Teenage motherhood and induced abortion among teenagers
A longitudinal study of all 15 to 19 year old women born in 1966

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Abstract

Objective: The purpose of this study is to investigate the social background of teenagers before being teenage mothers or having an induced abortion.
Among the 41,362 women born in 1966, 2,369 women had an induced abortion for the first time before their 20th birthday. Half as many (1,190) had chosen to be a teenage mother.

Method: Population-based registers covering children born in Denmark in 1966 at the age span 15 - 19 years, and their parents: health, education, family dissolution, suicidal behaviour, substance abuse, criminality, and unemployment. A discrete-time proportional hazard modelling was used to analyse the longitudinal observations.

Results
a) About 3 per cent of the women born in 1966 had their first child while they were teenagers. The high-risk groups had a higher probability of teenage motherhood than others. The childhood of teenage mothers had several indicators of severe disadvantage. First-time teenage mothers were associated with parental substance abuse, experiencing abuse and neglect, and being in care during their childhood. Increased risk of becoming a teenage mother was also found among teenagers who had experienced parental separation and among daughters of mothers who themselves were teenage mothers. Teenagers who suffered from psychiatric disorder had a higher probability of being teenage mothers than their contemporaries. Long-term parental unemployment and lack of vocational training was seen more frequently in these families. Teenagers who have had an induced abortion had an increased risk of becoming a teenage mother, subsequently.

b) About 6 per cent of the women born in 1966 have had an induced abortion before their 20th birthday. Teenagers coming from high-risk groups had an increased risk of having an induced abortion. First-time induced abortions were associated with parental substance abuse, child abuse and neglect, and being in care during childhood. Increased risks were also found among teenagers who suffered from psychiatric disorder. Daughters of teenagers and teenagers who had experienced parental separation had an increased risk of having an induced abortion. Teenage mothers had an increased risk of having an induced abortion before their 20th birthday.
    The study shows a significant social gradient for teenage pregnancies. The teenage mothers were in a more disadvantaged position than pregnant teenagers who chose abortion.

Conclusion: pregnant high-risk teenagers who choose to be a parent need qualified support in order to avoid aggravated social disadvantages among these young parents and their children.

Key Words: Longitudinal study, teenage pregnancy, adolescence disadvantage, education, substance abuse, domestic violence, induced abortion.

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Introduction

Denmark has one of the lowest rates of teenage births in Western Europe together with Switzerland, Netherlands, Italy, Sweden and Spain. The UK has the highest rate of teenage births in Western Europe and is exceeded only by Canada, New Zealand and the United States. United States has a rate of teenage births that exceeded about ten times the rate of Denmark (FPSC, 1999; Social Exclusion Unit, 1999).

Attention of the U.S. policy community and the media has been focussed on the relative high teen fertility rate and the increase in out-of-wedlock births among teen mothers who followed the normal trend of cohabiting (Elo et al., 1999). The United States has the highest teenage pregnancy rate of all developed countries, about 95% of those pregnancies are unintended, and almost one third end in abortions (CDC, 1999). Experts and researchers have surveyed the declines of teen pregnancy but are uncertain why the rates had gone down, and how these trends can be sustained (Donovan, 1998; Selman, 1996).

Figure 1. Number of births per 1000 15-19 years old women. U.S. teenagers 1917-1998 and Danish teenager 1903-2001.

Figur 1. Age specific fertility rate for women under 20 years USA, UK and Denmark.
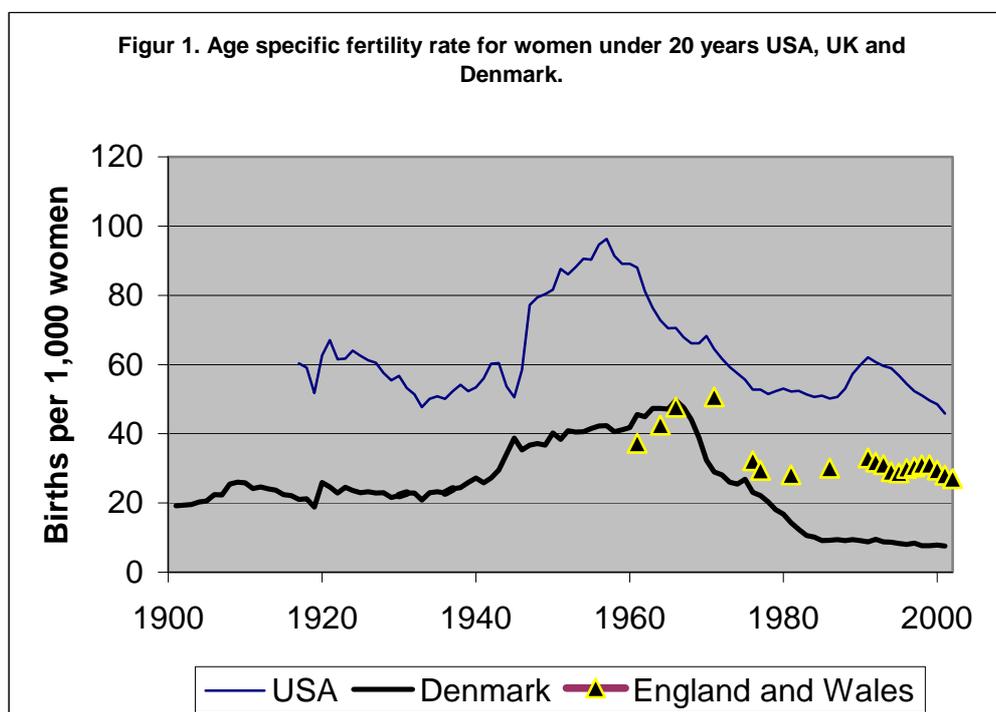
Note: From 1940 through 1960 birth rates for teenagers (births per 1,000 women 15-19) increased from about 50 to about 90 (U.S: Bureau of the Census, 1980). From 1960 through 1987 this rate decreased to about 50. An increase to 62 was recorded until 1991 then birth rates again declined during 1991-98 to 51 per 1000 15 to 19 years old adolescents.Sources: National Center for Health Statistics (1976; 1980), AmeriStat staff (2003).

The UK's and United States' trends form a contrast to Danish experiences. Teenage childbearing in Denmark has decreased continuously since mid 60th. In 1998 there have been only seven births per 1000 women in the age group 15 to 19. These differences give rise to curiosity.

One explanation may be unrestricted access to contraceptives (the Pill since mid 60th), effective information, and abortion on demand since 1973. Another explanation may be the great expansion of education, vocational training, especially for women during the last twenty or thirty years. Education is free of charge and universally supported by the State Education Fund. The general trend in society is that the educational requirements are forced up.

But why did some women choose to be a teenage-mother even when the access to effective contraceptives and induced abortions were facilitated?

Resent Danish studies have caused attention on family disadvantages as an explanation of teen pregnancies. Research findings showed that about 9 per cent of women who had been in residential care during childhood became a teenage mother, while this was the case for about 1 percent among their contemporaries (Christoffersen, 1993).

Further more, it has caused surprise that one of every third child in care has a mother, who started childbearing as a teenager (Hestbæk, 1997). A Danish study based on an interview with 25-year-old teenage-mothers showed that which differentiates them from their contemporaries was a loss of self-esteem (Christoffersen, 1994). This and other studies (Social Exclusion Unit, 1999; Raley, 1999) open the way for further investigations in the family background and disadvantages during childhood and adolescence for teenage mothers.

The present longitudinal study illuminates why some Danish teenager choose teen childbearing. What was their social and psychosocial situation the years before their pregnancy? Were women who choose induced abortion in a more disadvantaged position than the women who choose to be a teenage mother? The aim of the present study is to explore childhood stressors in order to explain why some adolescents choose teen childbearing although the odds are against such a decision.

Teenage mothers have bad odds

Teenage childbearing may have serious health consequences compared with older mothers according to statistics for preterm birth, low birth weight, complications, long-term illness, developmental delays, and elevated risk of dying in first year of life (Botting et al., 1998). Correspondingly smoking during pregnancy is more frequent than among others. It is reported that the vast majority of teenage pregnancies are unintended among U.S. and British teenage mothers and therefore in a disadvantaged position (NVSS, 1998; McAnarney & Thiede, 1983; Wellings et al., 1997; Social Exclusion Unit, 1999; Clarke et al., unpublished).

Some researchers suggest that the young mothers may not have been fully developed in spite of the fact that they have had their menarche. Other researchers lean to the opinion that social and economic stressors are to blame e.g. bad nutrition during pregnancy, poor sanitary conditions, smoking habits, lack of education, and insuffi-

cient support during pregnancy and care and no health courses in the antenatal period. Lack of information about hazardous factors and poor ability to read the child's signals may be associated with immature mothers (McAnarney & Thiede, 1983).

The same picture is found in recent Danish studies. Among (45 %) half of the teenage mothers gave birth to a child after an unintended pregnancy while this was the case for only 12 % among older mothers. Smoking during pregnancy was also seen more frequently among Danish teenage mothers. Breast-feeding was significantly shorter among teenage mothers even when smoking and other social and economic constrains were taken into account (Christoffersen, 1998).

Early motherhood, for the most part, is associated with short schooling, no vocational training, not living in a stable relationship, dependency of social benefits, low income, and low-prestige jobs. Low academic achievement, lack of educational goals is associated with early sexual experience both among black and whites (Hayes, 1987; Williams et al., 1987). Accordingly, Chilman (1980) finds, reviewing research findings concerning the causes of adolescent childbearing in the decade 1970-80, that powerlessness alienation, a sense of personal incompetence and hopelessness in respect to striving for high educational and occupational goals characterize the situation of teenage mothers. This is especially true when racism combines with poverty to reduce one's life chances. Teenager who elected abortion were likely to have been doing well in school before pregnancy (Wellings et al., 1997; 1999).

Women who have children at an early age have few chances to pass education or vocational training at a later time. Danish studies show that the younger the mother the less chance of completing an education (Knudsen, 1993). While U.S. long-term studies show that teen mothers gain some ground but in the long-term they are still worse off than their contemporaries (Hayes, 1987; Chilman, 1980). To little surprise, early childbearing is associated with low income, dependency on state benefits, poverty, and single motherhood according to British studies in two decades (Williams et al., 1987).

Accordingly, Miller concludes in his review (1987) that there is little doubt that teen childbearing is usually associated with heavy psychological, social, and economic costs. Women who have the first child at an early age often have many children, and an extra elevated risk for family dissolution - whether the parents have been married or not. But then again Catherine Chilman (1980 a) reviewing research findings conclude, that the direct social and psychological effects of early childbearing, *per se*, appeared to be fairly minimal in many aspects of their later lives, when free or low-cost high quality medical care is made readily available. Negative health consequences seem to be caused by poverty not getting adequate obstetrical care, rather than by their age.

Children of teenage mothers are in a disadvantaged position
Former studies of children of teen mothers show an increased risk for that the children will have a short schooling and they will have social problems school problems, substance abuse, and early childbearing, themselves (Card, 1981). Low income is

equivalent to housing area loaded with social problems. The teen mothers describe these conditions as disadvantaged for their children (Hayes, 1987).

Chilman's review of research findings (1980) in the 70th summarize significant higher ratings in behaviour problems, lower cognitive scores, and educational achievement for children (in particular sons) of adolescent mothers (Furstenberg et al., 1989). Daughters tend to repeat the parental pattern of early childbearing. This tendency remained even after effects of racism, and poverty was statistically controlled for.

A Danish study of a national random sample of children taken into care (in the year 1994) shoved that one third of these children had a mother who were originally a teenage mother (Hestbæk, 1997). Accordingly, it was found that children's risk of being in care is redoubled, if the mother started having children as a teenager compared to children with older mothers. Children of teenage mothers generally have a shorter school education, and an increased risk of being unemployed when they were 27 years old (Christoffersen, 1996; 1999). Boys of teenage mothers had an increased risk of being convicted of a violent crime before they were 27-years old, compared to their contemporaries, even when several other constrains were taken into account (e.g. violence in the family, alcohol abuse, parental lack of vocational training). The risk of being a drug addict, having attempted suicide, being a teenage mother, or being admitted to a hospital because of mental illness was more often seen among adolescents and young people of teenage mothers than among their contemporaries (Christoffersen, 2003).

Some researchers have looked at early sexual behaviour and the decision making process in order to explain teenage pregnancies. In this connection, it was found that the career orientation has been relevant to contraceptive use in an English sample among well-educated wives. Since the wife, often taking the initiative to contraceptive use it is suggested that the success of family planning depend on their ability to rationally plan, control, and achieve their goals (Miller, 1987). Unfortunately, this explanation is close to bee tautological. To have a child as a teenager, living with your mother, without education, low income or dependent on social benefits is rarely seen as a rational choice. Brent C. Miller (1987) conclude that motivation for childbearing are sometimes illogical and irrational, and these emotions underlie reproductive behaviour are often powerful determinants of actual fertility.

Research suggests that influence of peer groups and neighbourhoods' tolerance for sexual activity, and teen childbearing may be an important determinant of adolescent decision making, but on the other hand it is difficult to understand the role of neighbourhoods attitudes because most studies have been unable to sufficiently control for them (Hayes, 1987). Differences in childbearing between schools may in many ways reflect the socio-economic status and disadvantages between groups.

Theory and hypothesis:
Teenage motherhood as a consequence of loss of self-esteem?
An interview study of 25-year old adolescents formerly in care revealed that 9 % of these women had become a teenage mother while this was the case for about 1% of

their contemporaries. Accordingly, the Danish study also found that 4 % of women of long-term unemployed parents were early childbearing (Christoffersen, 1993). A British study finds accordingly that women formerly in care during childhood have an extra high probability of being a teenage mother (Quinton & Rutter, 1985). Men formerly in care did not turn out to be teenage fathers.

Analyses shoved that only few information differentiates the teen mothers form their contemporaries. The teenage mothers have often a low self-esteem e.g. a feeling of emptiness, they have often a feeling of being rejected by others, and they often lack self-confidence. These indicators of lack of self-esteem seem to by the most characteristic difference between the teenage mothers formerly in care and other adolescents formerly in care (Christoffersen, 1993). The logistic regression model revealed that the factors, which statistical explained the loss of self-esteem, were partly due to experiences during childhood and partly to their present situation. Parental unemployment, violence in the home, being bullied in school seems to drain the self-esteem. Their present situation being unemployed and no vocational training have a statistical effect on their self-esteem as well as lacking support from a spouse. Even most of the teenage mothers' background were characterized by unemployment, short education, no vocational training and family dissolution, those adolescents who actually took the General Certificate, or went through with a vocational training manifested more self-esteem than their contemporaries (Christoffersen, 1994).

These and similar results indicate that some of the teenage mothers may have a feeling of loss or lack of self-esteem according to serious stressors during childhood. The theoretical assumptions of the present study are that the adolescents did try to fill up the emptiness by having a baby in an early stage of life. The aim of the present study is to explore childhood stressors, which can explain why some adolescents choose teen childbearing although the odds are against such a decision.

To some extent, it seems as if teenage mothers experience an improvement in psycho-social temper unlike the other mothers when interviewed about 6 months after the birth, according to a Danish study of mothers who have given birth to a child in 1995. The sample of teenage mothers reported a better mood and a feeling of mastering daily problems after having a child. Likewise, their interests in social gathering and their ability to keep one's temper had been improved according to their own judgement. Compared with the situation before given birth to a child, these subjective improvements were significantly more frequent among the teenage mothers than among the other mothers (Christoffersen, 1998).

Furstenberg (1991) had found similar results studying to generation of teenage mothers: they had not intended to be pregnant but many were now glad to be parent. According to Furstenberg (1991) there is little evidence that teenage childbearing can be seen as an adaptive strategy for disadvantaged families. Younger women cannot expect more favourable birth outcome. The rates of mortality over the first year of life are higher among the offspring of teen mothers. Interview with teenage mothers revealed that they do not think that it improves the prospect of the offspring and the vast majority of disadvantaged black teenagers believes that it is better for teenagers to wait until their 20s to begin childbearing. Most young mothers reported that their

mother looked back with some regret about the timing of her first birth (Furstenberg, 1991).

These and other studies support a need for further studies in the actual psycho-social context of teenage mothers in order to understand their specific situation and what they see as realistic goals (Raley, 1999).

In the present study, the family background of all women born in 1966 including all women who become teenage-mothers are studied on the basis of longitudinal data. The descriptions of the family background are compared to family situation of pregnant teenagers who choose an induced abortion. The birth cohort of women born in 1966 is followed until their 20th birthday. Risk factors, which are collected prospectively on the basis of linked registers, include parental health, early motherhood, education, family cohesion or separation, domestic violence, parental self-destructive behaviour (attempted suicide, parental alcohol/drug abuse), and parental unemployment and vocational training. Further more, women's abuse/neglect, being in care, admissions to hospitals because of psychiatric disorder during their adolescence and formative years were included.

Data

The objective of the present survey is to investigate the likely causes of teenage fertility and the attempts to illuminate why some pregnant teenagers choose an induced abortion and why some teenagers choose the teenage motherhood. There are almost always problems of methodology associated with investigations of social effects, but in this survey, attempts have been made to solve these problems by following the 1966-generation and their parents while the children were in the age group 15 to 19 years old. Analyses have been carried out using the total national birth cohorts including 41,362 women, and their parents. The number of teenage mothers were N=1,190 and the number of first time induced abortions were N=2,369 among teenagers born in the year 1966.

By using unemployment statistics from 1980-93, it was possible to follow the extent of the parents' unemployment (number of days) for individual years. Statistics have also been collected for the same period, which year by year cover a number of health aspects (e.g. admittance of children and parents to hospital, deaths), family aspects (e.g. family break-up, teenage motherhood, and victim of violence, placement of children outside the home), self-destructive behaviour (e.g. criminal convictions, suicide attempts) and other social circumstances.

The children's personal identity number is the key, which links the children to their parents whether they are living together, married, or not. Information from 12 register has been collected for each calendar year, and information is combined to a record for each child (table 1).

Table 1: Information selected from the population-based registers used in the Danish cohort study.

Population statistics	gender, age, marital status, address	1980-91
Medical register on vital statistics	cause of death, suicide	1979-93
Unemployment statistics	branch of trade, unemployment	1976-79
Education statistics	grades	1980-93
Educational classification module	schooling, vocational training	1993
Social assistance act statistics	children in care	1976-93
Integrated Database for Labour Market Research	Occupation, unemployment	1980-92
Crime statistics	violation, adjudication, imprisonment	1980-93
Income compensation benefits	social benefit, duration	1984-93
Fertility research	no. of siblings, parity, link to parents	1980-91
National inpatient register	ICD-8 diagnoses (somatic)	1979-93
National psychiatric register	ICD-8 diagnoses (psychiatric)	1979-93

By following the extent of the parents' unemployment and other risk factors prior to these social circumstances, this method offers better opportunities than other survey methods (e.g. traditional cross section surveys or analyses of aggregated data) to judge the consequences of disadvantage in adolescence. Information about the living conditions, family problems, and health problems has been prospectively collected for all persons in the actual birth-cohort. This method avoids the recall-bias because all information has been collected systematically for each calendar-year with-out being confounded by events that occur the following years.

Former studies have had difficulties to obtain an adequate sample of teenage respondents, largely because parental permission is obligatory (Chilman, 1980). The register-based total birth cohort is not corrupted by this bias, on the other hand some urgently necessary information may be obtained in an personal interview and not included in any register.

Further more, longitudinal studies following adolescents and their children for decades to study the long-term consequences for children of adolescent parents will always meet objections that data are history bound and the findings may have little relevance for those teenagers reaching adolescence today.

Risk factors (the independent variables)
According to former studies an extended list of potential risk factors were included in the analysis covering several health aspects, family aspects, education etc.

Factors associated with the parents/family circumstances:
Alcohol abuse: According to hospital admissions the following diagnoses were expected to be associated with long-term alcohol abuse: Alcoholic psychosis, alcoholism, oesophageal varices, cirrhosis of liver (alcoholic), chromic pancreatitis (alcoholic), delirium, accidental poisoning by alcohol.
Attempted suicide: The definition of suicide attempts included only behaviour that conformed to the following three conditions: (i) Suicide attempts that had led to hos-

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pitalisation, (ii) assessment of the trauma being an act of self-mutilation according to the international statistical classification of injuries when discharged from hospital, (iii) the trauma had to be included in a specified list of traumas traditionally connected with suicide attempts: cutting in wrist (carpus), firearm wounds, hanging, self-poisoning with drugs, pesticide, cleaning fluids, alcohol or carbon monoxide. ICD 8-Diagnoses in the National Patient Register and the Danish Psychiatric Nationwide Case Register were in use in Denmark throughout the observation period.

Battered adults: Victims of violence, which led to hospitalisation and professional assessment of the injury being wilfully inflicted by other persons (E960-E969), according to the Danish modification of the ICD-8 classification[1].

Conviction for violence: The Criminal Statistic Register includes persons convicted for violence. This category comprises a wide range of criminal behaviour of various degrees of seriousness: manslaughter, grievous bodily harm, violence, coercion and threats. This category does not include accidental manslaughter in combination with traffic accidents, or rape, which belongs to the category of sexual offences.

Domestic violence: battered adults according to hospitals admissions or parents convicted of a violent crime.

Drug abuse: addiction or poisoning by drugs according to hospitals admissions (ICD-8: 304). Dependence on morphine was not included if chronic pain-giving diseases were observed, too. E.g. rheumatoid arthritis and allied conditions (712), displacement of intervertebral disc (725), vertebrogenic pain syndrome (728), or cancer (140-239).

Family separation: Family dissolution includes information on all children who had experienced divorce, separation and the death of a parent before they were 18-years-old. The Danish Central Population Register (CPR) includes information that connects all children to their parents whether they are married or not.

Parental mental illness: Psychiatric disorder according to hospital admissions (e.g. psychoses ICD-8: 290-299, neurotic: 300, 305 or personality disorder: 301-302). Only few of the fathers' neurotic disorders were disclosed in the Danish Psychiatric Nationwide Case Register. Some of the fathers were registered instead in the National Patient Register with symptoms in the cardiovascular system (e.g. ICD-8: 782.09-29 chest pain, irregular heart beat or 782.50-59 loss of consciousness)[2].

Parental suicidal behaviour: parents' suicide attempts according to the National Patient Register and the Danish Psychiatric Nationwide Case Register or suicide according to the Causes of Death Register.

Substance abuse: Alcohol abuse and/or drug abuse.

Teenage-mother: The age difference between the mother and the child in focus being less than 20 years.

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[1] The ICD-8 (International Classification of Diseases) was in use for the years 1971-1993.

[2] The reason for including such symptoms as mental disorders, in the absence of any serious cardiovascular disorder, was, that they could be interpreted as part of a neurotic disorder characterized by anxiety and somatisation. Traditionally, doctors in Danish somatic hospitals would often not give a patient a psychiatric diagnosis, but leave this to a psychiatrist.

Vocational training: Education statistics or the educational classification module is population based, including schooling and educational training for the highest education.

Unemployment: The number of days unemployed during a calendar year according to registers of Income Compensation Benefits, Labour Market Research, and Unemployment Statistics.

Factors associated with the adolescent or young adults:

Abortion: Adolescents and young adults (15 to 19 years old) having an induced abortion. This procedure was legal throughout the observation period.

Battered/neglected children: adolescents being victims of violence, abuse or neglect, which led to hospitalisation and professional assessment of the injury being wilfully inflicted by other persons (E960-E969, 796.00, 796.01, 796.02 according to the Danish modification of the ICD-8 classification).

Psychiatric disorder: mental illness according to hospital admissions in the Danish Psychiatric Nationwide Case Register.

Residential care (or foster care): according to the population based register of social assistance to children in care.

Statistical methods

The statistical method is developed by Allison (1982) combined with the logistic regression analysis improved by Hosmer & Lemeshow (1989), and Breslow & Day (1980, 1987). Breslow (1992) describes the used discrete-time proportional hazard modelling.

The purpose of the present analysis is to locate relevant risk-factors and describe both the strength (Odds Ratio) of different risk factors and the over all exposure of risk factors (P) among children and adolescents. In order to evaluate the risk-factors contribution to the number of abused children and adolescents, attributable fractions (A.F.) are calculated for each risk-factor in the final model according to Greenland (1998). The attributable fraction (A.F.) is seen as the reduction in incidence that would be achieved if the population had been entirely unexposed, compared with the current exposure pattern.

It is generally accepted that the longitudinal study of a nation wide birth cohort is well-qualified method to analyse relatively rare response reactions. But the method can also handle relatively rare stress factors (e.g. parental mental illness, domestic violence, substance abuse, being in care). The relevance of a potential risk factor is decided upon the size of incidence in the case-group (Breslow & Day, 1980; 1987).

The present study includes all the Danish women born in 1966 who have been a teenage mother, when they were about 15 to 19 years old. In the literature it has been recommended to use general population samples as control-group, because it gives a good standard of reference and the possibility of generalizing the results (Breslow & Day, 1980). The controls (years at risk) were constructed by the total birth cohorts

(41,362 women). Children in case group and controls were excluded after the first delivery (or induced abortion) or if they had died, or emigrated.

Results

When all the risk factors are introduced to stepwise regression model, some of the risk factors revealed lack of robustness to give some extra information that may explain the occurrence of teenage pregnancy. Results of the final models are presented in table 2 and 3.

Results show, that parental substance abuse and sentences according to the Danish Criminal Code elevate the risk for teenage pregnancies, as do mother's own teenage childbearing, family separation, parental unemployment and their lack of vocational training. Furthermore, a teenager who had been battered, neglected, or a victim of abuse during adolescence, or a teenager who had been in care during childhood has an increased risk of teenage pregnancy compared to their contemporaries who postpone childbearing. In addition, teenager who has been admitted to a hospital for psychiatric reasons had an elevated risk of teenage pregnancy, subsequently.

About 2.9 percent of the women born in 1966 have had their first child while they were teenagers. The number of cases (N=1,190) allows to include a number of risk factors which are significant associated with teenage child bearing - the other risk factors taken into account. The results showed that high-risk groups had higher probability of teenage motherhood than others.

Parental personality disorder, neurotic disorder (neurotic anxiety, depression, unspecified neuroses) or other kind of psychiatric disorder elevate the risk for adolescents being a teenage mother, as so parental alcohol abuse and parental drug abuse according to hospitals admissions. Accordingly parental self-destructive behaviour such as parental suicide or parental suicide attempts increases the risk of teenage childbearing. Domestic violence or violence towards an adolescent are more often seen in the years before teenage childbearing than among their contemporaries. Furthermore diminishing social network (e.g. family separation, or mothers own teenage childbearing) precedes adolescents teenage motherhood significantly often compared to their contemporaries who postpone childbearing. Finally, parental lack of vocational training or long-term unemployment was associated with their children's teenage motherhood.

The childhood of teenage mothers had several indicators of severe disadvantage during their childhood (table 3). These girls had more often than their contemporaries experienced neglect/abuse and being in foster care or residential care during childhood. Girls who suffered from mental illness evinced a higher risk of teenage motherhood than their contemporaries.

When all these risk factors were introduced to stepwise regression model, some of the risk factors were not robust or incidence too scares to give extra information that may explain the occurrence of teenage motherhood. The remaining robust risk factors are shown in table 2.

Table 2 Risk factors for being a *teenage mother*. Adjusted odds ratio on the basis of the final stepwise logistic regression model. Children born in 1966, followed 1981 - 1985. Denmark.

Risk factors included In the final model:	Type	No. of cases	% of cases	P % of contr.	OR		C.I. 95% level
Factors associated with the parents/family circumstances:							
Parental substance abuse	III	123	10.3	4.3	1.3	*	1.1-1.6
Family separation	II	359	30.2	18.3	1.4	***	1.2-1.6
Mother teenager	II	182	15.3	8.8	1.5	***	1.3-1.8
Mother unemployed > 21 weeks	I	255	21.4	7.1	1.9	***	1.6-2.2
Father unemployed > 21 weeks	I	178	15.0	5.6	1.6	***	1.4-1.9
Mother no vocational training	III	721	60.6	51.6	1.2		1.1-1.4
Father no vocational training	III	662	55.6	49.0	1.2	*	1.0-1.3
Factors associated with the teen-ager:							
Adolescent in foster/residential care	II	246	20.7	2.9	4.1	***	3.5-4.8
Teenager had been bat-tered/neglected	III	34	2.9	0.4	3.8	***	2.6-5.9
Teenager had had an induced abor-tion	I	58	4.9	0.8	2.5	***	1.9-3.3
Psychiatric disorder	II	11	0.1	0.1	4.3	***	2.2-8.3

Note: All risk factors are significant at 0.05-level. * 0.01-level; ** 0.001-level; *** 0.0001-level. Type I: exposed to risk factor the previous year. Type II: exposed to risk factor at least one of the previous years. Type III: risk factor observed for at least one of the years under investigation. The total number of teenager mothers N=1,190.

Let us assume that the mentioned risk factors which are significant associated with an elevated risk of teenage pregnancy, also indicate a causal relationship, the results show that a reduction in the incidence of teenage motherhood should be expected if children were unexposed to every single of following disadvantages: 1) family life (battered child, abuse and neglect) causing children being in care; 2) adolescence psychiatric disorder; 3) parental substance abuse; 4) parental lack of vocational training and their unemployment; 5) family separation, mothers teenage pregnancies.

In addition, the regression analysis revealed that a teenager who had had an induced abortion seems to have two and a half times increased risk of becoming a teenage mother the following year. The number of characteristics, which significantly differentiated between teenage mothers and their contemporaries, were eleven.

A reduction of one third of the teenage childbearing should be expected if the mentioned disadvantages were reduced to a minimum.

The numbers of teenage pregnancies were slightly reduced from 29 per 1000 teenagers to 23 per 1000 teenagers among women born in 1966 compared to women born in 1973. Previous findings revealed that the 1973-birth cohort roughly replicates the pattern of the 1966-birth cohort.

Table 3. Risk factors for teenage experiencing induced abortion. Adjusted odds ratio on the basis of the final stepwise logistic regression model. Children born in 1966, followed 1981 - 1985. Denmark.

Risk factors included in the final model:	Type	No. of cases	% of cases	P % of contr.	OR		C.I. 95% level
Factors associated with the parents/family circumstances:							
Parental substance abuse	III	195	8.2	4.2	1.4	***	1.2-1.6
Family separation	II	682	28.8	18.1	1.5	***	1.4-1.7
Mother teenager	II	274	11.6	8.6	1.3	**	1.1-1.4
Factors associated with the teenager:							
Adolescent in foster/residential care	II	286	12.1	2.8	3.1	***	2.7-3.6
Teenager had been battered/neglected	III	33	1.4	0.4	2.2	***	1.5-3.1
The teenager had given birth to a child	I	35	1.5	0.2	3.1	***	2.2-4.5
Psychiatric disorder	II	8	0.3	0.1	2.5		1.2-5.3

Note: All risk factors are significant at 0.05-level. * 0.01-level; ** 0.001-level; *** 0.0001-level. Type I: exposed to risk factor the previous year. Type II: exposed to risk factor at least one of the previous years. Type III: risk factor observed for at least one of the years under investigation. The total number of teenagers who have had an induced abortion N=2,369.

About 5.7 percent of the women born in 1966 have had an induced abortion before their 20th birthday. Teenagers coming from high-risk groups had an increased risk of having an induced abortion (table 3). First-time induced abortions were associated with parental substance abuse, child abuse and neglect, and being in care during childhood. Increased risks were also found among teenagers who suffered from psychiatric disorder. Daughters of teenagers and teenagers who had experienced parental separation had an increased risk of having an induced abortion. Teenage mothers had an increased risk of having an induced abortion before their 20th birthday.

In conclusion, the study shows a significant social gradient for teenage pregnancies. In addition teenager who recently have given birth to a child seemed to have an increased risk of pregnancy and an induced abortion in the

following calendar year. Although, incidence of induced abortion were at a higher level among teenagers than teenage motherhood, the number of characteristics, which significantly differentiated teenagers having an induced abortion from their contemporaries, were only seven.

To our surprise, the teenage mothers were at a higher social risk and in a more social disadvantaged position than pregnant teenagers who choose abortion. While children who had been in care (foster care or residential care) during childhood had a 3 times increased risk of a teenage abortion compared to children who had not been in care. In contrast children who had been in care have had a 4 times increased risk of teenage motherhood compared to other women also born in 1966. Accordingly, girls who suffered from mental illness had a 2½ times increased risk of having an abortion, but a 4 times elevated risk of being a teenage mother, also when other risk factors were taken into account.

The same trend was seen among children who had suffered from being battered or neglected during childhood. These girls had 2.3 times the risk of having an induced abortion during the teenage years, but 3.8 times the risk of being a teenage mother compared to other girl who were not exposed to abuse and neglect, according to adjusted odds ratio.

Analysing all the mentioned risk factors one by one shows an even more surprising pattern (table 4). All risk factors indicating social disadvantage during childhood and adolescence were found significantly (P<0.0001) more frequent among girls who later became a teenage mother than among their contemporaries. Compared with the other young girls born in 1966 parental substance abuse, mental illness, domestic violence, parental suicidal behaviour, and being in care during childhood, experiencing to be battled or neglected were found more often among girls who became young mothers.

The girls who were pregnant as a teenager and choose induced abortion had had the same disadvantages but to a much lesser extent. The unadjusted odds ratio shows that all the mentioned risk factors occurred less often among the girls who had chosen induced abortion.

Table 4 Risk factors for being a *teenage mother or having an induced abortion*. Unadjusted odds Ratio for each factor separately. Children born in 1966, followed 1981 - 1985. Denmark.

Risk factors included separately:	Type	Induced Abortion N=2,369	Teenage motherhood N=1,190
Factors associated with the parents/family circumstances:			
Parental substance abuse	III	1.8***	2.3***
Parental mental illness	III	1.4***	1.7***
Domestic violence	III	1.7***	2.7***
Parental suicidal behaviour	II	2.3***	3.3***
Family separation	II	1.7***	1.8***
Mother teenager	II	1.5***	2.0***
Mother unemployed > 21 weeks	I	1.6***	3.7***
Father unemployed > 21 weeks	I	1.6***	2.9***
Mother no vocational training	III	Ns	1.4***
Father no vocational training	III	Ns	1.3***
Factors associated with the teenager:			
Adolescent in foster/residential care	II	4.4***	8.1***
Teenager had been battered/neglected	III	3.3***	6.7***
Teenage pregnancy previous year	I	6.7***	6.1***
Psychiatric disorder	II	6.1***	15.7***

Note: 'Ns' stands for: 'Not significant'. * 0.01-level; ** 0.001-level; *** 0.0001-level.
Type I: exposed to risk factor the previous year. Type II: exposed to risk factor at least one of the previous years. Type III: risk factor observed for at least one of the years under investigation.

Discussion

Unlike the rest of Scandinavia, Denmark has experienced increases in unemployment like other European countries in the period 1974 to 1993 and especially, while the girls born in 1966 were teenagers. Before the crisis, unemployment was between 1 and 2 per cent of the work force, but after 1974 and during the next two decades unemployment increased to about 12 per cent. After 1993 the unemployment rate decreased to about 6 per cent. Although adolescents are more vulnerable during crises, the teen fertility rate was constantly declining before the crises and during the last twenty years. Unemployment may have influenced the adolescents' fertility behaviour indirectly, because more opportunities for education and vocational training became available.

One of the explanations for the trend to postpone childbirth within the past generation could be the wish to ensure a secure social and financial framework for the children's childhood and adolescence. To achieve this, young people stay today rela-

tively longer in the educational process than earlier. Additionally, the housing market has become organised for families with two full-time incomes, which the young people discover when they look for a place to live.

Likewise, a relatively high level of unemployment must be assumed to have affected the decision of the families to postpone starting a family and childbirth (cf. Wallace, 1987). The individual's possibility of reducing the risk of a long-lasting, unwished-for unemployment situation will for most people be through vocational training, which within fields of high unemployment may result in increasing educational requirements.

Parental unemployment may have another indirect effect on teenage childbearing through the influence on parent's diminished support and warmth for their children. The climate in the family may be influenced by this burden and therefore affect the children and their role-modelling.

On a more general level, adolescents' low education, and foremost low expectations are mentioned as factors that stand out reviewing the studies about risk factors for teenage pregnancies. Studies from UK show a strong link between teenage parenthood and not being in education, training or work (Wellings et al., 1997; 1999; Social Exclusion Unit, 1999; Kiernan, 1995).

The results from the present study indicate a social gradient for teenage pregnancies. Teenagers who had been suffering from abuse and neglect during childhood are at risk of starting a family at a very early stage in life. Compared with other young people young mothers were more likely to have had mothers who were teenagers themselves, and their parents had low socio-economic status they had more likely experienced financial hardship. The young mothers are more likely to have experienced emotional difficulties while growing up and they were less likely to have performed well in school (Kiernan, 1995).

The present Danish study confirms the findings of Chilman (1980) and Kiernan (1995) that causes of teenage childbearing are a sense of hopelessness in respect to striving for educational goals. The British and American teenagers who chose induced abortion were more likely to have been doing well in school before pregnancy. These studies combined with the present study leave us with an assumption for further investigation that teenage pregnancy could be seen as a consequence of social exclusion of young women. Our conclusion is that pregnant high-risk teenagers who choose to be a parent need qualified support in order to avoid aggravated social disadvantages among these young parents and their children.

It is suggestive that among the OECD countries with the greatest income inequality we also find the highest levels of live births rates to women aged 15-19. United States, New Zealand, United Kingdom, Australia are among the countries with highest rates of teen childbearing and besides similarities in the educational systems, a greater income inequality than other OECD countries. There is a striking negative correlation between countries with high rates of live births to teenagers and participation for 17 years olds in public and private educations (Social exclusion Unit, 1999). As a reasonable proposition for further research is that social exclusion or dropping

out of education may influence the rates of teenage childbearing when combined with poverty and high rates of economic inequality.

Since evidence based research shows that school-based sex-education linked to easy access to contraceptive services does not increase sexual activity but reduce pregnancy rates (Franklin et al., 1997; NHS 1997) the most effective approaches for preventing unintended teenage pregnancy seem to be a comprehensive advisory and family planning service combined with tackling the adverse socio-economic factors which are associated with teenage pregnancy (Peckham, 1993).

Acknowledgements

Appendix

Statistical methods

The statistical method used is recommended by statisticians Allison (1982) and demographers as Hoem &Hoem (1992) to analyse event histories. The applied regression-analysis described by Hosmer & Lemeshow (1989), and Breslow & Day (1980, 1987). Breslow (1992) describes this discrete-time Cox modelling of a longitudinal study and the demographers Arjas & Kangas (1992) have demonstrated the use of this discrete-time method in demographic longitudinal studies of event histories according to Allison (1982).

The available event history data contains information on events that fell within a calendar year during 1979 until 1991. When the discrete time unit is a calendar year, it is excluded to use continuous-time methods, since more than one individual experience an event in the same time interval. The problem will, therefore, be covered by discrete-time methods, which allows estimation of parameters in the model by treating each individual history as a set of independent observations. Benefit can be gained from earlier findings where it has been shown that the Maximum Likelihood estimator can be obtained by treating all the time units for all individuals as though they were independent (Allison 1982).

Individuals' event history is broken up into a set of discrete time units in which an event either did or did not occur. An event is an induced abortion or teenage childbearing. Each individual is observed until time t, at which point an event occurs or the observation is censored either because of emigration, death, or the individual is lost for observation for other reasons. Consequently, families were excluded from the case group and controls after the first event, or if the child or one of the parents had died, or the child in question had emigrated. Pooling the non-censored years of all individuals, the person-years made up the controls.

A most popular choice is the logistic regression function, which is readily understood and methodologically unsophisticated, according to Paul D. Allison (1982). In the notation for the model it is assumed that time takes only positive integers values (t=1,2,3,,,,) and we examine n independent individuals (i=1,2,3,,,,n) while the observed explanatory variables x_{it} may take on different values at different discrete times. P_{it} expresses the conditional probability that an event occurs at time t, given that it has not already occurred. α_t is a set of constants for each calendar year. This logistic regression function specifies how the hazard rate depends on time and the explanatory variables can be written in logit form:

$$\log \frac{P_{it}}{1 - P_{it}} = \alpha_t + \beta x_{it}$$

The study analyses in what way the family situation, prior to the family separation differs from the controls. The cohort data were analysed by means of logistic regression to isolate the potential influence from exposed risk factors, beta-coefficients. The model is based on the proportional hazards model, so called, because they as-

sume that the ratio of the hazards rates for any two individuals at any point in time is a constant over time.

A dummy variable for each year under observation is created to estimate the parameters (alpha). Since all individuals are born in 1966, this constant also includes information on age and therefore estimation of beta-parameters is taken age into account.

The log-likelihood function L of the data may thus be written as,

$$\log L = \sum_{i=1}^{n} \sum_{j=1}^{ti} y_{it} \log\{\frac{P_{ij}}{1 - P_{ij}}\} + \sum_{i=1}^{n} \sum_{j=1}^{ti} \log(1 - P_{ij})$$

while y_{it} is a dummy variable equal to 1 if a person experiences a family separation at time t, otherwise zero, according to Allison (1982). Maximum Likelihood estimators for the regression models are then calculated on the basis of pooling all the time units over all individuals. Controls were constituted by person-years under risk of separation in the chosen period from six to eighteen years old.

The present analysis identifies relevant risk factors and describes the strength of different risk factors which could be represented by the estimates of the beta-parameters, or the odds ratio, which is more easily understood. The odds ratio is the fraction between the odds for family separation if exposed to a risk factor and the odds, if non-exposure. The interpretation of the odds ratio is approximately the relative risk, for rare risk factors. To estimate the uncertainty of the estimated odds ratios, the 95%-limits is also calculated.

In the case of rare incidents or colinearity, the numerical problems will eventually manifest themselves by extraordinary large estimated standard errors (Hosmer & Lemeshow 1989), and therefore consequently by extraordinary large range between the 95%-limits of estimated odds ratio (table 2 or table 3).

The over all exposure of risk factors among children and adolescents is named (P) in table 2 or table 3. To evaluate the risk-factors contribution to the number of induced abortions (or teenagers delivering a child), attributable fractions (A.F.) are calculated for each risk factor in the final model according to Greenland (1998), Greenland & Drescher (1993). The attributable fractions (A.F.) are seen as the reduction in incidence that would be achieved if the population had been entirely unexposed, compared with the current exposure pattern.

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