Does one have to be healthy to have children in Norway today?

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Abstract

Extensively analyzed fertility determinants such as income and education influence fertility because they structure the time and money available, and to some extent also proxy preferences. Health is a comparable resource: Poor health may constrain women's capacity for active leisure, including family life and childrearing, for earning money in the labor market, but also potentially affect preferences. Still, health remains remarkably understudied.

We explore the association between health and fertility, using uptake of doctor-certified sick leaves and long-term health-related benefits as proxies for health. We examine whether compositional changes in health distributions and/or changes in the health-fertility association have contributed to the distinct fall in TFR in Norway since 2009. Lastly, we investigate if health-related associations differ across socio-demographic characteristics, and thus influence fertility differently in various groups.

We use nationwide registry data on women aged 16-45 from 2004-2018. We analyze first, second and third births separately, and use annual observations with lagged time-varying covariates for education, income, employment and health.

Long-term benefits are negatively associated with fertility, but such uptake is relatively rare. The use of sickness absence, positively associated with fertility, is common but decreases over time. If this indicates a stronger labor market preference and attachment among women in fertile ages, it might help explain parts of the observed decline. Trends are similar across parities and health status over time, with an initial increase, followed by a slow decline until 2013, and thereafter a sharper drop for healthy women. Health as a fertility determinant warrants further research.

Keywords: Fertility; Health; Labor market; Norway; Welfare benefits

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Extended abstract

Introduction

Extensively analyzed fertility determinants such as income, educational attainment and enrollment are thought to influence fertility because they structure the time and money available to individuals, and to some extent also proxy preferences (Lappegård & Rønsen 2005; Berrington et al. 2015; d'Albis et al. 2017; Jalovaara et al. 2019). Health is, in a comparable way, a resource. Health may constrain the individual's capacity for participating in leisure activities, including family life and childrearing, for earning money in the labor market, but also potentially affect preferences. Still, health remains remarkably understudied as a fertility determinant, although some exceptions are discussed below.

The primary aim of this paper is to explore the extent to which women's health is associated with fertility. More specifically, we use nationwide registry data to examine whether poor health matters for whether one chooses to have children or not, and whether it influences the overall number of children. As we have no direct measures of health available, we investigate if uptake of doctor certified sickness absences and/or more long-term health-related benefits are negatively correlated with childbearing among women in Norway. We also examine whether compositional changes in health distributions and/or changes in the effect of health proxies on fertility may have contributed to the distinct fall in the total fertility rate in Norway since 2009. Lastly, we investigate whether any health-related associations differ across educational characteristics, and thus influences fertility differently in various groups.

Poor health may make it more challenging to becoming pregnant and carry a pregnancy to term. Older women have, on average, more health problems related to pregnancy than younger women, and with the steadily increasing birth age, it is expected that pregnancy and birth-related health problems will continue to increase in the years to come. This may imply that health will become an increasingly important factor women must consider when deciding *whether* they want children, *when* they want children, and how *many* they would like to have. The theoretical framework and factors potentially affecting fertility choices, are outlined in more detail below, along with results from existing studies.

Theoretical framework

There are many ways in which poor health could influence fertility. We apply an economic-demographic framework, in which supply, regulation costs and demand are considered important fertility determinants (Easterlin & Crimmins 1987). Supply is defined as the number of children one would have without regulation and depends on the chance of conceiving and the rate of spontaneous abortions (Bongaarts 1983). It may also be affected by the likelihood of women to bring a pregnancy to term and give birth to a live child. Regulation costs refers to the availability, affordability and acceptability of contraception and abortion. It is not likely that poor health has operated through this channel in Norway in recent years, although some women might have health issues limiting their contraceptive choices. As there are several alternative contraceptive methods available and we have no data on such use, possible implications of changing regulation costs are not discussed further.

Demand or fertility desires is defined as the number of children one would ideally like to have. It depends on purchasing power, costs of childbearing, the preferences for spending time and money on raising children rather than on alternatives, and norms. The various ways in which health might impact on supply and demand will be outlined in more detail in the full paper, but a brief version is outlined below.

Supply

Poor health may lower supply at a population level. A decrease in sexual desire among persons with certain specific illness, such as for instance cancer, may be linked to hormonally induced changes, but also to fatigue, chronic weakness, and nausea related to both illness and treatment (Schover 2005; Wenzel et al. 2005). This may influence fecundity negatively. However, of greater concern is subfecundity in patients with serious illnesses, such as for instance after chemotherapy, ablative therapy, and/or radiation (Meirow & Nugent 2001; Meirow & Schenker 1996; Wenzel et al. 2005). Previous studies have shown, for instance, that all reproductive cancer forms result in significant fertility reductions, and the overall fertility reduction is most pronounced the first few years following diagnosis (Syse et al. 2007). As such, the majority of studies we have located have focused on aspects related to fecundity, the ability to conceive and, for women, bring a pregnancy to term, in patients in whom reproductive organs have been directly involved or adversely affected by treatment.

Demand

Poor health may well lead to a reduced income, which could impact on purchasing power and fertility desires. Poor health in younger ages might also result in a lower education than one would otherwise have, thus also influencing income negatively, with the same possible implications for purchasing power and fertility desires. Poor health may also influence preferences, as one might have less energy for childrearing, or opt to spend one's time and energy otherwise.

People having stable high incomes do not necessarily want more children than those having stable low incomes, because the former may also feel obliged to spend more on each child and may have developed stronger preferences for competing activities and investments (Becker 1991). However, income drops are likely to result in fertility declines. Men are the main wage earners in the family even in contemporary Norway (Dommermuth et al. 2019), and a decline in men's income may have a pronounced effect (see e.g. Kravdal 2002; Comolli et al. 2019). On the other hand, women with poor work possibilities or low earning potentials face low opportunity costs of childbearing and may thus be more likely to display high fertility.

Income may be reduced after serious illness due to changes in both work ability and opportunities. High costs of treatment and rehabilitation may have the same effect in countries where health care must be bought in the open market, like for instance the US (Northouse 1994; Mellon & Northouse 2001). In Norway, this may have lesser relevance than in countries with less extensive public welfare systems (Blekesaune et al. 2003). However, income drops among men may still be important, but for women sharper physiological effects or perhaps an increased value placed on parenthood may simply counteract such a pattern.

Weakened fertility desires may also reflect that women in poor health, depending on the cause and prognosis, may have concerns related to not being able to live to see their children grow up, or not being able to be sufficiently resourceful and present parents (Schover 1999). Concerns regarding the health of potential children may also influence desires negatively, especially if there are any hereditary components to the health issue in question (Schover 2005). It should be noted, though, that harmful effects of childbearing after serious illnesses are notoriously difficult to identify, as there may be a highly selected group of relatively healthy women with supposedly good prognosis who go on to have children (Kravdal 2003).

On the other hand, there are also mechanisms contributing to high fertility among women in poor health. Suboptimal health, and especially poor health, might be hypothesized to increase persons' family orientation and their consciousness of the positive emotional value of having children, thus altering preferences for parenthood in a positive direction. Having experienced

and lived through a serious illness may increase the value that is placed on children and family life (Schover 1999; Schover 2005). Norms and values concerning childbearing after illness, such as for instance cancer, are generally more positive today compared to earlier, reflected both in clinical practice of various illnesses as well as in a steadily growing research interest in this topic. There are also indications suggesting norms about working women: To be truly successful, they should also be mothers. Along the same lines, there are studies that suggest that non-working women should have more children than other women, regardless of their health status.

Poor health may also influence the chance of finding (and keeping) a partner, with links to fertility, although in a causally complex way. On the one hand, a sexual relationship is necessary to conceive a child, and those with a partner are typically in better positions economically and have someone to share the joys and distresses of childrearing. On the other hand, pregnancy or birth may trigger consensual unions or lead cohabitants to marry. This is especially true for first births, where the direction of causality is particularly ambiguous. We thus account for the possible mediating effect of partners for higher-order births. While some studies have shown that people with poor health are less likely to enter a union, and more often experience disruption (Lillard & Panis 1996; Blekesaune et al. 2003), other studies do not find this to the same extent (Syse & Kravdal 2007; Syse 2008).

Existing studies

There are relatively few studies that look at the associations between general health and fertility. The literature in this area is primarily centered around specific illnesses, such as for instance cancer, where the literature is steadily increasing. Studies from the Nordic countries suggest that the impact of cancer is minor today compared to earlier, but that illnesses affecting reproductive organs reduces fertility quite substantially. A Norwegian study covering the period 1965-2001 estimates that female fertility is reduced by around one fourth for first births and one third for higher-order births (Syse et al. 2007). It should be noted, however, that the differences in fertility between cancer survivors and the general population were much smaller towards the end of the period as compared to earlier periods, and more recent studies suggests that the effect of cancer on fertility are much smaller today (Weibull et al. 2018) Most studies find that the reductions in fertility are most pronounced for reproductive cancer forms, presumably related to subfecundity. However, also cancer forms unrelated to reproductive function were associated with reduced fertility, perhaps suggesting underlying psychological and/or social mechanisms. This is further supported by the difference in probability between first and subsequent births observed for women (Syse et al. 2007; Baxter et al. 2013). In the full paper, a more thorough literature review will be provided, including also studies concerning general health as well as other specific illnesses, and used to guide the discussion.

Norwegian setting

From 2004 to 2009, the total fertility rate (TFR) in Norway increased slightly, from 1,83 to 1,98. Since 2009, the TFR has declined steadily, and reached 1,56 in 2018. This is the lowest TFR ever reported in Norway. At the same time, recent cohort of Norwegian women have surpassed men in terms of educational activity and participate more actively than before in the labor market. At the same time, an increasing number of individuals report poor health, and there has been a steady increase in the uptake of health-related long-term benefits. Sickness absence, has, on the other hand, decreased slightly over the past decade. Norway is a welfare

state with several social security measures in place, to promote health and gender equality. Lately, there has also been a discussion centered around measures aimed towards childbearing and -rearing. Such pronatalistic discussions have been uncommon in the past.

After the economic downturn in 2010-2011, which hit Norway less hard than many neighboring countries, the labor market has changed somewhat. Laws have changed to facilitate an increasing share of temporary jobs. Since 2011, there has been other minor economic downturns, and there is a general perception that the labor market is becoming increasingly demanding – as young people compete for interesting jobs after having invested heavily in education. Even in a strong welfare state, such as Norway, slight changes in labor market regulations accompanied by a temporary economic downturn, might lead to an increase in the perceived economic uncertainty. Previous research indicates, that individuals perceiving insecurity tend to postpone or abolish intentions in different life spheres, including childbearing intentions (Pailhé & Solaz 2012). Individuals in poor health may struggle more to combine work and family under such conditions, and hence be quicker to reduce their family size. Further, uncertainty in combination with increasing pressure to participate in the labor market, also in temporary jobs, might lead to the emergence of new health problems.

Data and method

Discrete-time logistic regression models for conceptions leading to live births[1], hereafter called fertility, were used to estimate possible health effects separately for first, second and third births in nationwide registry data covering the entire population of women aged 16-45 from 2004 through 2018 (Allison 1995). In analyses of first births, each woman contributed a series of annual observations from age 16 (or earliest age at inclusion in 2004) to age 45, unless conception, emigration, death or end of follow-up occurred earlier. For second and third births the starting point was set to the birth of the previous child. Each observation included variables that referred to the situation at the beginning of the year (e.g. age, time since previous birth, educational activity, level and type, labor market participation, income and partnership status) or the beginning of the previous year for the lagged health variables, certified sickness absence (SA) and long-term benefits (LTB). LTB is an aggregate measure of work assessment allowance, disability benefits, basic and attendance benefits. Because we have uncertain information on educational and work history of immigrant women, these were excluded from all analyses. Classifications and descriptive statistics for the explanatory variables for the three parity transitions is shown in Table 1.

In analyses of first births, we used data on nearly 434,000 childless women, who gave birth to a total of 286,000 children. In analyses of second births, women with one child (N = 295,000) were followed from the birth of their first child. These women had a total of 250,000 children. In analyses of third births, we followed close to 260,000 women with two children from their last birth. In total, these women gave birth to nearly 100,000 children. The data set is described in more detail in Table 1, and further descriptive statistics are portrayed in Table 2.

Logistic regression models were estimated using the proc logistic procedure in SAS (Allison 1995). Average marginal effects and adjusted predicted probabilities of conceptions leading to live births at different time periods were calculated to facilitate comparisons across models, using the margins command in Stata (Mood 2010; Williams 2012). The statistical significance level was set at 5%.

[1] We opted to backdate the time of birth to time of conception to avoid capturing ill health associated with pregnancy and/or births in the health indicators.

Preliminary results

Table 1 shows that there are pronounced differences in background characteristics between women at risk for a first, second or third birth. This is especially true for educational activity and level of education. Educational activity is far less common among women who are already mothers, while these women also have a higher education. Likewise, the proportion of educational types aimed at specific types of occupations and/or labor market sectors is more common for higher parities. This may be important for our study, because some of the health benefits we examine are closely related to labor participation. However, it is common in Norway to work some hours while enrolled in education, as is evident in the relatively large share of women with an active labor market participation across parities. As such, the majority of women included in this study were entitled to both sickness benefits as well as more long-term benefits. We find that first births are more frequent among women who work, as the mean income is much larger among those who have a child compared to those who are childless. For higher-order parities, the differences are minor.

Table 1. A summary of background characteristics of women included in the analyses of a first, second and third birth, respectively.

	First birth		Second birth		Third birth	
	Pyrs/N/mean	**%**	**Pyrs/N/mean**	**%**	**Pyrs/N/mean**	**%**
Total person-years (pyrs)	6.8 million		2.5 million		3.7 million	
Number of women	433854		295224		259802	
Number of births	286482	4.2	246847	9.7	98400	2.7
Mean age (years)	26.3		35.1		37.8	
Birth=yes	27.7		30.4		32.6	
Birth=no	26.2		35.6		37.9	
Period						
2004-2006	1434021	21.2	694895	27.4	928663	25.0
2007-2009	1376419	20.3	589952	23.3	829888	22.5
2010-2012	1329948	19.6	494619	19.5	730764	19.8
2013-2015	1313674	19.4	406689	16.1	638755	17.3
2016-2018	1323258	19.5	346988	13.7	568697	15.4
Age groups						
16-18 yrs	1293265	19.1	N/A[a]	N/A	N/A	N/A
19-21 yrs[b]	1216138	17.9	57624	2.3	4606	0.1
22-24 yrs	1054631	15.6	142815	5.6	36728	1.0
25-27 yrs	829976	12.2	237289	9.4	121143	3.3
28-30 yrs	572642	8.4	304110	12.0	254786	6.9
31-33 yrs	380882	5.6	309067	12.2	417708	11.3
34-36 yrs	304214	4.5	290958	11.5	559694	15.1
37-39 yrs	310817	4.6	321015	12.7	670821	18.2
40-42 yrs	366348	5.4	391307	15.4	772283	20.9
43+ yrs	448407	6.6	478958	18.9	858998	23.2
Labor market participation[c]	5566056	82.1	2270718	89.6	3412972	92.3
Mean labor market income (NOK)	192 900		332700		370700	
Birth=yes	304800		337400		350700	
Birth=no	188000		332200		371200	
Enrolled in education[d]	2548810	37.6	106991	4.2	65543	1.8
Higher education	1952548	28,8	994430	39.3	1583201	42.8
Educational type						
Female dom., public sector	903600	13.3	657592	26.0	1067115	28.9
Female dom., private sector	432045	6.4	247292	9.8	370767	10.0
Mixed gender, high specificity	993734	14.7	488973	19.3	809646	21.9
Male dom.	340585	5.0	163977	6.5	260223	7.0
Other, general education[e]	4107356	60.6	975309	38.5	1189016	32.2

[a]Not applicable. [b]For second and third births, the few women below age 19 are also included in this group. [c]Includes women with any income from labor market activities. As it is common to work part-time while enrolled in education, the majority of women have some attachment to the labor market. [d]Includes only women for whom enrolment in education comprises their primary activity. [e]Women with missing education are also included here, but they are relatively few since immigrants have been excluded.

The health variables used in this study are shown in Table 2. In terms of general health, the share receiving long-term benefits (LTB) is relatively stable across parities, whereas the share who uses sickness absence benfits (SA) is almost threefold for mothers as compared to

childless women. If we compare women with a low and high education, we see that the use of both SA and LTB is less common among those with a high education.

Table 2. A summary of health characteristics of women included in the analyses of a first, second and third birth, respectively.

	First birth		Second birth		Third birth	
	Pyrs	%	Pyrs	%	Pyrs	%
Original variables						
Health proxies t-1[a]						
Certified sickness absence	570030	8.4	609410	24.1	871521	23.6
Work assessment allowance	198917	2.9	130314	5.1	173217	4.7
Disability benefits	272139	4.0	155137	6.1	196872	5.3
Basic or attendance benefits	253028	3.7	58365	2.3	73399	2.0
Health proxies t-5 to t-1[b]						
Certified sickness absence	1273685	18.8	1232268	48.7	1938428	52.4
Work assessment allowance	332903	4.9	226501	8.9	303850	8.2
Disability benefits	285674	4.2	166396	6.6	212584	5.8
Basic or attendance benefits	253028	3.7	58365	2.3	73399	2.0
Recoded variables						
General health[c]						
Healthy	5674939	83.7	1681065	66.4	2517831	68.1
Only sickness absence (SA)	510154	7.5	557231	22.0	794340	21.5
Long-term benefits (LTB)[d]	592227	8.8	294847	11.6	384596	10.4
Health and educational level[e]						
Healthy, low education	3991113	58.9	962571	38.0	1352627	36.6
Healthy, high education	1683826	24.9	718494	28.4	1165204	31.5
SA, low education	331300	4.9	332606	13.1	456218	12.3
SA, high education	178854	2.6	224625	8.9	338122	9.2
LTB, low education	502359	7.4	243536	9.6	304721	8.2
LTB, high education	89868	1.3	51311	2.0	79875	2.2
Health and educational type+A66[f]						
Healthy, general education	3476037	51.3	617435	24.4	758014	20.5
Healthy, female dom.	1049758	15.5	591595	23.4	968468	26.2
Healthy, high-specificity, gender-mixed or male dom.	1149144	17.0	472035	18.6	791349	21.4
SA, general education	206468	3.0	185314	7.3	233292	6.3
SA, female dom.	189460	2.8	238249	9.4	354667	9.6
SA, high-specificity, gender-mixed or male dom.	114226	1.7	133668	5.3	206381	5.6
LTB, general education	424851	6.3	172560	6.8	197710	5.3
LTB, female dom.	96427	1.4	75040	3.0	114747	3.1
LTB, high-specificity, gender-mixed or male dom.	70949	1.0	47247	1.9	72139	2.0

[a]A distribution of the original variables the year before conception (t-1). The variables are not mutually exclusive. [b]A distribution of the original variables in aggregate form during the last five years (i.e. from t-5 to t-1). The variables are not mutually exclusive. [c]Health variables coded so that the groups are mutually exclusive. [d]This group comprises women who receive long-term benefits, which is an aggregate measure of all benefits listed in under 'original', except sickness absence benefits. Some of these women may also receive sickness benefits, but since they also receive long-term benefits they are grouped in this category. [e]This variable is a composite measure of educational level and health, and high education includes all women with education beyond high school, whereas the low education group includes all other women. The categories are mutually exclusive. [f]This variable is a composite measure of educational type and health. The categories are mutually exclusive.

Childless women are almost equally likely to receive SA and LTB, whereas the relative share of mothers with LTB is lower, about half that of SA. One of the most interesting aspects of Table 2 is that the proportion who have received health-related benefits is lower among women at risk of having a third child than a second child. Thus, it is conceivable that there is a health selection among women who want three children. This is further explored in Appendix Table A1[2], as well as in the univariate and multivariate regression analyses.

Table 3 shows fully adjusted results for the risk of a first, second or third birth by health- and health- and educational-related characteristics. Altogether three models are shown for each parity, and the respective control variables accounted for are indicated with an 'X'.[3] Model 1 shows that the uptake of any LTB lowers the chance of a birth, across all three parities, although most pronounced for a first or a second birth. On the other hand, SA appears to increase the chance of having a child, especially a first child. For a third birth, the associations

[2] Appendix Table A1 shows the distribution of health benefit uptake among women who gave birth to a first, second or third child. Births are most common among women with a SA the year before conception. This may capture that these women participate more fully in the labor market rather than that they have a poorer health. This is explored in Appendix Table A2, where labor market participation and income are accounted for.

[3] Appendix Table A2 shows results from models with various controls, accounting for different distributions of characteristics of the women who may have their first, second or third child. Overall, the results appear relatively stable across the different models.

are generally weaker, albeit statistically significant. This may imply that there is a health selection for having children at all among childless women on LTB, i.e. in poor health. This is especially true for childless women on *disability benefits*, whose fertility is reduced by 75% (not shown, available upon request). This selection appears to be present also for second birth, where a more than 50% reduction in fertility is observed.

Table 3. Odds ratios with 95% confidence intervals from three models describing the associations between health, education and fertility, for first, second and third births, respectively.

	FIRST BIRTHS, INCL. STUDENTS		FIRST BIRTHS, EXCL. STUDENTS		SECOND BIRTHS		THIRD BIRTHS	
	OR	95% CI	OR	95% CI	OR	95% CI	OR	95% CI
FIRST BIRTHS								
Model 1: General health[a]								
Healthy	1	ref	1	ref	1	ref	1	ref
Only sickness absence (SA)	1.32	1.31-1.34	1.28	1.27-1.30	1.17	1.15-1.18	1.06	1.04-1.07
Long-term benefits (LTB)[b]	0.52	0.51-0.53	0.49	0.48-0.50	0.57	0.56-0.59	0.73	0.71-0.75
Model 2: Health and educational level[c]								
Healthy, low education	1	ref	1	ref	1	ref	1	ref
Healthy, high education	1.36	1.34-1.37	1.42	1.41-1.44	1.98	1.95-2.00	1.88	1.85-1.91
SA, low education	1.40	1.38-1.43	1.35	1.33-1.37	1.28	1.26-1.30	1.16	1.14-1.19
SA, high education	1.67	1.64-1.71	1.72	1.69-1.75	2.12	2.08-2.15	1.82	1.78-1.87
LTB, low education	0.50	0.49-0.51	0.47	0.46-0.48	0.57	0.56-0.59	0.77	0.74-0.80
LTB, high education	0.84	0.81-0.87	0.84	0.81-0.87	1.20	1.15-1.25	1.25	1.18-1.33
Model 3: Health and educational type[d]								
Healthy, general education	1	ref	1	ref	1	ref	1	ref
Healthy, female dom.	1.46	1.44-1.47	1.43	1.41-1.45	1.17	1.16-1.19	0.98	0.96-0.99
Healthy, high-specificity, gender-mixed or male dom.	1.17	1.15-1.18	1.22	1.21-1.24	1.31	1.30-1.33	1.05	1.02-1.07
SA, general education	1.56	1.53-1.59	1.46	1.43-1.49	1.30	1.27-1.32	1.12	1.08-1.15
SA, female dom.	1.69	1.65-1.72	1.67	1.64-1.70	1.31	1.28-1.33	**1.03**	**0.99-1.05**
SA, high-specificity, gender-mixed or male dom.	1.57	1.53-1.61	1.57	1.53-1.61	1.47	1.44-1.51	1.06	1.03-1.10
LTB, general education	0.50	0.49-0.51	0.46	0.45-0.47	0.57	0.55-0.59	0.77	0.74-0.81
LTB, female dom.	0.78	0.75-0.81	0.76	0.73-0.79	0.70	0.68-0.73	0.67	0.64-0.71
LTB, high-specificity, gender-mixed or male dom.	0.74	0.71-0.77	0.74	0.70-0.77	0.74	0.70-0.78	0.74	0.69-0.79
Control variables								
Age group	X		X		X		X	
Period	X		X		X		X	
Time since last birth[e]	X		X		X		X	
Educational variables	X		X		X		X	

Note: Estimates not in bold, p <0.05. [a]The categories are mutually exclusive. [b]A measure of whether one receives any long-term benefits. Som women may also receive sickness benefits. [c]Education is dichotomized. Low education comprises all women with education limited to high school. The few women with missing education are also included here. High education comprises women with any education beyond high school. [d]Genereal education also include women with only high school or missing education. [e]Only relevant for second and third births.

Model 2 compares women in similar health with a high versus a low education. It shows that fertility is higher among the highly educated, across all parities, but that the difference is most pronounced for second births. Model 3 compares individuals with different types of education. The patterns appear different across health status and types of education for first and second births, whereas the differences in general are more modest for third births. The general trend of lowered fertility for women on LTB are however consistent across parities, independent of type of education.

Figure 1 portrays changes over time in fertility, shown as adjusted predicted probabilities, among healthy women (blue lines), women on SA (green lines) and women on LTB (red lines).[4] The general pattern observed in Table 3 is evident also in this figure. Fertility is higher among women with SA, whereas it is clearly lower among women who receive LTB and thus are likely to be in the poorest health. The healthy women have experienced the most pronounced decline in fertility over time, for all transitions. In absolute terms, the sharpest fall is observed for those at risk for a second birth. In relative terms, however, the sharpest fall is observed among those at risk for a third birth. However, the trend for all is declining over

[4] Appendix Figure A1 shows average marginal effects.

time, suggesting that the role played by poor health has diminished in recent years and thus had a greater significance earlier in the 2000s, contrary to our hypothesis.

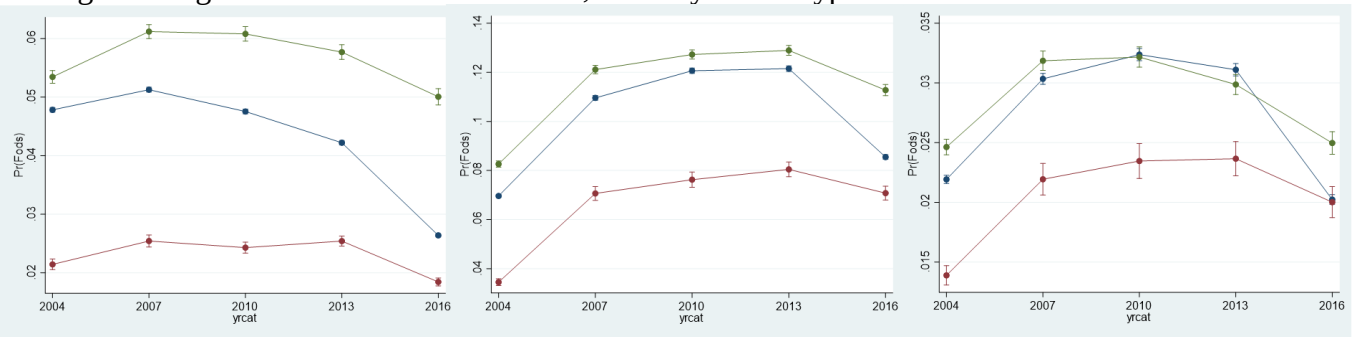

Figure 1. Predictive probabilities with 95% confidence intervals for the probability of a first (left panel), second (mid-panel) or third (right panel) child for women by proxies for general health.
Note: The groups are mutually exclusive. The axes vary between the parities. Women who receive long-term benefits (LTB, red line) may, however, also receive sickness absence benefits (green line). The reference group (blue line) does not receive any health benefits. LTB is an aggregate measure of whether women have received work allowance benefits, disability benefits and/or basic or attendance benefit payments the previous year.

The left panel of Figure 2 shows that the most pronounced decline in fertility over time is observed for healthy women with a high education. The right panel, portraying differences across educational types, shows a more mixed pattern, both between the educational types within parities and across parities.

Figure 3 shows trends in general health over time. As is evident from the figure, doctor certified sickness absence (SA) has declined substantially from 2004 to 2018 among women in fertile ages. The relative decline is most pronounced for first births, where the use is almost halved towards the end of the period. However, sickness absence was substantially lower in this group to begin with. For second and third births, the uptake of such benefits was much higher and increased throughout the first half of the period. The decrease over time is sharp for the latter half, and similar for the two transitions. For long-term benefits (LTB) we see much more modest changes over time. However, a slight increase can be observed for all parities across time. The combined changes over time in educational characteristics and health are shown in Appendix Figures A3-A5.

In 2010, major changes were enforced in the Norwegian welfare system concerning health-related benefits (Frøyland et al. 2018). The aim was to reduce the number of younger individuals on long-term benefits (LTB), in part to increase work force participation but also based on research that has shown that labor market attachment might be positive for mental and physical health, as well as economic welfare, even for individuals in suboptimal health. Along the same lines, efforts have been made to reduce sickness absence (SA), especially full-time absences over extended time periods. In summary, an increased focus has been directed towards the importance of work and work attachment, both at an individual and a societal level. As a result, relatively strong incentive structures have been established to avoid LTB and utilize residual work capacity. As is evident from the figure, the incentive structures appear to have worked well for the uptake of SA but not LTB. Whether the changes represent a development in health or reflects underlying changes in the welfare system, or both, is not clear. This will be further discussed in the full paper.

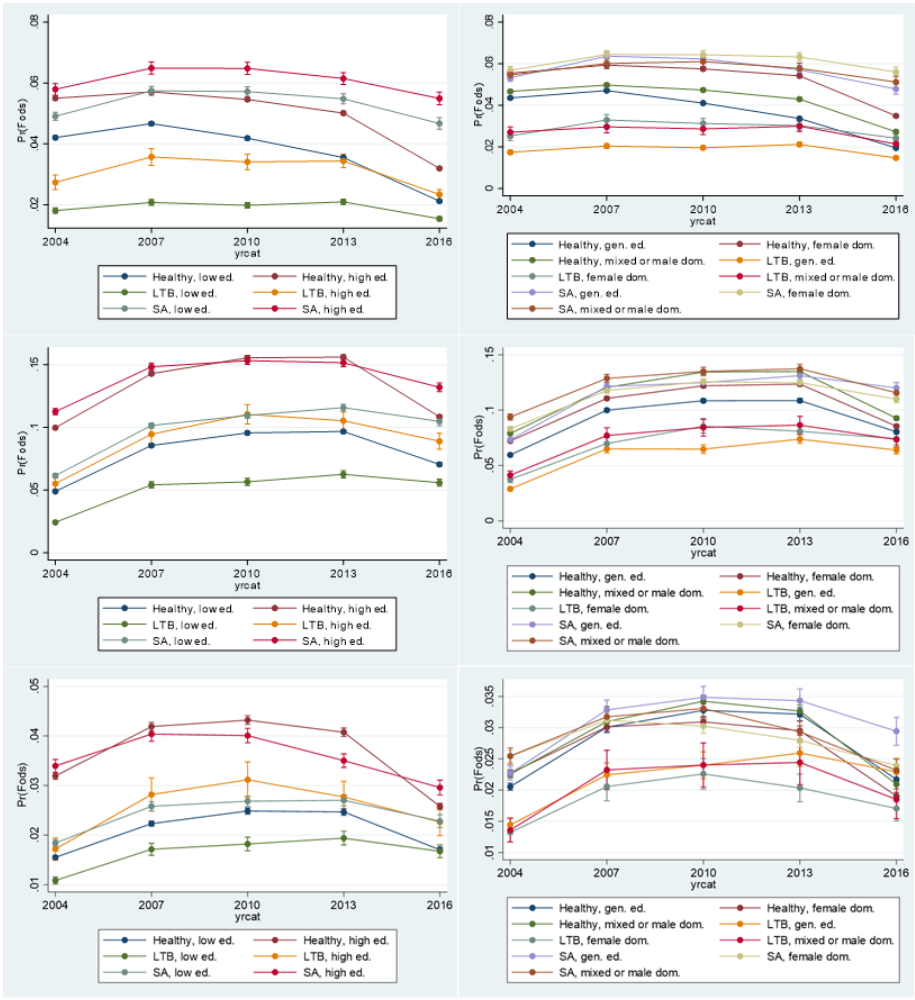

Figure 2. Predictive probabilities with 95% confidence intervals for the probability of a first (upper panel), second (mid-panel) or third (bottom panel) child for women by uptake of health benefits and educational variables.

Note: The groups are mutually exclusive. The axes vary between the parities. Those who receive long-term benefits (LTB) may, however, also receive sickness absence benefits (SA). The healthy women do not receive any health benefits. LTB is an aggregate measure of whether women have received work allowance benefits, disability benefits and/or basic or attendance benefit payments the previous year. Low education is defined as any education through high school, whereas high education is defined as any education at college or university level. General education includes educational types other than the female, mixed or male dominated ones.

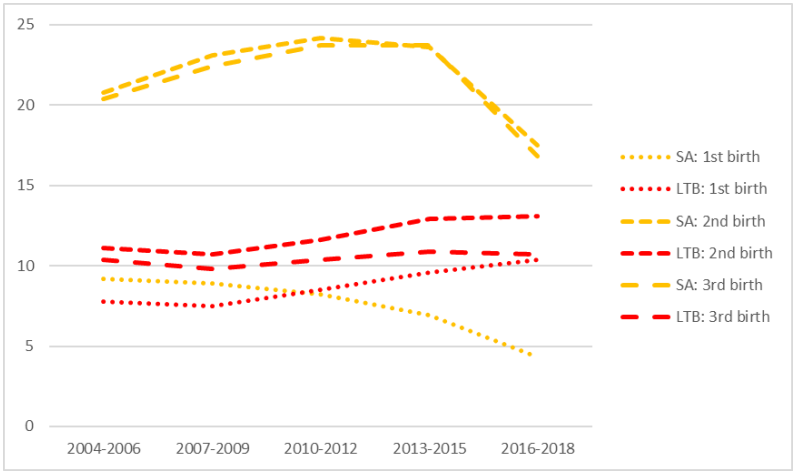

Figure 3. Changes over time in sickness absence (SA) and long-term benefits (LTB) for women at risk for a first, second or third birth.

Discussion, preliminary conclusions and next steps

We have examined whether sickness absence or other indicators of poor health are negatively correlated with childbearing among women in Norway, and whether this association has become stronger in recent years and thus might have contributed to the distinct fall in the total fertility rate in Norway since 2009. Our preliminary results show that long-term health benefits (LTB) were negatively associated with fertility, whereas the opposite was true for sickness absence (SA). LTB are indicative of poorer health than SA, and thus might be negatively correlated with finding (and keeping) a partner which many may consider a prerequisite for starting or continuing to build a family. However, our results did not change when we accounted for partnership status. Furthermore, poor health may interfere with the chance of conception, as well as the likelihood of completing a successful pregnancy. It might also affect the desire for a family, or impact on the desired number of children. Our study cannot distinguish between these mechanisms. A detailed discussion of the likely mechanisms in play will be provided in the full paper, based on the chosen theoretical framework as well a more thorough review of existing studies.

Women with SA may have a somewhat weaker attachment to the labor market than those without such absences. As such, they may have a stronger preference for family formation than careers. Our preliminary results cannot corroborate such explanations, and further research as to what underlines the differences we observe are clearly warranted.

The reductions in fertility in this *unselected* national material is perhaps less pronounced than what could be expected, based on what is known of poor health and based on what previous research has suggested. On the other hand, as age of first, as well as later, births continues to increase slightly, parenthood will remain an issue for many women in suboptimal health in the years to come, and thus warrants further study.

Limitations and strengths

This study is based on high quality registries. which is a necessary premise for this type of study to yield valid findings. It is also likely that the results may pertain to other countries with similar population structures, illness burdens, health systems, and welfare structures, particularly the other Nordic countries. Research from other countries with equally good population registries on health proxies and fertility is needed to determine to which extent these findings are valid for women in suboptimal health outside Norway.

As this is a registry-based study, we do not have information on *why* persons act the way they do. On the other hand, by using registry data we have reliable information on the entire Norwegian population, and we are thus able to include *all* women, thereby avoiding selection bias often present in survey-based studies on health. Previous research on the influence of poor health on family life has primarily focused on various quality of life measures and self-reported demographic data. The studies have consequently mostly been based upon personal questionnaires or interviews. These studies have provided detailed information, but questions have been raised as to whether subjective answers and selection in both recruitment and participation has influenced the results. Population-based registry data, data available and valid for an entire population, will not be affected by different groups reporting consistently differently regarding the conditions studied or subjected to selection bias in the same degree. The different study types may in this manner complement each other: Whereas this study contributes interesting but limited information on an entire population of women in fertile ages in different states of health, in-depth studies provide extensive knowledge on the lives of selected subgroups.

Whether our findings show minor or modest associations between fertility and health depends on the perspective one chooses to take. The estimates shown in Table 3 have pronounced magnitudes and appear robust with narrow confidence intervals. However, the use of health-related benefits is fairly uncommon among women in fertile ages, as shown in Table 1. This is especially true for long-term benefits. Thus, on an absolute scale, any health-related impact is likely to be fairly minor.

The fact that we use health indicators related to the use of sickness absence benefits or more long-term health-related benefits could be problematic. One concern is that many of the benefits people in poor health are entitled to are closely related to labor market participation. Thus, such benefits may be less relevant for subgroups like for instance students. However, the labor market participation rate is high in Norway, and the vast majority of students hold part-time jobs in which they are also entitled to sick pay. Thus, our health indicators should capture parts of this 'morbidity' as well, as perhaps is indicated by the relatively minor differences observed in Table 3 for the comparison of first birth risks among all women and among women excluding students. Along the same lines, the changes over time were also very similar when students were excluded (Appendix Figure A2).

The way we evaluate it, it is likely that our measures largely capture suboptimal health. There will, however, be substantial variation in *how* sick people are and how *long-lasting* their problems may be. At the same time, there may be people in poor health who are not in working life – but who also do not meet the requirements for health-related benefits and thus use alternative benefits, such as financial social assistance. However, this is a relatively small group that will have little influence on the large group without benefits. As such, it is of minor significance for our comparison. Nevertheless, studies using other health measures are clearly needed to validate our findings.

Kravdal (2001b) has shown that parity specific analyses may yield less valid results than those that model all parities jointly. However, as we use time-varying covariates, this should reduce the drawbacks associated with the chosen method. However, it will be interesting to see if our analyses could be replicated in a study where parities are modeled jointly.

Next steps

Suboptimal health, and especially poor health, might be hypothesized to increase persons' family orientation and their consciousness of the positive emotional value of having children, thus altering preferences for parenthood in a positive direction. In this study, this hypothesis was not explored directly. A next step would be to compare the impact of poor health in men (e.g. Barclay & Kolk 2019) and women. If we find that poor health impacts equally in childless men and women although women are 'burdened' by pregnancies and subsequent nursing periods, this may indicate that women value parenthood more strongly.

On the other hand, poor health was expected to reduce fertility as it may reduce persons' perceived ability to be healthy and caring parents, economically and otherwise. This could not be directly explored by our data. However, there was a strong 'self-selection' into parenthood, as indicated by the difference between women using sickness absence benefits as opposed to long-term benefits, and we found that the 'healthiest' women in suboptimal health chose to have children. This may indicate that persons take considerations of this kind into account when they decide to opt for parenthood. Furthermore, the association between poor health appears to be particularly strong for firstborns. Whether this might relate to the fact that these women are doing worse in the 'partner market' should be examined further. The association is somewhat weaker for second births, and again weaker for third births, but the trends are similar. In other words, health status appears to matter the least for third births. This might imply that there is a selection of relatively healthy women into motherhood, and subsequently

into the ‘two-child’ norm – but that this selection has been largely ‘taken out’ for women at risk for having a third child. This should be further investigated.

Conclusion

We have shown that the use of both short-term benefits, i.e. sickness absence, and longer-term health-related benefits has a bearing on fertility, for all parity transitions. However, there are marked differences between short-term and longer-term benefits: While the use of sick leave is positively associated with childbirth, the opposite is the case for longer-term benefits. Such uptake is, however, relatively rare, and thus unlikely to explain much of the observed decline in fertility. On the other hand, such uptake is increasing in Norway. The use of sickness absence, positively associated with fertility is, on the contrary, decreasing over time. If this decrease indicates a stronger labor market attachment and a preference for careers over motherhood among women in fertile ages, it might help explain parts of the observed decline. The use of health-related benefits by women in fertile ages deserves more attention, both to ensure that women in various states of health can reach their desired family size, but also to ensure that women with suboptimal health do not have to forgo children due to difficulties with combining family and work life.

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Appendix

Table A1. Distribution of education and health characteristics among women who do have a first, second or third child.[a]

	First birth (%) (N=286 482)	Second birth (%) (N=246 847)	Third birth (%) (N=98 400)
Education			
Enrolled in education[b]	1.7	10.6	3.8
Not enrolled in education	5.7	9.7	2.6
High school or below	2.8	7.0	2.1
Higher education	7.7	14.0	3.4
General education	2.5	7.4	2.3
Female dom.	7.5	11.1	3.0
Mixed gender, high specificity or male dom.	6.2	11.4	2.6
General health			
Healthy	4.2	10.7	2.8
Only sickness absence (SA)	7.5	10.2	2.9
Long-term benefits (LTB)[c]	2.1	3.4	1.3
Health and educational level[d]			
Healthy, low education	2.7	7.7	2.2
Healthy, high education	7.7	14.8	3.5
SA, low education	6.4	8.2	2.5
SA, high education	9.5	13.2	3.4
LTB, low education	1.8	2.9	1.2
LTB, high education	3.8	5.7	1.6
Health and educational type[e]			
Healthy, general education	2.4	8.3	2.5
Healthy, female dom.	7.8	12.0	3.1
Healthy, high-specificity, gender-mixed or male dom.	6.3	12.3	2.7
SA, general education	6.3	8.4	2.7
SA, female dom.	8.5	11.1	3.2
SA, high-specificity, gender-mixed or male dom.	7.8	11.2	2.7
LTB, general education	1.7	3.0	1.3
LTB, female dom.	3.2	4.0	1.3
LTB, high-specificity, gender-mixed or male dom.	3.0	3.9	1.2

[a]All variables are coded so that the groups are mutually exclusive. [b]This group comprises women where enrolment in education is their primary activity, and the remaining are included in the 'not enrolled in education' category. [c]Comprises women who receive long-term benefits. Some of these women may also receive sickness benefits. [d]This variable is a composite measure of educational level and health, and high education include all women with education beyond high school, whereas the low education group include all other women. [e]This variable is a composite measure of educational type and health. The women included in the long-term benefit group may also receive sickness benefits.

Table A2. Odds ratios with 95% confidence intervals from models with different covariates, for first, second, and third births, respectively.

	Model A		Model B		Model C		Model D		Model E		Model F	
	OR	95% CI	OR	95% CI	OR	95% CI			OR	95% CI	OR	95% CI
First births: General health[a]												
Healthy	1	ref	1	ref	1	ref	1	ref	N/A	N/A	1	ref
Only sickness absence (SA)	1.43	1.41-1.44	1.39	1.38-1.40	1.27	1.26-1.29	1.27	1.26-1.29	N/A	N/A	1.27	1.25-1.28
Long-term benefits (LTB)[b]	0.48	0.47-0.49	0.58	0.57-0.59	0.49	0.48-0.50	0.54	0.53-0.55	N/A	N/A	0.53	0.52-0.54
Second births: General health												
Healthy	1	ref	1	ref	1	ref	1	ref	1	ref	1	ref
Only sickness absence (SA)	1.12	1.11-1.13	1.08	1.07-1.09	1.12	1.11-1.13	1.18	1.16-1.19	1.18	1.16-1.19	1.18	1.16-1.19
Long-term benefits (LTB)	0.47	0.46-0.48	0.57	0.56-0.59	0.50	0.49-0.51	0.58	0.56-0.59	0.59	0.57-0.60	0.58	0.57-0.60
Third births: General health												
Healthy	1	ref	1	ref	1	ref	1	ref	1	ref	1	ref
Only sickness absence (SA)	1.02	1.00-1.03	1.02	0.99-1.03	1.02	1.00-1.04	1.06	1.05-1.08	1.07	1.05-1.08	1.07	1.05-1.08
Long-term benefits (LTB)	0.64	0.62-0.66	0.66	0.63-0.68	0.66	0.64-0.68	0.74	0.71-0.76	0.75	0.73-0.77	0.74	0.72-0.77
Control variables												
Age group	X		X		X		X		X		X	
Period	X		X		X		X		X		X	
Time since last birth[c]	X		X		X		X		X		X	
Interaction between health and calendar period[d]											X	
Employed			X									
Married									X			
Income (quartiles)[e]					X		X		X		X	
Educational variables							X		X		X	

Note: Estimates not in bold, p <0.05. [a]The categories are mutually exclusive. [b]A measure of whether one receives any long-term benefits. Som women may also receive sickness benefits. [c]Only relevant for second and third births. [d]The reference period is the first calendar period, i.e. 2004-2006. [e]The results are virtually identical if the sample is restricted to only women with income, or considers only women without income.

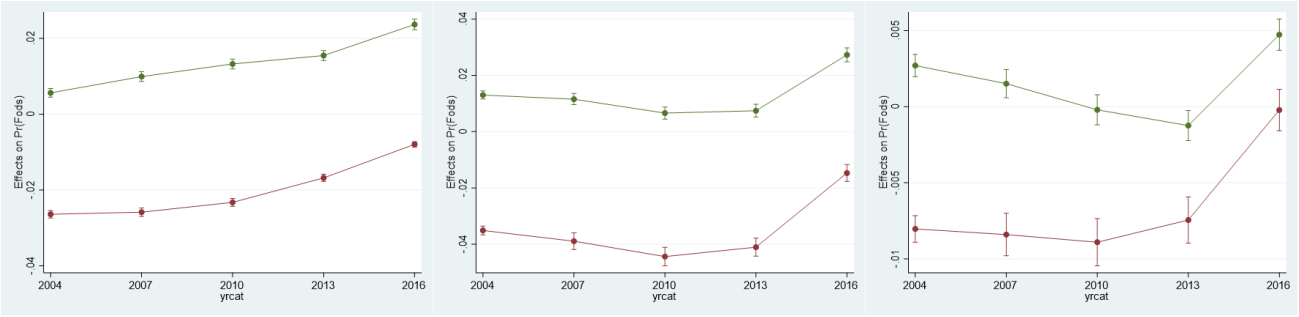

Figure A1. Average marginal effects with 95% confidence intervals for the probability of a first (left panel), second (mid-panel) or third (right panel) child for women by general health proxies relative to women who are healthy.

Note: The groups are mutually exclusive. Women who receive long-term benefits (LTB, red line) may also receive sickness absence benefits (SA, green line). The reference group of healthy women is not shown but may be presented as a horizontal line through 0. These women do not receive any such benefits. LTB is an aggregate measure of whether women have received work allowance benefits. disability benefits and/or basic or attendance benefit payments the previous year.

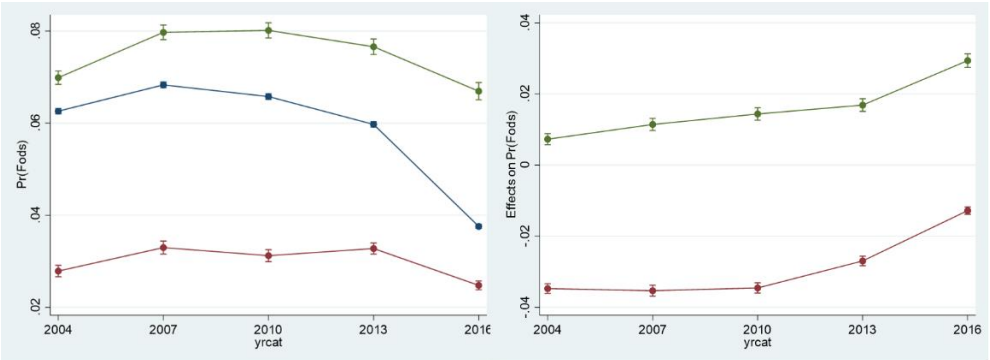

Figure A2. Predicted probabilities (left panel) and average marginal effects (right panel) with 95% CI for the risk of a first birth by health status, not including students.

Note: The groups are mutually exclusive. Women who receive long-term benefits (LTB, red line) may also receive sickness absence benefits (SA, green line). LTB is an aggregate measure of whether women have received work allowance benefits. disability benefits and/or basic or attendance benefit payments the previous year. In the left panel, the healthy women (blue line) do not receive any such benefits. In the right panel, the reference group of healthy women is not shown, but may be presented as a horizontal line through 0.

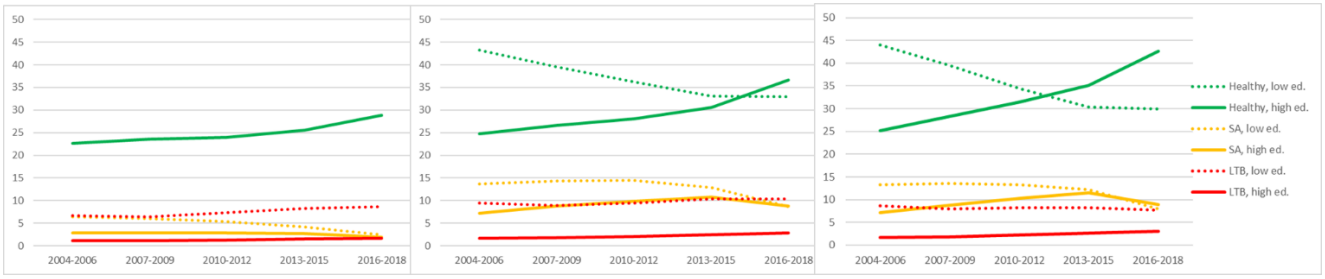

Figure A3. Changes over time in health by educational level for women at risk for a first, second or third birth, respectively (left to right).

Note: The groups are mutually exclusive. Healthy women with a low education are not shown in the left panel (first births). They comprise 60% in 2004-2006, and the share declines throughout the period. In 2016-2018, the group comprised 56%. SA is short for sickness absence, whereas LTB is short for long-term benefits. The healthy women receive no such benefits.

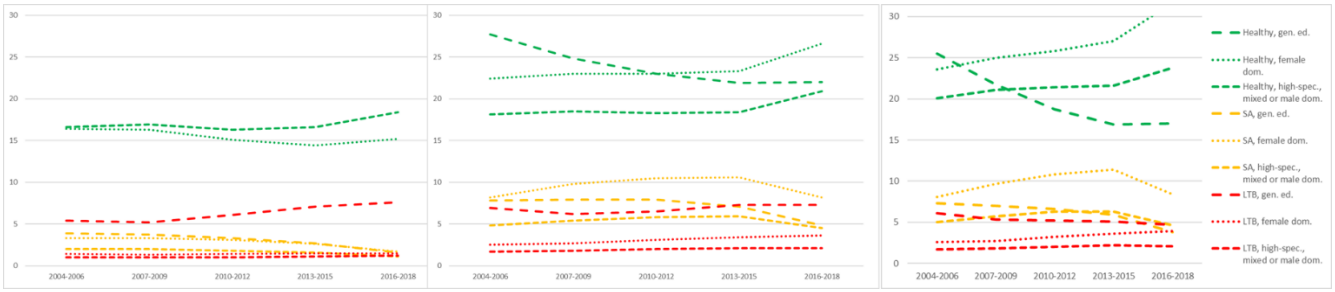

Figure A4. Changes over time in health by educational type for women at risk for a first, second or third birth, respectively (left to right).

Note: The groups are mutually exclusive. Healthy women with a general education are not shown in the left panel. They comprise 50% in 2004-2006, and increase to around 53% in 2010-2012, before the share declines to around 52% in 2016-2018. SA is short for sickness absence, whereas LTB is short for long-term benefits. The healthy women receive no such benefits.

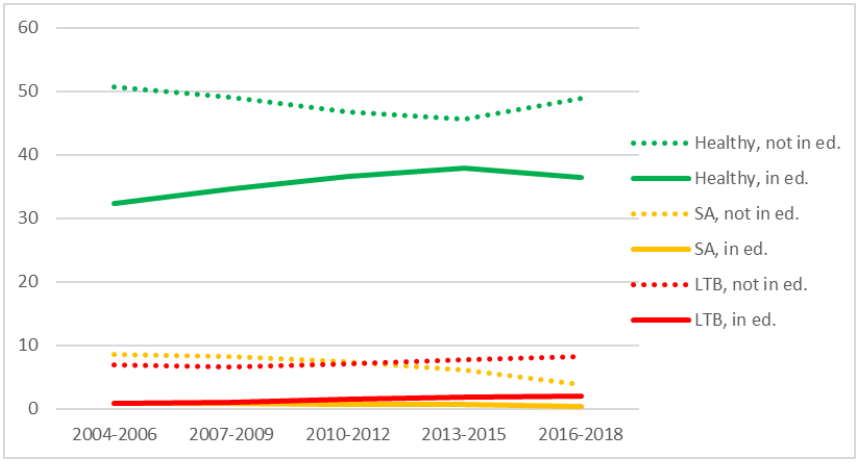

Figure A5. Changes over time in health by educational enrollment for women at risk for a first birth.

Note: The groups are mutually exclusive. SA is short for sickness absence, whereas LTB is short for long-term benefits. The healthy women receive no such benefits.