

Rates of induced abortion in Denmark according to age, previous births and previous abortions

Marie-Louise H. Hansen¹, Ditte Mølgaard-Nielsen¹, Lisbeth B. Knudsen², Niels Keiding³

Abstract:

Background: Whereas the effects of various socio-demographic determinants on a woman's risk of having an abortion are relatively well-documented, less attention has been given to the effect of previous abortions and births.

Objective: The objective is to study the risk of having an induced abortion among Danish women according to previous births, previous abortions and a number of other demographic characteristics.

Data and methods: From the Fertility of Women and Couples Dataset we obtained data on the number of live births and induced abortions by year (1982-2001), age (16-39), county of residence and family situation. Logistic regression analysis was used to estimate the influence of the explanatory variables on the probability of having an abortion in a relevant year.

Main findings and conclusion: A woman's risk of having an abortion increases with the number of previous births and previous abortions. Some interactions were found in the way a woman's risk of abortion varies with calendar year, age and fertility parity. The risk of an abortion for women with no children decreases while the risk of an abortion for women with children increases over time. Furthermore, the risk of an abortion decreases with age, but relatively more so for women with children than for childless women.

The two first-mentioned authors have contributed equally to the article, and both could have been named as the senior author

¹ M.Sc. in Public Health, Department of Biostatistics, Institute of Public Health, University of Copenhagen, Denmark

² Professor, Department of Sociology, Social Work and Organization, Aalborg University, Denmark

³ Professor, Department of Biostatistics, Institute of Public Health, University of Copenhagen, Denmark

Table of Contents

1.0 Introduction

1.1 The Danish setting

1.2 Background

1.2.1 Previous abortions

1.2.2 Previous abortion and previous births

1.2.3 Previous births

2.0 Data and methods

2.1 Study population

2.2 Variables

2.3 Descriptive methods

2.4 Logistic regression methods

3.0 Descriptive analyses

3.1 Age-specific abortion rates

3.2 Abortion parity

3.3 Fertility parity

4.0 Logistic regression analyses

4.1 Modelling data

4.2 The logistic regression model

5.0 Discussion

5.1 Validity of data

5.2 The abortion rates in 1996

5.3 Fertility parity

5.4 Abortion parity

5.5 Urbanisation

5.6 Family situation

6.0 Conclusion

References

Appendix

1.0 Introduction

Since the first known worldwide assessment was developed in 1995, abortion rates have been declining all over the world (Sedgh et al. 2007). In recent decades, women in many western countries have had access to fertility regulation such as induced abortions, while western countries also have the lowest abortion rates, 19 per 1000 women aged 15-44 (Sedgh et al. 2007). Although abortion rates are declining, more knowledge on the determinants of women having an abortion is needed to help guide policy-making and reproductive health campaigns. The effects of various determinants such as age, marital status, ethnicity etc on a woman's risk of having an abortion are relatively well-documented, both internationally and for Denmark (e.g. Barrett, Peacock & Victor 1998; Henshaw 1990; Rasch, Knudsen & Gammeltoft 2005). Less attention has been given to the role of a woman's previous abortions and births⁴. Especially information on the effect of the number of previous abortions is relatively sparse, probably due mainly to lack of relevant data, particularly at population level. The scope of this article is to examine the possible link between previous abortions and births on Danish women's risk of having an abortion.

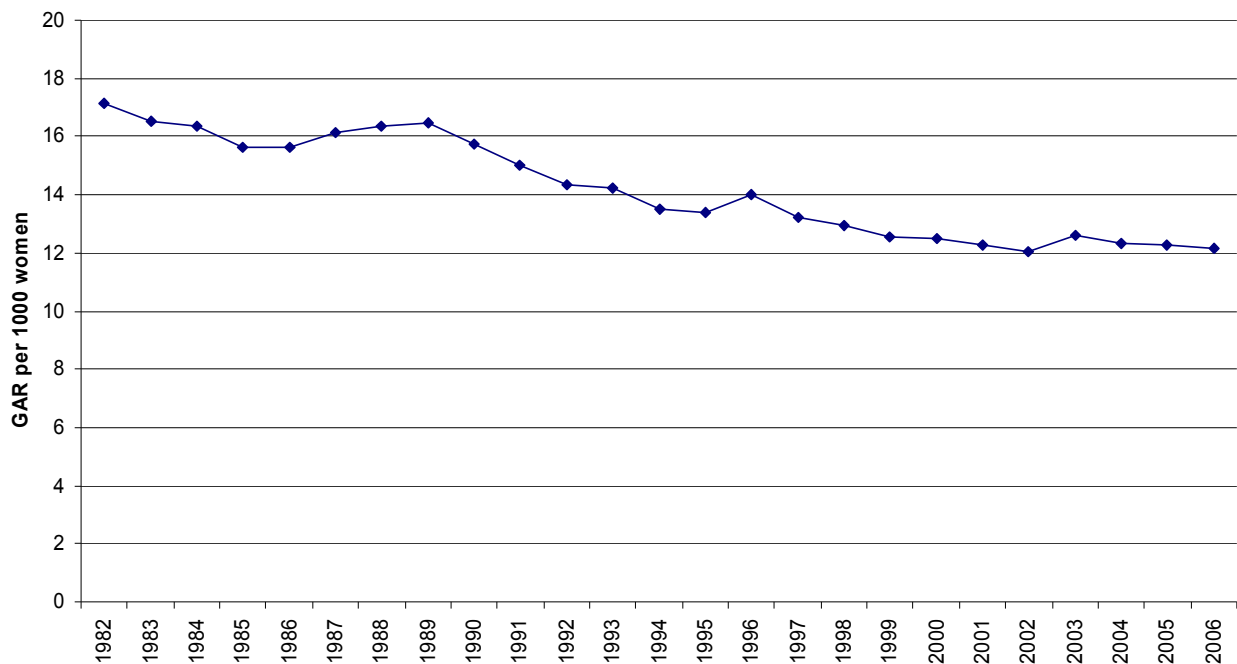
1.1 The Danish setting

In 1973, the act on legal pregnancy termination was liberalised and today this act, with minor changes, is still applicable in Denmark. Under this act, all women above the age of 18 have the right to an induced abortion at a public hospital, cost-free and on demand, provided the woman is domiciled in Denmark and the induced abortion is performed before the end of the 12th week of pregnancy. Induced abortions after the 12th week require special permission (Law No. 350 of 13 June 1973 on the interruption of pregnancy).

The general abortion rate peaked in 1975 with approx 23.7 abortions per 1000 women and has been declining ever since – in 2006 the general abortion rate was approx 12.2 abortions per 1000 women, cf Figure 1. Hence, the general abortion rate almost halved from 1975 to 2006.

⁴ The number of previous abortions and children a woman has had is referred to as the woman's abortion parity and fertility parity that year respectively. Unless otherwise specified, the term "abortion" refers to legally induced abortions.

Figure 1: General abortion rate per 1000 women aged 15-49 from 1982-2006, Danish women⁵



1.2 Background

The main focus of this paper is to examine if and how a women's abortion parity and fertility parity influence the risk of an induced abortion. Few articles consider both characteristics (eg Bettarini & D'Andrea 1996; Millar, Wadhera & Henshaw 1997; Russo, Horn & Schwartz 1992), whereas a large number of articles discuss either a woman's abortion parity or fertility parity when having an abortion. In this section, we give a brief overview of selected relevant literature.

1.2.1 Previous abortions

The interest in women's abortion parity is often centred on an interest in how many women have repeat abortions, this originates largely from an early concern in the extent to which some women would 'use/abuse' the extended pregnancy termination rights as a substitute for contraception. In the first years after the right to induced abortion on demand was ratified in Denmark, Statistics Denmark compiled figures based on record linkage regarding repeat abortions. These linkages revealed that approx 5% of the women having abortion in one calendar year had another termination within the next 12 months. When the period was extended to 24 months, the proportion of repeaters almost doubled, indicating that the repeaters in the second year were other women than

⁵ Data comes from Statistics Denmark

the ones in the first year (Statistics on Contraceptives and Induced Abortion, various years). A study from Norway indicated that one out of every seven women who had an abortion in 1987 returned for a repeat abortion within 4 years after the initial abortion (Skjeldestad 1994).

In 1987, 38% of induced abortions in Denmark were performed on women who had already had one or more prior abortions. In the same year, the proportion of repeat abortions was approx 20% in England/Wales, France and the Netherlands. In Sweden and Hungary, the proportion was 35% and 50% respectively (Henshaw 1990). According to a Canadian study by Millar et al. (1997), women with one or more previous abortions are more likely to have a further abortion in a given year compared to women who have never had an abortion, regardless of the women's age. Furthermore, the study shows that approx 20% of all women seeking induced abortion in the period 1975-1993 had had at least one previous abortion; 15.5% had had just one, 3.1% two and 0.9% had three or more previous abortions (Millar, Wadhera & Henshaw 1997). An American study from 1995 found that repeat abortion-seekers are more often older, younger at first pregnancy, black and single compared to first-time abortion-seekers (Westfall & Kallail 1995).

1.2.2 Previous abortions and previous births

An Italian study, unfortunately including only married women, found that about 30% of the registered induced abortions in 1991 were repeat abortions. This study also indicated that the likelihood of a repeat abortion increases with the woman's fertility parity; that is, the more previous births the higher the likelihood of a repeat abortion (Bettarini & D'Andrea 1996).

This finding was supported by the previously mentioned Canadian study, although no clear association between the woman's fertility parity order and risk of a repeat abortion was found. However, repeat abortion was found to be more prevalent among women who have already given birth (Millar, Wadhera & Henshaw 1997). A study from the US found that almost half of all women seeking an abortion in 1987 were mothers (Russo, Horn & Schwartz 1992).

1.2.3 Previous births

Knudsen and Wielandt (2000) demonstrated that in Denmark the proportion of abortion-seeking women with no children have increased. In the mid-1970s, about one third of the abortion-seeking women had no children, whereas in the 1990s almost half the abortion-seeking women had no children. The authors interpreted this as a trend where induced abortions today in Denmark is used

as a means of postponing the onset of childbearing rather than ending childbearing. However, as the present article shows, these findings must be interpreted with caution because of the increase in the average age of women having their first child.

The majority of the women in a study from the US who had an abortion in 2000-2001 had given birth at least once before. Furthermore, age-adjusted abortion rates showed that women with no children had the lowest rates compared to women with one or more children. The proportion of pregnant women choosing an induced abortion was higher among women with two or more previous births than among those with only one previous birth (Jones, Darroch & Henshaw 2002). A Danish study comparing pregnant women seeking an induced abortion with pregnant women attending antenatal care indicated similar associations between previous birth and induced abortion. After adjusting for age, pregnant women with no children had the lowest risk of an abortion and women with two or more children the highest risk when compared to women with one child (Rasch, Knudsen & Gammeltoft 2005).

Findings from a Norwegian study comparing women who either gave birth or had an induced abortion in 1979-1990 indicated that the majority of abortion-seeking women were either unmarried with no children or married with more than two children. Further, when analysing the impact of marital status, age and fertility parity on the decision whether to have an abortion or not, the study found that regardless of marital status and age the risk of having an abortion increases significantly with parity order; that is, the number of previous births (Skjeldestad et al. 1994).

Barrett et al. found a relation between fertility parity and induced abortion after adjusting for socio-demographic characteristics, lifestyles and attitudes. Women with one to three children and women with four or more children had a 1.5-fold and 3-fold increase in abortion rates respectively, when compared to women without children (Barrett, Peacock & Victor 1998). However, the interpretation of the causality of the association is ambiguous. Furthermore, information on abortions was collected through questionnaires, and the answers could be subject to information bias.

2.0 Data and methods

2.1 Study population

All data used in this study stem from a number of national public registers in Denmark, primarily from the Registry of Legally Induced Abortions and the National Discharge Register (Andersen et al. 1999). From these, information has been extracted and data linkages performed by means of the unique Danish civil registration number to establish the Fertility of Women and Couples Dataset (Kohler et al. 2002). The Fertility of Women and Couples Dataset (FWCD) includes socio-demographic information on any woman in the fertile age (13-49 years) living in Denmark in the period 1980-2001, collected annually from Statistics Denmark. Information on all live births as well as stillbirths stem from the Medical Birth Register and the civil registration in the country, while information on legally induced abortions is based on separate registrations in the health services. A compilation of events of both fertility and abortions was made when creating the FWCD, which was originally established for analyses of reproductive patterns at the Centre for Demographic Research at the University of Southern Denmark (Knudsen & Murphy 1999). A reorganisation of the abortion registration in 1995 might have affected the number of registered abortions in the following years, due to registration differences.

The study population in this study comprises all women over the age of 20 from birth cohorts 1961 to 1981, who were resident in Denmark on 1 January in a given year in the time period from 1 January 1982 to 31 December 2001. Only women above the age of 20 are included due to an assumption that abortions among teenagers call for considerations and discussions of a somewhat different character than what regards the same event in older ages. Furthermore, the study population only comprises native born women⁶.

⁶ Native Danish women are women where at least one of the parents is a Danish citizen and born in Denmark, regardless of the women's own country of birth and citizenship

Figure 2: Lexis Diagram. The composition of data regarding the women's age, cohort and calendar year.

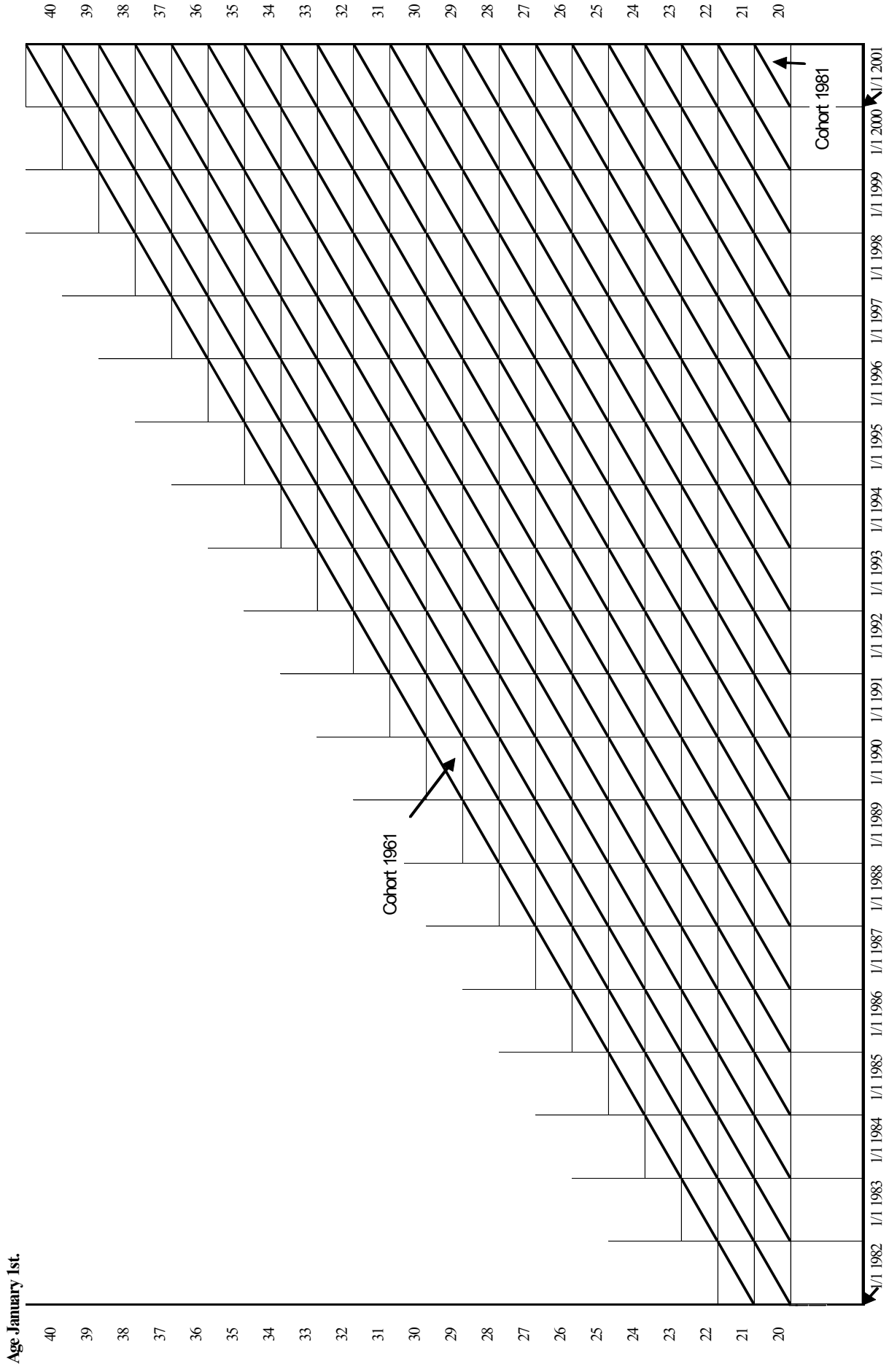


Figure 2 shows that in 1982 only 20 years old women can be included in the analysis, while in 2001 the data comprise women between 20 and 39 years. As mentioned before, abortion on demand was legalized in Denmark in 1973. The Registry of Legally Induced Abortions includes information on women in the fertile age – in this context defined as 13-49 year-old women. Thus, women from birth cohort 1961 is the first birth cohort who are eligible to be included in the registers as they turn 13 years in 1974 – the first year of registration. In 1982, women above 20 years cannot be included, since the law and register were not in place from the beginning of their reproductive period, and full information on the women's abortion parity was therefore unavailable. This means that we have information on 20-year-old women every year from 1982 to 2001, whereas we only have information on eg 35-year-old women from 1996 to 2001. The consequent triangular shape of data places some constraints in the comparisons of age groups over time. In some of the analyses, we only report abortion rates for women aged 20-35. This is because even though we have some data on the 36- to 39-year-old women, it is not enough to determine a development over time.

2.2 Variables

Data includes information for every calendar year from 1982 to 2001 about the woman's age⁷, the fertility parity, the woman's municipality of residence, the woman's family situation, the abortion parity – all recorded 1 January. Furthermore, data included information on and whether the woman had an induced abortion during the relevant year, which is recorded 31 December.

The variable indicating the woman's municipality of residence was re-coded into a new urbanisation variable. The urbanisation variable comprises four categories: the Capital area, the Urbanised area, the Close periphery, the Distant periphery (Tonboe 2001).

The family situation variable describes the women's position within a household and is categorised into: single, married and cohabiting. According to this variable, divorced women, if not living together with a partner, are categorised as single. Married women have to live with their partners in order to be registered as married. Furthermore, single women might have a partner but are still categorised as single if they are not living together. Thus, it is not so much the women's marital status as it is her living arrangement that are pivotal to the classification of the women's family situation variable.

⁷ Completed years

Women in registered same-sex partnerships were disregarded, because of an assumed different fertility and abortion pattern.

2.3 Descriptive methods

As response parameter, we have chosen the age-specific abortion probability in a relevant year. This is in line with the organization of these data, with the central binary variable "abortion this year", which indicates whether the woman has had an induced abortion the relevant year or not, and the restriction to women who were alive and living in the country for the whole year. For the sake of completeness: the abortion parity variable used as covariate counts, at the beginning of each year, the actual number of abortions performed, even if several were performed during one year.

To illustrate the connection to a concept of abortion incidence counting each abortion separately, reference may be made to data from the Danish National Board of Health showing that the number of women who have an induced abortion within 12 months after the last induced abortion was 5% in 1989 (Knudsen 1998). Obviously, not all of these multiple abortions would take place in the same calendar year. Our abortion probability parameter is therefore close to the abortion incidence and the patterns should be very similar.

2.4 Logistic regression methods

The influence of several explanatory variables on the probability of having an abortion in a relevant year was estimated by logistic regression analysis. In this paper we use the logistic regression model descriptively, to attempt to capture primary structures in the data. Use of confidence intervals and p-values derived from the model is difficult with the large data set.

First, in logistic regression the variance is a fixed function of the mean and therefore the usual maximum likelihood estimates of variation are derived from the estimates of the mean, not from the actual variability in the data. This is in contrast to statistical models based on the normal distribution, where the variance has its own freely varying parameter. For large data sets one will in practice almost always find lack of fit, in the form of overdispersion (Dean, 2005) or otherwise, and the usual maximum likelihood estimates of variability are not robust to the resulting model misspecification. We found it beside the point to enter into elaborate generalizations of the estimation procedure in this publication.

Secondly, the standard intuition concerning p-values, e.g. the conventional 5% level, was developed by R.A. Fisher in the 1920s and 1930s when he revolutionised statistics by analysing small data sets from his agricultural experiments; the tradition from the 19th century and from Karl Pearson who studied larger data sets was to require much stronger effects to claim statistical significance. For the large datasets in demography adherence to the Fisherian ‘5%’ conventions will lead to focusing on differences too small to be of demographic interest.

3.0 Descriptive analyses

The analyses of the following section intend to give an overview of the association between women's abortion parity and fertility parity and the risk of having an abortion. It was decided to present the abortion rates in 2-year age groups to ensure sufficient incidents in each stratum. The age groups are only included in the analyses when both birth cohorts of a 2-year age group are registered in the data.

3.1 Age-specific abortion rates

Figure 3 shows the age-specific abortion rates per 1000 women in 1983-2001. The women's ages are divided into 2-year age intervals from 20-21 years to 38-39 years.

Figure 3: Age-specific abortion rates per 1000 women from 1983-2001, cohort 1961-1981

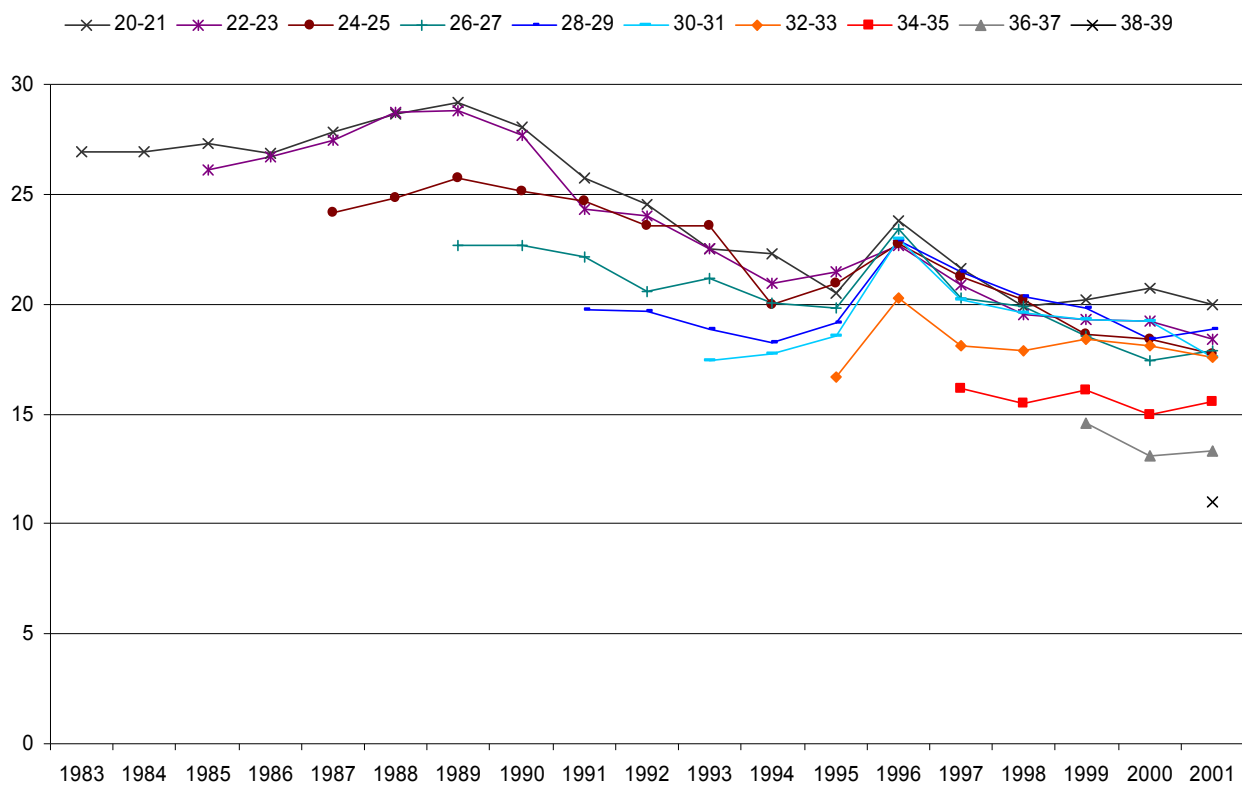


Figure 3 shows that the abortion rates are highest for women in the age intervals from 20-21 years and 22-23 years. Furthermore, the abortion rates seem to decrease with age. Roughly, abortion rates drop by one to two abortions per 1000 women the older the age group the women belong to. Eg the abortion rate is approx 29, 29, 25 and 24 abortions per 1000 women in 1988 for the age groups 20-21, 22-23, 24-25 and 26-27 respectively.

As shown in Figure 3, abortion rates for the 20- to 29-year-old women seem to peak in 1989 with a continuous fall over the years afterwards.

Furthermore, the abortion rates seem to increase abruptly in 1996, while abortion rates in 1997 resemble the level of 1995. In the subsequent analyses, we have chosen not to comment on the top in 1996. However, it will be discussed further in section 5.2

3.2 Abortion parity

Age and abortion parity specific abortion rates were calculated for each year of the study period. The table below shows the age-specific abortion rates for selected age groups, according to abortion parity in 2001.

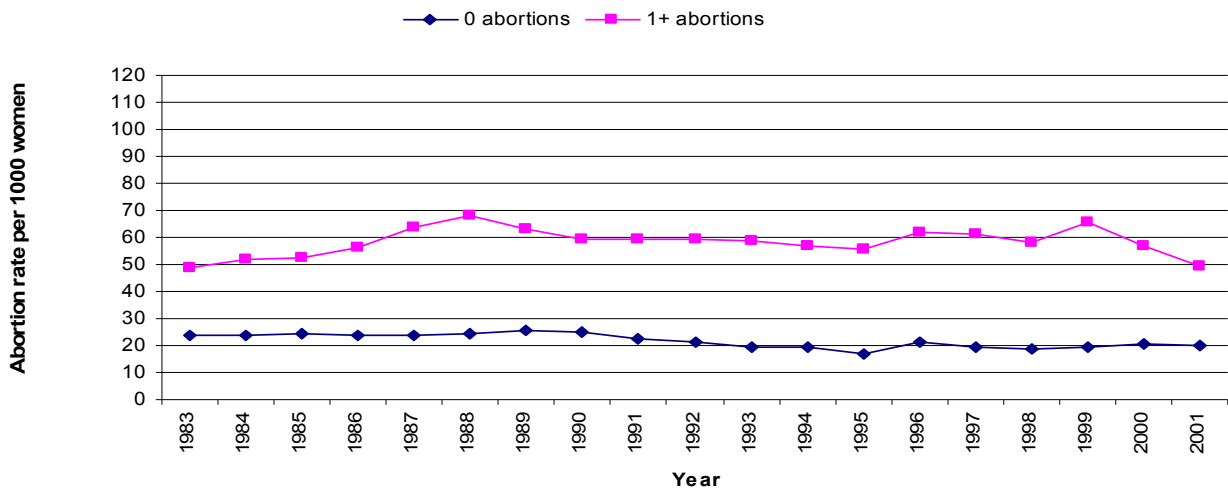
Table 1: Abortion rates per 1000 women for selected age groups in 2001, according to abortion parity

Age per 1 Jan	Abortion parity			
	0 abortions	1 abortion	2 abortions	3 or more abortions
20-21	19.9	51.1		
26-27	15.6	38.9	62.3	56.8
30-31	14.6	27.8	53.0	65.8

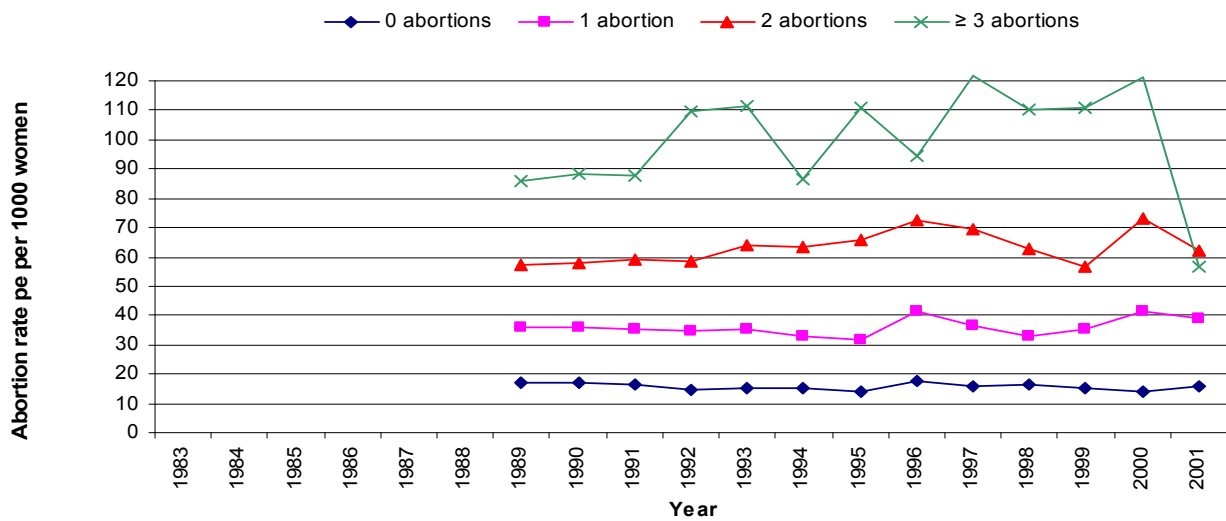
As Table 1 shows, the abortion rates for all age groups are higher among women with previous abortions than women with no previous abortions. Generally, abortion rates increase with increasing abortion parity. Figures 4a-4c show that this is the case for all years between 1983-2001. Abortion rates, regardless of abortion parity, are decreasing with age.

Figures 4a-4c: The abortion rates of women aged 20-21, 26-27 and 30-31 given the different abortion parities from 1983-2001, cohort 1961-1981

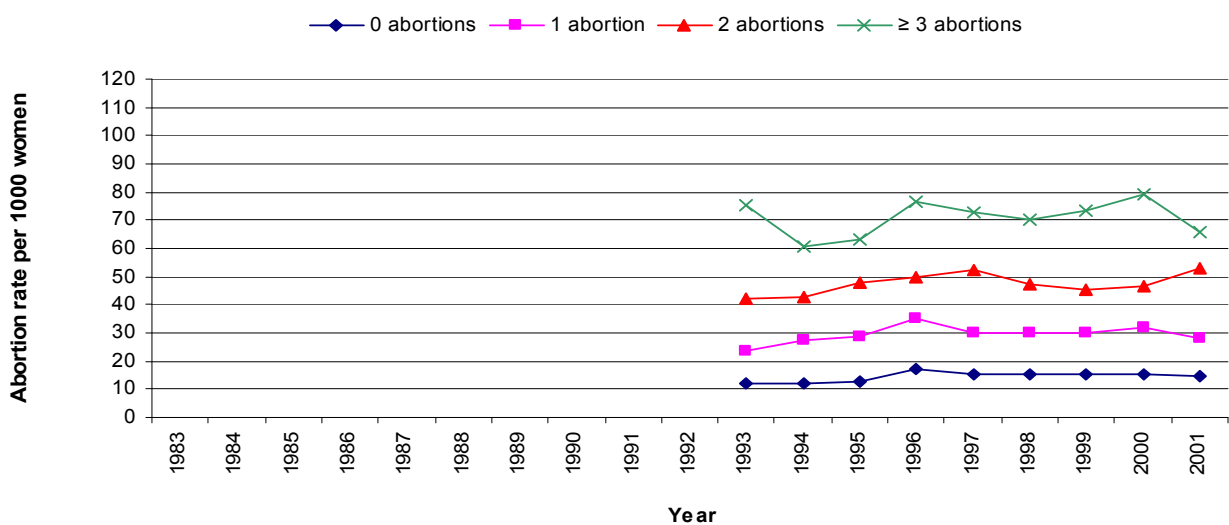
4a) women aged 20-21



4b) women aged 26-27



4c) women aged 30-31



In general, abortion rates for women aged 20-21 (data shown), 22-23 and 24-25 with *no* previous abortion are increasing in the 1980s and seem to peak around 1990, subsequently followed by a decrease in abortion rates in the 1990s. The abortion rates for women aged 26-27 (data shown), 28-29, 30-31 (data shown) and 32-33 with no previous abortions increase in the time period from 1990-2001.

The abortion rates for women in the early 20s (20-21 years (data shown) and 22-23 years) *with* previous abortions increase in the 1980s and seem to peak in the late 1980s. In the 1990s, the abortion rates for women with previous abortions do not display consistent time trend across ages.

3.3 Fertility parity

Age-specific abortion rates for a given fertility parity have been calculated for the period 1982-2001.

Table 2: Abortion rates per 1000 women for selected age-groups in 2001, according to fertility parity

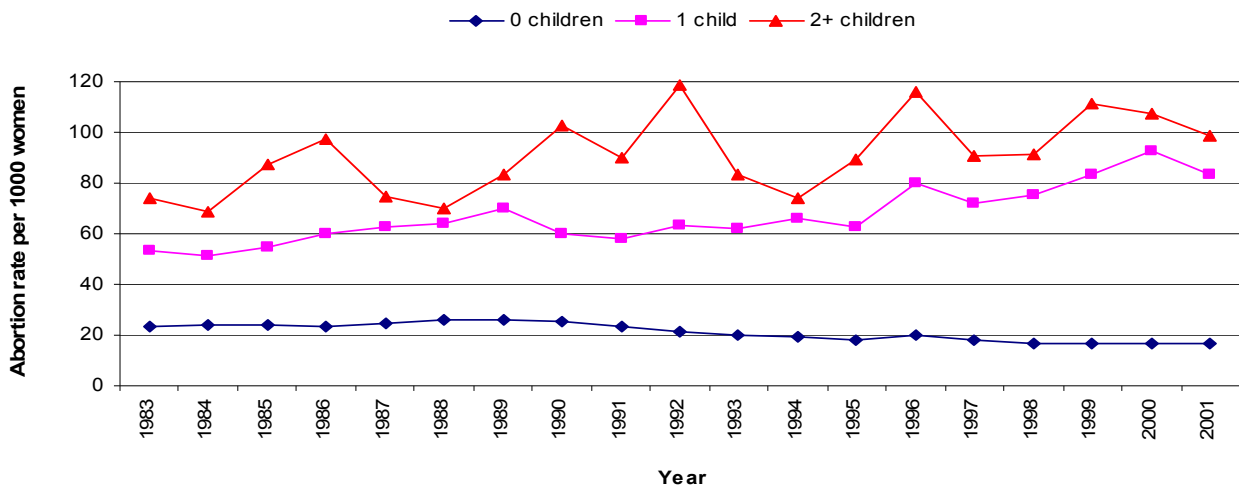
Age per 1 Jan	Fertility parity			
	0 children	1 child	2 children	3 children or more
20-21	16.6	83.5	100.7	58.8
26-27	11.5	21.3	42.2	49.7
30-31	10.6	18.1	20.9	31.4

Table 2 and Figures 5a-5d illustrate abortion rates for selected age groups and given the fertility parity

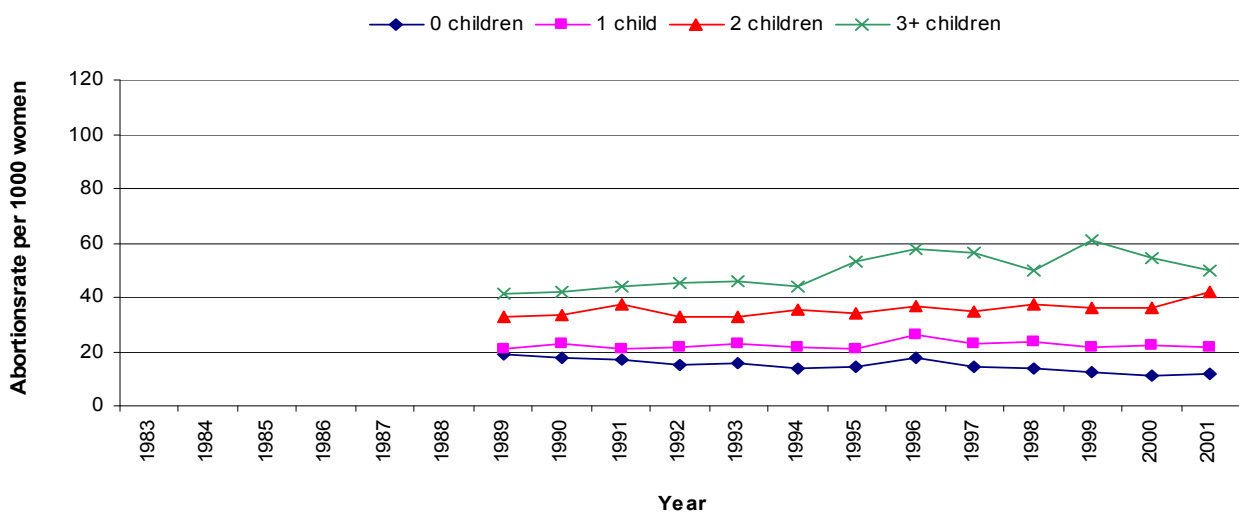
The overall trend is that women who have previously given birth have higher abortion rates in a relevant year compared to nulliparous women. To have given birth is thus associated with an increased risk of having an abortion. Furthermore, the risk of an abortion seems to increase with the number of children. This trend is observed for all age groups.

Figures 5a-5c: Abortion rates of women aged 20-21, 26-27 and 30-31 given the different fertility parities from 1982-2001, cohort 1961-1981

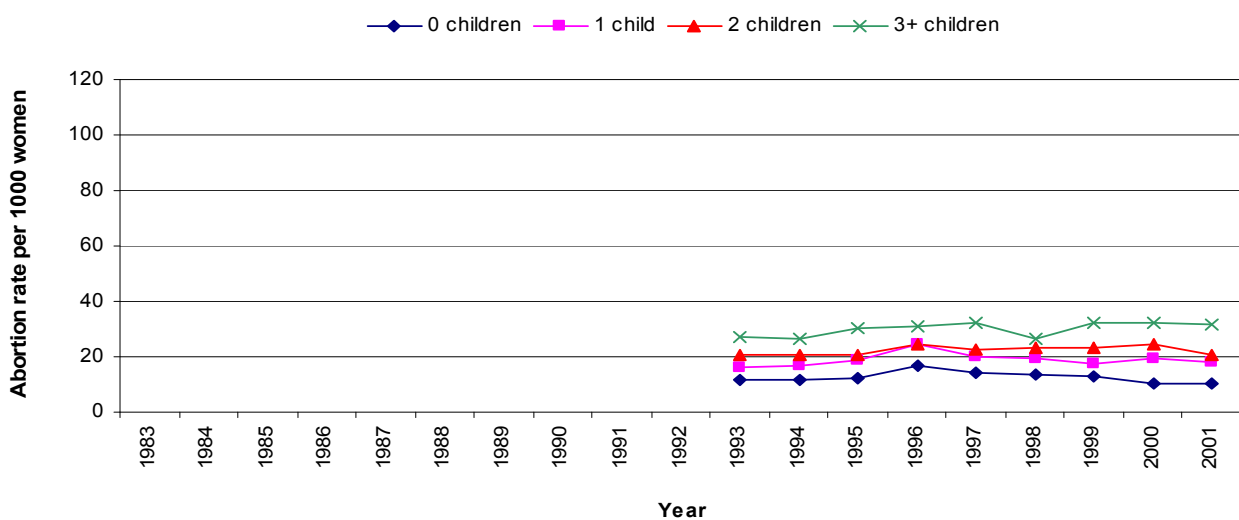
5a) women aged 20-21



5b) women aged 26-27



5c) women aged 30-31



The excess risk of having an abortion the more children the woman has decreases the older the woman is. That is, a young woman with children has a greater risk of an abortion compared to a woman with the same number of children, but older. 26- to 27-year-old women with three children in 2001 have an almost 4.3 times higher risk of an abortion compared to women in the same age group with no children. In comparison, 30- to 31-year-old women with three children in 2001 have an approx 3 times higher risk of an abortion compared to women in the same age group with no children, cf Table 2. The age of the woman thus modifies the increased risk of an abortion when she has one or more children

The age-specific abortion rates over time show two different time trends in the 1990s. One applies to nulliparous women and the other to women with children. Abortion rates of nulliparous women decline over time, while the abortion rates of women with children increase over time for women aged 20-21 (data shown), 22-23, 24-25, 26-27 (data shown), 28-29, 30-31 (data shown).

4.0 Logistic regression analyses

4.1 Modelling data

As mentioned under Methods, the data set is so large that a straightforward use of the usual likelihood-based p-values and confidence intervals is not justified here.

In our search for a model to describe important features of the data, we applied another approach based on the descriptive findings and the overall objective of this study. The descriptive findings show that abortion parity, fertility parity, age and calendar year seem to influence a woman's risk of having an abortion. The first model (model 1) therefore contains all the main effects of the above-mentioned factors, cf Table 3, along with the women's family situation and urbanisation that we wish to control for. Furthermore, the descriptive analyses indicate interaction between some of the factors. The main objective of this study is to investigate the effect of fertility parity and abortion parity on a woman's risk of having an abortion. Hence, only interactions containing either fertility parity or abortion parity are considered.

Interaction occurs if the effect of an independent variable on the risk of having an abortion is different at different levels of a second independent variable. The logarithm of the odds ratios (OR) of the interaction is plotted into a graph (main effect is included).

Table 3: Table of the fitted logistic regression models⁸

Model	Interactions
Model 1	-
Model 2	Fertility parity * calendar year Fertility parity * age
Model 3	Abortion parity * calendar year Abortion parity * age
Model 4	Fertility parity * abortion parity
The final model	Fertility parity bin. ⁹ * calendar year Fertility parity bin. ¹⁰ * age

Only data from 1986 is included in the models, since it is not until 1 January 1986 that five birth-cohorts (1961-1966) had reached the age of 20. In all of the models the reference category is that

⁸ All the fitted models contain main effects for calendar year, age, abortion parity, fertility parity, family status and urbanisation

⁹ Cf. section 4.2

for a 20 years old single women with no previous abortions and no children who lives in the Capital area in 2001.

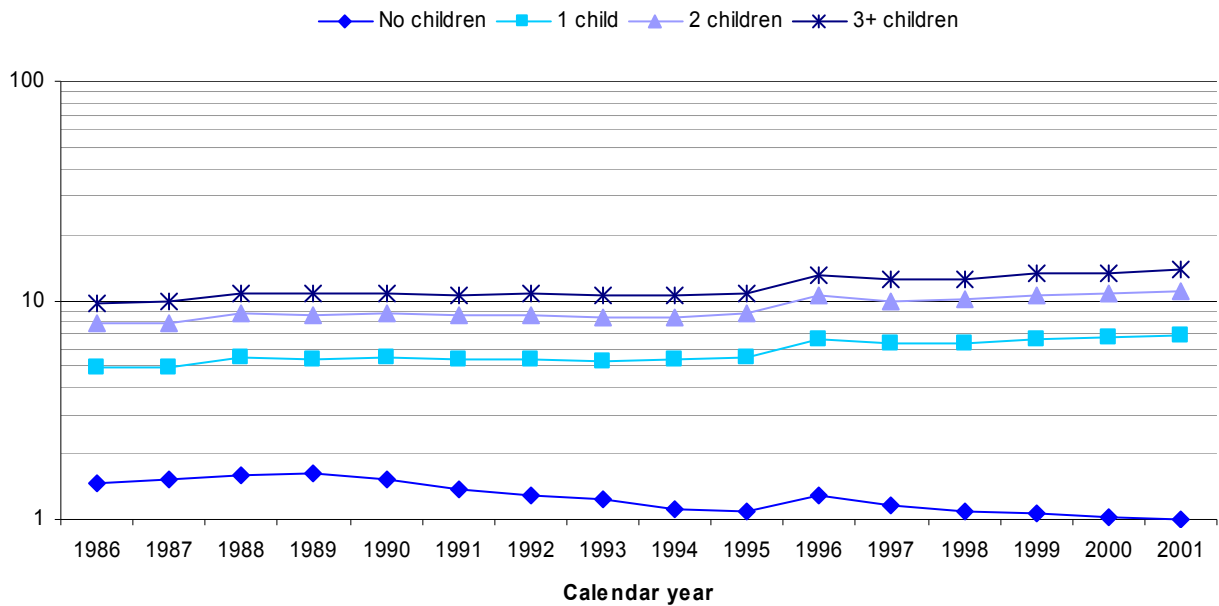
The estimates of the main effects and interactions in the different models can be found in appendix 1. Only the results of the final model are included in the article.

4.2 The logistic regression model

Based on the previously fitted models, a model containing all the main effects together with the interactions between binary fertility parity and calendar year, binary fertility parity and age was fitted, cf Table 3. Figures 6a-6b show the ORs of the interactions, including the main effects. In the interactions in the final model it was chosen to include the women's fertility parity as a binary variable. We did this based on the observations from model 2, where there seemed to be no differences in the abortion risk according to the number of children the women had had – only whether they had had children or not. The binary fertility parity therefore contributes to a simpler model, while not compromising the information given in it.

The final model shows that a woman's risk of having an abortion depends on both the women's fertility parity and abortion parity, even when adjusted for calendar year, age, family situation and urbanisation. More specifically, the model shows that the risk of having an abortion increases with the number of abortions the woman has had. Compared to women in the reference group, those with one, two or three abortions have risks that are 1.9, 2.7 and 3.5 times as high, respectively. In regard to the women's family situation, married women have the lowest risk of having an abortion, followed by cohabiting women and single women who have the highest risk. Concerning the urbanisation level of the women's residence, women living in the Distant periphery have the lowest risk, while women living in the Capital Area have the highest. Furthermore, the final model shows that there are interesting interactions between fertility parity and age and fertility parity and calendar year. Thus, the main effect of the women's fertility parity included is not to be interpreted individually, since it seems to be modified by at least the calendar year and age. The following figures show the OR values of the interactions in the final logistic regression model.

Figure 6a: The ORs of the interaction between fertility parity and calendar year plotted into a logarithmic scale



In Figure 6a two distinct different trends can be identified: declining abortion rates from 1986-2001 for nulliparous women and increasing abortion rates for women with one child or more in the same period. Note that the three upper curves in Figure 6a are parallel by design under the assumption of what was termed binary fertility parity above.

Figure 6b: The ORs of the interaction between fertility parity and age plotted into a logarithmic scale

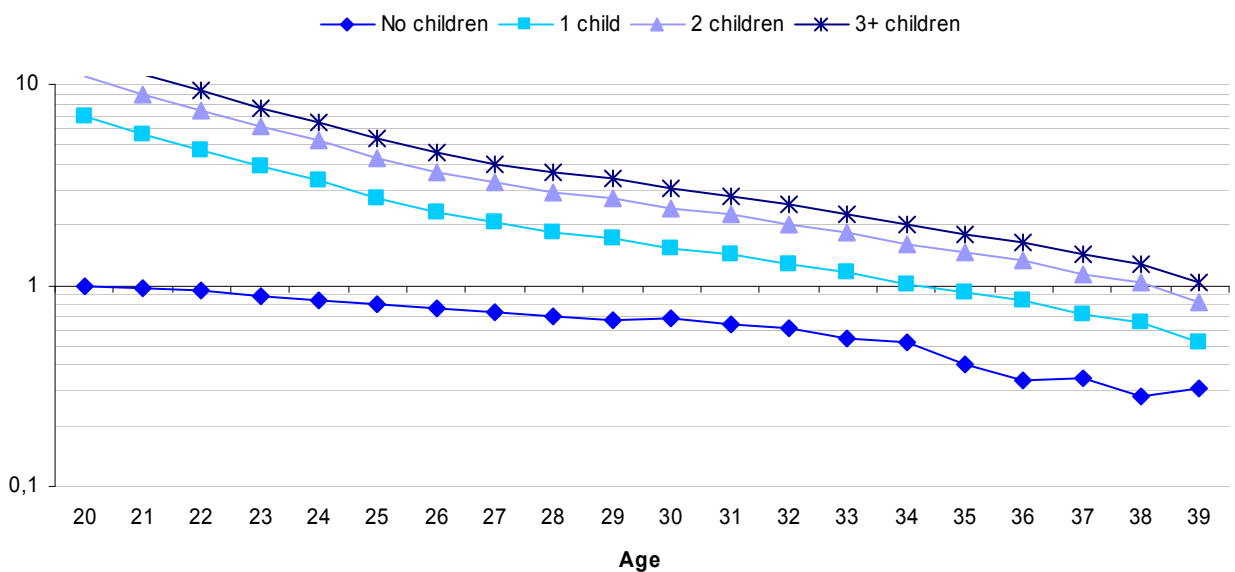


Figure 6b shows that the two different trends depending on whether the women have children or not still pertain. The risk of having an abortion is decreasing with age, but there is a weak tendency that it decreases relatively more for women with children compared to nulliparous women. In spite of these trends, it is still nulliparous women who have the lowest risk of having an abortion, regardless of age; that is, women with children never catch up with women with no children with regard to the low risk of having an abortion.

5.0 Discussion

5.1 Validity of data

The data used in this study stem from national public registers in Denmark, cf section 2.1. This means that the accuracy of the information does not rely on the women's memory or willingness to participate; hence there is no obvious recall bias or selection bias. On the other hand, the registers only comprise certain information regarding the women and relevant confounders; for instance, there is no available information on use of contraception or attitudes towards abortion, and no information on gestational age at abortion.

In 1994, the Danish National Board of Health conducted an analysis of the abortion information of the National Discharge Register, which showed that 96% of all legally induced abortions were included. Before 1995, statistics of abortions were based on reports submitted by the hospitals, and the analysis showed that these reports included 94% of all legally induced abortions¹⁰. Thus, the registers seem to include almost all legally induced abortions.

Induced abortions in Denmark are legal, cost-free, and until the 12th week of pregnancy require no statement of reasons for seeking an abortion from the woman. Therefore, the number of illegal, non-registered abortions in Denmark is probably minimal. Induced abortions of foetuses with severe diseases are primarily performed after the 12th week of pregnancy and require special permission; they account for only 1-1.6% of all legal abortions (National Board of Health 2004, 2007).

5.2 The abortion rates in 1996

Figure 2 in section 3.1 revealed an abrupt increase in the age-specific abortion rates in 1996, regardless of age. As mentioned previously, cf section 2.1, the reorganisation of abortion registration may have resulted in some kind of registration error since the abrupt high abortion intensity in 1996 can also be found in Figure 1 based on data from Statistics Denmark. Alternatively, a study from Norway suggests another explanation for the increasing abortion rates in 1996. The study shows that the abortion rates for women ≤ 24 years, which had been decreasing from 1992 through 1995, rose significantly by 36% during the first quarter of 1996. The increasing

¹⁰ 14th February 2008

<http://www.dst.dk/HomeUK/Guide/documentation/Varedeklarationer/emnegruppe/emne.aspx?sysrid=763>

abortion rates for women ≤ 24 years were mainly found among single, nulliparous students. The authors ascribe the increasing abortion rates to a contraceptive pill scare that swept over several western European countries from late October through December of 1995. This was sparked by intensive media coverage of the increased risk for adverse vascular events from the use of third-generation contraceptive pills (Skjeldestad 1996). It is possible that the contraceptive pill scare might have contributed to part of the high abortion intensity in 1996, however, in our analyses the increased abortion intensity is not more pronounced among women ≤ 24 years. Furthermore, the analyses show no evidence that the increase is more pronounced among single, nulliparous women or any other sub-group. Thus, even though the contraceptive pill scare might have contributed there might also be other contributing factors such as the reorganisation of the abortion registration.

5.3 Fertility parity

The descriptive findings show that the risk of having an abortion increases with the number of children a woman has given birth to. These findings correlate with the findings of another study by Jones (2002), examining abortion rates in the US.

The descriptive findings also show that the women's age modifies the effect of children on the risk of an abortion. The older the age group the lower the abortion rates, especially for women with children. Furthermore, the risk of having an abortion declines over time for women without children, whereas the risk increases for women with children, indicating different effects of the woman's fertility parity dependent on the calendar year. The final logistic regression model supports these findings, and interactions were identified between the *women's fertility parity and age*, and the *women's fertility parity and the calendar year*.

Age modifies the abortion rates with different effect depending on whether or not the woman has children. The risk of an abortion decreases with a factor 10 with age for women with children, whereas for nulliparous women the risk decreases with a factor 3. Thus, age has a much larger impact on the risk of an abortion for women with children than for nulliparous women. The fact that the risk of an abortion is decreasing with age (within the age span of our data) is well documented (see eg Statistics Denmark 2006). A Danish study that interviewed a number of women who had undergone an induced abortion, found that having children is closely correlated with a specific notion of when is the right time, and thus when is not the right time. The "right" age to have children is not so much biological as an indication of a social status, where maturity and personal

readiness are of great importance (Rasch, Knudsen & Wielandt 2005). However, these things often come with biological age. Thus, intuitively it makes sense that the abortion rates are decreasing with age throughout the 20s and early 30s. In the mid and late 30s the biological factor plays an important role in the abortion rates, since research shows that female fecundity is highly dependent on the women's age (Jensen et al. 2008; Lampic et al. 2006), and unintended pregnancies and subsequent abortions might therefore be less frequent. Yet, the question is why the risk of an abortion decreases relatively more for women with children than for nulliparous women? This might partly be explained by a high abortion risk for women with children compared to nulliparous women at the age of 20, which leaves room for reduction. The ORs from Figure 8b show that for women with children the OR decreases 61% from the age of 20 to the age of 25. However, for nulliparous women the decrease is only 34% in the same interval. The results could indicate that for nulliparous women in the early 20s, abortion is perhaps a far more negotiable solution to an unwanted pregnancy than it is for women who have already commenced childbearing. Women with children have already faced considerations on the "right" age to have children and they considered themselves ready and are therefore perhaps relatively less inclined, than nulliparous women in the same age group, to choose abortion as an option.

The final logistic regression model shows that for women with no children the risk of an abortion decreases from 1986 to 2001, while in the same period the risk of women with children increases, cf Figure 8a. This seems to indicate that previously Danish women may have used induced abortions to postpone childbearing, whereas today they increasingly use abortion as a means to control and time childbearing. However, previous findings have suggested that over the years Danish women have increasingly come to use abortion as a means to postpone rather than end childbearing, as the proportion of abortion-seeking women with no children has increased from the mid-1970s to 1990s (Knudsen & Wielandt 2000). Knudsen et al.'s results might be explained by the increasing average age at first birth, from 24.6 years in 1980 to 28.1 in 2000 (Statistics Denmark 2006), since the proportion of women with no children in the younger age groups is larger in the latter part of the period, meaning that the proportion of abortion-seeking women with no children grows.

However, the observed different time trend according to fertility parity could perhaps also be attributed a birth cohort effect. Experimentally, we therefore chose to include information on the women's birth cohort in our logistic regression model while excluding calendar year. Thus we fitted a model with all the main effects (excluding calendar year and including birth cohort) and two

interactions between the women's age and fertility parity and the women's birth cohort and fertility parity. The new model shows that to include information on the women's birth cohort instead of calendar year does not alter the estimates of the main effects or the two-way interaction between the women's age and fertility parity substantially. However, the fitted model showed an interesting interaction between the women's birth cohort and fertility parity - Figure 7 illustrates this.

Figure 7: The ORs of the interaction between fertility parity and birth cohort plotted into a logarithmic scale, selected birth cohorts

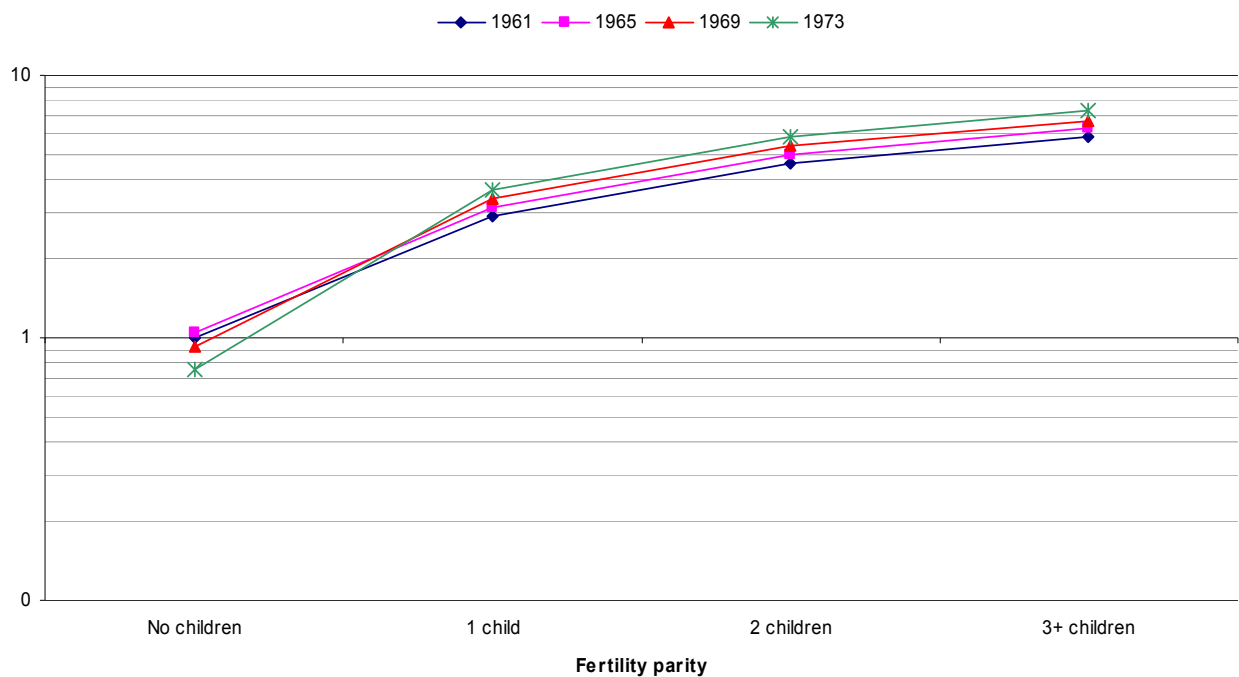


Figure 7 shows that for nulliparous women from the younger birth cohorts (the late 1960s to early 1970s) the odds of an abortion were low compared to nulliparous women from the older cohorts (early to mid 1960s). The risk of an abortion is higher for women with children compared to nulliparous women regardless of birth cohort. However, the risk increases relatively more for women from the younger birth cohorts. This could indicate that abortions, by the younger cohorts, are used as a mean to end childbearing once it has begun, while for the older cohorts of women abortions are used as a mean to postpone childbearing – the first birth. Thus, these results show that the birth cohort does influence the risk of an abortion however depending on the women's fertility parity.

The result of the new fitted logistic regression model is very interesting since it shows that women from different cohorts in Denmark use abortions differently. However, unfortunately, it is very difficult to disentangle whether the previously mentioned observed time trend actually is a cohort

trend or a calendar trend because a linear effect of age, period, and cohort cannot be identified uniquely (Holford 2005).

5.4 Abortion parity

The descriptive findings and the final model show that the abortion rates increase the more previous abortions a woman has had. This finding is consistent with the Canadian study by Millar (1997).

Tietze (1978) suggested different factors for why women who have had one previous abortion have a higher risk of having another compared to with women no previous abortions. Firstly, women who have had an abortion are sexually active and will probably remain so. Among women with no abortions a proportion of the women are not sexually active. Secondly, women with previous abortions are able to conceive and will therefore most likely conceive again (Tietze 1978). Among women with no abortions a small proportion are unable to conceive. A Danish study substantiates this, as it shows that women with a previous abortion have a higher probability of a first birth compared to women with no previous abortion when adjusted for a number of demographic covariates (Stage et al. 2009). Thirdly, women who have already chosen abortion as a means to end a pregnancy will probably be more likely than women with no abortions to resort to that choice (again). This can be caused by different religious, moral and ethical beliefs. Fourthly, a small percentage of women might use abortion as birth control (Tietze 1978). Tietze solely compared women with no previous abortions to women with previous abortions and offered explanations regarding these two groups; however, the findings of the present paper demonstrate that the more previous abortions the higher the risk of a further abortion. So the increased risk of another abortion might not only be a matter of whether the women are able to conceive and whether they are sexually active, but also a matter of how fertile and how sexually active the women are.

The descriptive findings show that the risk of having an abortion for women with previous abortions decreases over the period, while the risk of having an abortion for women with no previous abortions increases. Thus, the calendar year seems to modify the effect of a woman's abortion parity on the woman's risk of an abortion. However, the final model did not support the notion of an interaction between women's abortion parity and the calendar year.

5.5 Urbanisation

The logistic regression analysis shows that women living outside the Capital area have a 30-40% reduced risk of having an abortion compared to women living in the Capital Area.

Tonboe's division of Denmark into four regions is based on analyses from the Danish section of the European Value Studies. The four regions differ within four dimensions; economic-material conditions (e.g. work, income), political-institutional conditions (e.g. activity, orientation), social conditions (e.g. social relations, children, families) and cultural conditions (e.g. moral, religion). A sub-dimension of social conditions is attitudes towards abortion, both within and outside marriage. Tonboe shows that induced abortion is least accepted in the Close and Distant periphery and most accepted in the Capital area. The differences in attitude towards abortion may explain some of the regional variation in abortion behaviour; that is, abortion risk.

5.6 Family situation

The logistic regression analysis shows that even after adjusting for the women's fertility parity and other characteristics, single women still have a higher risk of an abortion compared to married and cohabiting women. Married women have a 61% lower risk of an abortion and cohabiting women a 42% lower risk both compared to single women. As pointed out by a Danish study, single women will probably more often be in a situation where they do not feel financially and socially prepared for parenthood (Rasch, Wielandt & Knudsen 2002). However, in contrast, many single women may not be in risk of unintended pregnancies and abortions, simply because they are not sexually active.

6.0 Conclusion

We find that a woman's risk of having an induced abortion increases notably with the number of previous births and previous abortions. There are interactions in the way that a woman's risk of abortion varies with calendar year, age and parity. Furthermore, the risk of an abortion for women with no children declines, whereas the risk of an abortion for women with children increases over time. Moreover, the risk of an abortion decreases with age, but relatively more so for women with children compared to women with no children.

References

- Andersen T.F, Madsen M, Jørgensen J, Mellekjær L, Olsen J.H. (1999). "The Danish National Hospital Register. A valuable source of data for modern health sciences" *Dan Med Bull*, 46:263-8.
- Barrett G, Peacock J, Victor C.R. (1998). "Are women who have abortions different from those who have not?" *Public Health*, 112: 157-163
- Bettarini S.S, D'Andrea S.S. (1996). "Induced abortion in Italy: Levels, Trends and Characteristics" *Family Planning Perspectives*, 28:267-271&277
- Dean, C. (2005). Overdispersion. Enc. Biostatistics, Second Edition, p 3913-3919
- Gerster M.H, Keiding N, Knudsen L.B, Strandberg-Larsen K. (2007). "Education and second birth rates in Denmark 1981-1994" *Demographic Research*, 17, 8: 181-210
- Henshaw S.K. (1990). "Induced Abortion: A World Review, 1990" *Family Planning Perspectives*, 22, 2:76-89
- Hoem J, Neyer G, Andersson G. (2006). "Education and Childlessness. The relationship between educational field, educational level and childlessness among Swedish women born in 1955-1959" *Demographic Research*, 14, 15:331-380.
- Holford T.R. (2005). "Age-Period-Cohort Analysis" *Encycl. Biostatistics* (2.ed.), 105-123
- Jensen, T.K., Sobotka, T., Hansen, M.A., Pedersen, A.T., Lutz, W., & Skakkebæk, N.E. (2008). "Declining trends in conception rates in recent birth cohorts of native Danish women: a possible role of deteriorating male reproductive health" *International Journal of Andrology*, 31(2), pp. 81-92.
- Jones R.K, Darroch J.K, Henshaw J.K. (2002). "Patterns in the Socioeconomic Characteristics of Women Obtaining Abortions in 2000-2001" *Perspectives on Sexual and Reproductive Health*, 34, 5:226-235
- Kohler H-P, Knudsen LB, Skytthe A, Christensen K. (2002). "The Fertility Pattern of Twins and the General Population Compared: Evidence from Danish Cohorts 1945-64" *Demographic Research*, 6, 14: 384-408
- Knudsen L.B. (1998). "Abortudviklingen siden 1973" In: Petersson B., Knudsen L.B., Larsen K.H., editors. Abort i 25 år. Lindhardt & Ringhof.
- Knudsen L.B. (1993). "Fertility trends in Denmark in the 1980s" Statistics Denmark
- Knudsen L.B, Murphy M.J. (1999). "Registers as data source in studies of reproductive behaviour" Demographic Research Center. Odense: Research Report 12

- Knudsen L.B, Valle A.K. (2006). "Teenage Reproductive Behaviour in Denmark and Norway: Lessons from the Nordic Welfare State" In: Daguerre A., Nativel C., editors. *When Children Become Parents. Welfare state responses to teenage pregnancy.* Bristol, Policy Press. page 161-181
- Knudsen L.B, Wielandt H. (2000). "Legally Induced Abortion – Experiences from Denmark" Danish Demographic Research Center. Odense: Research Report 18.
- Kravdal Ø. (2007). "Effects of current education on second- and third-birth rates among Norwegian women and men born in 1964: Substantive interpretations and methodological issues" *Demographic Research*, 17, 9: 211-246
- Lampic, C., Svanberg, A.S., Karlström, P., & Tydén, T. (2006). "Fertility awareness, intentions concerning childbearing, and attitudes towards parenthood among female and male academics" *Human Reproduction*, 21(2), pp. 558-564.
- Lappegård T., Rønsen M. (2005). "The multifaceted impact of education on entry into motherhood" *European Journal of Population*, 21: 31-49
- Millar W.J, Wadhera S., Henshaw S.K. (1997). "Repeat abortions in Canada, 1975-1993" *Family Planning Perspectives*, 29:20-24
- National Board of Health (Denmark). (Various years). "Statistics on Contraceptives and Induced abortion" Copenhagen
- National Board of Health (Denmark). (2007). "Legalt Provokerede Aborter 2006 (foreløbig opgørelse)". Copenhagen
- National Board of Health (Denmark). (2004). "Legalt Provokerede Aborter 2003 (foreløbig opgørelse)". Copenhagen
- Rasch V, Knudsen L.B, Gammeltoft T. (2005). "Når der ikke er noget tredje valg" Danish National Board of Health
- Rasch V, Wielandt H, Knudsen L.B. (2002). "Living conditions, contraceptive use and the choice of induced abortion among pregnant women in Denmark" *Scand. Journal of Public Health*, 30:293-299
- Russo N.F, Horn J.D, Schwartz R. (1992) "U.S abortion in context: Selected Characteristics and Motivations of Women Seeking Abortions" *Journal of Social Issues*, 48:183-202
- Sedgd G, Henshaw S, Singh S, Åhman E, Shah I. (2007). "Induced abortion: estimated rates and trends worldwide" *Lancet*, 370:1338-45
- Skjeldestad F.E. (1994). "The incidence of repeat induced abortion – a prospective cohort study" *Acta Obstet Gynecol Scand*, 73, 9:706-10

- Skjeldestad F.E. (1996). "Increased Number of Induced Abortions in Norway After Media Coverage of Adverse Vascular Events from the Use of Thrid-Generation Oral Contraceptives" *Contraception*, 55:11-14
- Skjeldestad F.E, Borgan JK, Dalveit, A.K, Nymoer E.H. (1994) "Induced abortion – Effects of marital status, age and parity on choice of pregnancy termination" *Acta Obstet Gynecol Scand*, 73, 3:255-260
- Stage L, Hansen M-L, Knudsen L.B, Keiding N. (2009) "Induced abortions and first births among Danish women in the 1980s and 1990s" *Submitted*
- Statistics Denmark. (2007). "Statistical Yearbook 2007" Copenhagen
- Statistics Denmark. (2006). "Vital Statistics 2006" Copenhagen
- Statistics Denmark. (1995). "Vital Statistics 2006" Copenhagen
- Tietze C. (1978). "Repeat Abortions – Why More?" *Family Planning Perspectives*, 10:286-288
- Tonboe J. (2001). "Moralens Geografi" Sociologisk Arbejdsrapport, nr.11, 2001. Sociologisk Laboratorium, Aalborg Universitet
- Westfall J.M, Kallail K.J. (1995). "Repeat Abortion and Use of Primary Care Health Services" *Family Planning Perspectives*, 27:162-165
- 14th February 2008
<http://www.dst.dk/HomeUK/Guide/documentation/Varedeklarationer/emnegruppe/emne.aspx?sysrid=763>