:241–8.
- 9 Hall KS, Steinberg JR, Cwiak CA, *et al.* Contraception and mental health: a commentary on the evidence and principles for practice. *Am J Obstet Gynecol* 2015;212:740–6.
- 10 Bengtsdotter H, Lundin C, Gemzell Danielsson K, *et al.* Ongoing or previous mental disorders predispose to adverse mood reporting during combined oral contraceptive use. *Eur J Contracept Reprod Health Care* 2018;23:45–51.
- 11 Clarke JG, Hebert MR, Rosengard C, *et al.* Reproductive health care and family planning needs among incarcerated women. *Am J Public Health* 2006;96:834–9.
- 12 Easter A, Treasure J, Micali N. Fertility and prenatal attitudes towards pregnancy in women with eating disorders: results from the Avon longitudinal study of parents and children. *BJOG* 2011;118:1491–8.
- 13 Skovlund CW, Mørch LS, Kessing LV, *et al.* Association of hormonal contraception with depression. *JAMA Psychiatry* 2016;73:1154.
- 14 Skovlund CW, Mørch LS, Kessing LV, *et al.* Association of hormonal contraception with suicide attempts and suicides. *Am J Psychiatry* 2018;175:336–42.
- 15 Kanta Services. What are the Kanta services? Available: <https://www.kanta.fi/en/about-kanta-services> [Accessed 17 Feb 2020].
- 16 WHOCC. ATC/DDD index, 2020. Available: www.whocc.no/atc_ddd_index/ [Accessed 17 Feb 2020].
- 17 WHO. *Reproductive health indicators: guidelines for their generation, interpretation and analysis for global monitoring*. Geneva: World Health Organization, 2006: 63.
- 18 Statistics Finland. Sub-regional units, 2019. Available: https://www.stat.fi/meta/luokitukset/seutukunta/001-2019/index_en.html [Accessed 10 Feb 2020].
- 19 Turner H, Firth D. Generalized nonlinear models in R: an overview of the gnm package. R package version 1.1-1, 2020. Available: <https://cran.r-project.org/package=gnm>
- 20 Alonso J, Angermeyer MC, Bernert S, *et al.* Prevalence of mental disorders in Europe: results from the European study of the epidemiology of mental disorders (ESEMeD) project. *Acta Psychiatr Scand Suppl* 2004;420:21–7.
- 21 Ward ZJ, Rodriguez P, Wright DR, *et al.* Estimation of eating disorders prevalence by age and associations with mortality in a simulated nationally representative US cohort. *JAMA Netw Open* 2019;2:e1912925.
- 22 RStudio Team. RStudio: integrated development for R. RStudio, Inc, Boston, MA, 2019. Available: <http://www.rstudio.com/>
- 23 Daniels K, Abma JC. *Current contraceptive status among women aged 15–49: United States, 2015–2017. NCHS data brief, no 327*. Hyattsville, MD: National Center for Health Statistics, 2018.
- 24 Roter mann M, Dunn S, Black A. Oral contraceptive use among women aged 15 to 49: results from the Canadian health measures survey. *Health Rep* 2015;26:21–8.
- 25 Costas L, Sequera V-G, Quesada P, *et al.* Hormonal contraception and postmenopausal hormone therapy in Spain: time trends and patterns of use. *Menopause* 2015;22:138–46.
- 26 Frost JJ, Singh S, Finer LB. Factors associated with contraceptive use and nonuse, United States, 2004. *Perspect Sex Reprod Health* 2007;39:90–9.
- 27 Krings KM, Matteson KA, Allsworth JE, *et al.* Contraceptive choice: how do oral contraceptive users differ from condom users and women who use no contraception? *Am J Obstet Gynecol* 2008;198:e46–7.
- 28 Lucke JC, Watson M, Herbert D. Changing patterns of contraceptive use in Australian women. *Contraception* 2009;80:533–9.
- 29 Molloy GJ, Sweeney L-A, Byrne M, *et al.* Prescription contraception use: a cross-sectional population study of psychosocial determinants. *BMJ Open* 2015;5:e007794.
- 30 Gyllenberg FK, Saloranta TH, But A, *et al.* Induced abortion in a population entitled to free-of-charge long-acting reversible contraception. *Obstet Gynecol* 2018;132:1453–60.
- 31 Walsemann KM, Perez AD. Anxiety's relationship to inconsistent use of oral contraceptives. *Health Educ Behav* 2006;33:197–214.
- 32 Zink TM, Shireman TI, Ho M, *et al.* High-risk teen compliance with prescription contraception: an analysis of Ohio Medicaid claims. *J Pediatr Adolesc Gynecol* 2002;15:15–21.
- 33 Ramrakha S, Caspi A, Dickson N, *et al.* Psychiatric disorders and risky sexual behaviour in young adulthood: cross sectional study in birth cohort. *BMJ* 2000;321:263–6.
- 34 James-Hawkins L, Denardo D, Blalock C, *et al.* Do depressive symptoms in male and female adolescents predict unintended births in emerging adulthood? *Matern Child Health J* 2014;18:2115–23.
- 35 Hauck Y, Nguyen T, Frayne J, *et al.* Sexual and reproductive health trends among women with enduring mental illness: a survey of Western Australian community mental health services. *Health Care Women Int* 2015;36:499–510.
- 36 Garbers S, Correa N, Tobier N, *et al.* Association between symptoms of depression and contraceptive method choices among low-income women at urban reproductive health centers. *Matern Child Health J* 2010;14:102–9.
- 37 Stidham Hall K, Moreau C, Trussell J, *et al.* Young women's consistency of contraceptive use—does depression or stress matter? *Contraception* 2013;88:641–9.
- 38 Hall KS, Kusunoki Y, Gatny H, *et al.* The risk of unintended pregnancy among young women with mental health symptoms. *Soc Sci Med* 2014;100:62–71.
- 39 Hall KS, Kusunoki Y, Gatny H, *et al.* Social discrimination, stress, and risk of unintended pregnancy among young women. *J Adolesc Health* 2015;56:330–7.
- 40 Bulik CM, Hoffman ER, Von Holle A, *et al.* Unplanned pregnancy in women with anorexia nervosa. *Obstet Gynecol* 2010;116:1136–40.
- 41 Micali N, dos-Santos-Silva I, De Stavola B, *et al.* Fertility treatment, twin births, and unplanned pregnancies in women with eating disorders: findings from a population-based birth cohort. *BJOG* 2014;121:408–16.
- 42 Morgan JF, Lacey JH, Chung E. Risk of postnatal depression, miscarriage, and preterm birth in bulimia nervosa: retrospective controlled study. *Psychosom Med* 2006;68:487–92.
- 43 Linna MS, Raevuori A, Haukka J, *et al.* Reproductive health outcomes in eating disorders. *Int J Eat Disord* 2013;46:826–33.
- 44 Lahelma E, Pietiläinen O, Rahkonen O, *et al.* Social class inequalities in health among occupational cohorts from Finland, Britain and Japan: a follow up study. *Health Place* 2015;31:173–9.
- 45 Furu K, Wettermark B, Andersen M, *et al.* The Nordic countries as a cohort for pharmacoepidemiological research. *Basic Clin Pharmacol Toxicol* 2010;106:86–94.
- 46 Heino A, Niinimäki M, Mentula M, *et al.* How reliable are health registers? registration of induced abortions and sterilizations in Finland. *Inform Health Soc Care* 2018;43:310–9.