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DISABILITY PENSION AMONG YOUNG WOMEN IN SWEDEN, WITH SPECIAL EMPHASIS ON FAMILY STRUCTURE AND SICKNESS ABSENCE: A DYNAMIC COHORT STUDY

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Hagman M: Main contributor to acquisition of data and analysis.

Aronsson G: Contributing to analysis and interpretation of data. Revising the article critically for important intellectual content.

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ARTICLE SUMMARY

Article focus:

- Explanations of the increasing rate of disability pension (DP) in young women in European countries.
- High demands due to family structure and work was expected to be a contributing factor.
- A clear relation between DP and illness, measured by medically certified sickness absence was anticipated.

Key messages:

- Parenthood contributed to an increased risk of going on DP among young women. Lone working women with children had an increased risk of DP in both a one- and five-year perspective. Cohabiting working women with children had a lower risk of DP than other cohabiting women in a one-year perspective, while the opposite was shown in a five-year follow-up.
- The number of children among working women tended to increase the risk of DP five years later.
- Medically certified long-term sickness absence was an exceptionally strong predictor of going on DP irrespective of age, demographic, and socioeconomic status.

Strengths:

- High representativity due to the population based study group and high statistical precision due to the study size.

- The possibility to utilize different time spans of follow-up and to adapt to changes in the exposure and confounding factors during follow up.

Limitations:

- Lack of information on the diagnoses of disability pension.
- Lack of information on full time or part-time work.
- The generalizability is restricted to countries with a welfare system similar to that of Sweden, although the knowledge could also be a pointer for other countries developing or changing their welfare system.
- A similar study based on men is warranted.

DATA SHARING STATEMENT

In principle, data from the Swedish national registries are available to anyone within or outside the country who can present valid research funding and ethical approval of the research. Questions can be addressed to Statistics Sweden.

ABSTRACT

Objectives: The influence of family structure on the risk of going on disability pension (DP) was investigated among young women by analyzing its short- and long-term effect, controlling for potential confounding and the "healthy mother effect." Further, the relation between medically certified sickness absence and DP was explored.

Design and Participants: This dynamic cohort study comprised all women born in Sweden between 1960 and 1979 (1.2 million), 20-43 years of age during follow-up. Their annual data were retrieved from national registers for the years 1993–2003. For this period, data on family structure, sickness absence, and potential confounders were related to the incidence of DP one year after the exposure assessment. Using a modified version of the COX proportional hazard regression, we took into account changes in the study variables of individuals over the years. In addition, a five-year follow up was used.

Results: Cohabiting working women with children ran a decreased risk of DP compared to other cohabiting working women in the one-year follow up, while the opposite was indicated in the five-year follow up. Lone working women with children showed an increased risk of DP in both the one- and five-year follow up. The risk of DP tended to increase with the number of children five years earlier for both cohabiting and lone working women. Long-term sickness absence was an exceptionally strong predictor of DP irrespective of age, demographic, and socioeconomic status.

Conclusions: The study suggests that parenthood contributes to increasing the risk of going on DP among young women, which should be valuable knowledge to employers and other policy makers. The high numbers of young women exiting from working life may be counteracted by a) extended gender equality, b) fewer work hours among

fathers and mothers of young children, and c) by financial support to lone women with children.

INTRODUCTION

The exiting from working life due to reduced work capacity that has been occurring in Sweden and other OECD countries has entailed a heavy socioeconomic burden.[1, 2] A marked increase in the number of young individuals on disability pension (DP) based on psychiatric diagnoses has been observed, which has been most pronounced among young women.[3] The incidence of DP among women with psychiatric diagnoses tripled in Sweden between 1998 and 2005, while men showed a two-fold increase during the same period.[4] Since 2004, the numbers of new DPs have declined for the population as a whole, but the downward trend does not apply to individuals below 30 years of age, according to the Swedish Social Insurance Agency.[5] The long-term development has not been linear because of changes in the labor market along with changes in the criteria for being granted a DP. Also, in other Nordic countries with comparable social security systems, more and more young women have been granted a DP.[6-8]

In previous studies we have analyzed self-reported health [9, 10] and sickness absence [11] among young women with the purposes of testing the hypothesis that their work- and career-related demands along with the demands of their family life overextended their personal resources and thus contributed to impaired health and well-being. The first two studies on self-reported health were cross-sectional and based on face to face interviews. The third study with sickness absence as a measure of ill health was based on registry data with a prospective approach. The main finding was that the risk of sickness absence was higher in working mothers compared to those without children.[11] The present study is an extension of these studies, and the main objective was to explore the potential influence of family structure on the risk of being granted a DP among young women. Registry data were studied prospectively, and we analyzed short-term

and long-term effects controlling for potential confounding factors and the possibility of a "healthy mother effect".

STUDY POPULATION AND METHODS

The study base was comprised of all of the women in Sweden born between 1960 and 1979 who had reached the age of 20 at base-line, which occurred between 1993 and 2003. The dynamic cohort consisted of 1,218,094 women who were between 20 and 43 years old during the follow up period. Data were retrieved from central registers integrated in the Longitudinal database for health insurance and labor market studies (LISA).

Outcome

Disability pension could either be full time or part time. Participants were recorded as being on DP the (first) year it was granted to them. In most cases, the women who went on DPs during the study period were issued permanent DPs. The diminished health and work capacity that is grounds for a DP in Sweden is assessed through different types of systematic medical examinations that have been approved of through Swedish social security legislation.

Exposures

Family structure was based on partner status and whether there were any children in the home who were 18 years old or younger. Cohabitation meant either married or cohabiting with children in common. Thus, if they were cohabiting without children in common they were classified as lone. Four categories (cohabiting with children,

cohabiting without children, lone with children, and lone without children) were used. In a separate analysis, we also considered the number of children 18 years or younger (no children, one child, two children, and three or more children). *Sickness absence* (with sickness benefits) was treated as an exposure variable and comprised a medically certified sickness absence exceeding 14 days of sick leave from work. Sick leaves of fewer than 14 days are covered by the employer and such days are not included in the registration kept by the Social Insurance Agency. For each person and year, the total number of sickness absence days with sickness benefits from the insurance agency was calculated, and classified into: no days, 1–30, 31–90, 91–180,181–300, and 301–365 days. If one is unemployed, benefits from the Social Insurance Agency are paid from the second day, which causes a lack of comparability between employed and unemployed. Because of the very close relation between sickness absence and receiving DP, sickness absence was excluded from the multivariate analyses of family structure.

Potential confounders

The following potential confounders were considered:

Employment was broken down into employed (including self-employed) according to one's income tax declaration (showing a registered employer), and not employed, indicated by not having returned a tax declaration with a registered employer. We used the term "not employed" instead of "unemployed" to separate the category from the variable below: days of unemployment part of the year (see below). To reduce potential effects from parental leave, the women were classified as employed for the year of a birth if they were recorded as employed the year before as well as the year after the delivery. The analyses were stratified according to employment status because not all of

the potential confounders were relevant for women without employment, and because of inconsistent measurements of sickness absence.

Days of unemployment was able to be assessed among women who had been employed sometime in the same year in which they became unemployed. The variable measured the number of days the individual had received unemployment benefits, 0 (reference), 1–15, 16–30, 31–60, and more than 60 days.

Sector of employment was also restricted to women classified as employed. It was divided into four groupings: national-level public sector (reference), local- and county-level public sector, private sector, and "other."

Country of birth originally included 37 different countries that were collapsed into 19 (Table 1) and subsequently into three more general categories: Sweden (reference), Nordic countries other than Sweden, and countries outside the Nordic region. *Residential area* was separated according to population density: metropolitan areas, city areas, rural areas, and sparsely populated areas (reference).

Other potential confounders were *Education*, divided into 9 years or less, 10–12 years, and more than 12 years (reference); annual *Income* was classified, with cut-off points at the first and third quartiles, into low, medium, and high income (reference). In 1998, the values at the two cut-off points were approximately € 9,200 and € 14,200, respectively.

Statistical methods

The analytical approach of the present study was to account for the way in which individuals' exposure variables and potential confounders changed over time. The analyses were based on the SAS MPHREG macro developed at the Channing Laboratory.[12]The program has been used in other studies.[11, 13, 14] The difference from a

traditional Cox proportional hazard regression was that the units of observation did not correspond to individuals. Instead, an individual data record was created for each year in which the participant was at risk of receiving a DP, which allowed the study variables to change value each year of exposure classification. With this method, all of an individual's changes regarding, for example, family composition or level of education, could be accounted for across time. The number of person years at risk for an exposure category in a certain year was linked to DP/no DP in a subsequent year. The hazard ratio (HR) for the total follow-up period was estimated by the pooled HR across the years with a 95% confidence interval. A joint control for age and calendar year was built into the program.

Two time-spans of follow up were used, one year and five years, to study the predictive value of the exposure variables – with a short and a longer time of action.

One-year follow up: The exposure classification was started in 1993 or the year of entry into the cohort. Individuals were censored at the year of DP, emigration, or death. Women with a DP at baseline were excluded.

Five-year follow up: The exposure variables (family structure and sickness absence), were analyzed in a five-year follow up, using a similar methodology as in the one-year follow up. For each year for which a five-year follow up was possible (1993–1998), individual's exposure values were assessed and linked to their case status (DP/no DP) five years later. Individuals who received a DP or who emigrated or died during the five-year period were not taken into account for this follow-up period or the following periods. Further, the women were required to be "healthy" at base line in order to reduce the possibility of reversed causation (i.e., ill health influencing exposure). This was fulfilled by not having a registered sickness absence during the three-year period

preceding the year of exposure classification. The requirement was mainly meant to reduce the "healthy mother effect." [9]

RESULTS

Exploration of potential confounders (Table 1, 2)

From 1993 to 2003, 39,605 women aged 20 to 43 were granted a DP, corresponding to a rate of 39 per 10^4 person years; 4,345 DPs were granted to 20 to 25 year old women. The rate increased with increasing age. DP was most common in rural areas and least common in metropolitan areas. Country of birth showed a considerable variation, with the highest rates for those born in Greece, Lebanon-Syria-Turkey, and the former Yugoslavia. The lowest rates were found for women born in the US, the UK/Ireland, East Asia including Thailand and Vietnam, and Western Europe including Germany (Table 1).

Women with low education were found to have an incidence of DP that was five times higher than for those with high education, and the same increase was found when comparing those who were not employed with those who were employed. Those employed in the national-level public sector had the highest incidence of DP, while the lowest rate was found for women in private employment. Number of days of unemployment tended to show an inverse relation to the risk of being granted a DP the following year. When it came to income, the rates were observed to increase as income level decreased (Table 1).

There was no remarkable difference between the crude rates for cohabiting and lone women, but the age-adjusted HR showed an 80 percent increase in risk for the lone women. Women with children had a somewhat higher crude rate of DP, but the age-adjusted results showed the opposite, a decreased HR compared to women without children. The crude relative rates increased by number of children, but controlling for age decreased HRs were seen for one or more children, with the lowest HR for two children (Table 1).

A powerful association was found between number of days of sickness absence in a year and the risk of receiving a DP the following year. HRs started to increase substantially at the level of 31–90 days of sickness absence and went up dramatically at higher levels (Table 1).

Multivariate models for predicting DP that included potential confounders were computed for employed and not employed women (Table 2). In employed the increasing risk of DP with age and the reversed association with days of unemployment was strengthened after control for other confounders, while the associations with low education and low income were somewhat weakened.

Among the employed, women born in countries outside of the Nordic region had a slightly higher adjusted risk of DP compared to women born in Sweden. Among women without employment, however, there was a markedly lower risk of receiving a DP for those who were born in these countries as compared to those born in Sweden. A decreased HR was also seen for not employed women from the Nordic countries (Table 2).

The results of the investigation of potential confounding factors caused us to keep all the variables in the multivariate analyses of family structure and sickness absence.

Family structure and disability pension (Table 3)

As can be seen in Table 1, it was apparent that being lone, and having no children were both related to increased HRs of DP. In the multivariate analyses, the variables of partner status and children were combined, and "cohabiting women without children" was used as the reference category (Table 3).

In the one-year follow up, the risk of DP among cohabiting women with children was lower than that of the reference group, regardless of employment status. A similar result emerged for the two types of models (adjusting for age only, and the full multivariate model). Overall, lone women showed higher HRs than cohabiting women, and among employed lone women, the HR was highest for those who had children. On the other hand, among lone women with no employment, the HR was highest for those with no children (Table 3).

In the five-year follow up, the pattern changed. Among both lone and cohabiting women, the HRs of receiving a DP tended to increase for women with children. This tendency was seen among both employed and not employed women. The pattern was similar for the two types of models, but the estimates were lower in the full multivariate models. The HRs of the full model were strengthened after controlling for health at the start of follow up, which limited the women to those who had not had a medically certified sickness absence within the three years prior to the assessment of family structure (Table 3).

To further explore the validity of the effect of living with children, in the five-year follow up, we added an analysis of the number of children based on the full model controlling for health at baseline (Figure 1). The results suggested that the risk of DP increased with number of children for both lone and cohabiting working women, especially among lone working women. Among women without an employment, there was only a weak indication in the same direction among cohabiting women.

Sickness absence and disability pension (Table 4)

In the one-year follow up, a close relation between sickness absence and the risk of DP was apparent. The stratification according to employment showed that the association was particularly pronounced among the employed women, and that the figures only changed marginally in the multivariate analysis. It can also be noted that comparatively few days of sickness absence in a year (0-30 days) were predictive of DP in the following year, controlling for demographic and socioeconomic factors (Table 4).

In the five-year follow up, the predictive strength of sickness absence was attenuated but still evident, with a four- to five-fold increase in the risk of DP at the level of 31–90 days of sickness absence, and a thirty-fold increase for the highest level of absence among employed women. Controlling for the potential confounders produced only minor changes (Table 4).

DISCUSSION

Because of the size of the study base, there was a high degree of representativity and statistical precision. This also allowed us to evaluate the importance of different time

spans between exposure and outcome. Potential confounding factors were considered, and an attempt was made to reduce the possibility of selection bias – that the exposure status could be caused by foregoing impaired health. The chosen methodology took into account changes in individuals' exposure variables in all one-year follow-up analyses.

The relations between family structure and DP were inconsistent and varied according to employment status and the time of follow up. In the one-year follow up, cohabiting women with children had the lowest risk of receiving a DP, with only a marginal difference being observed between the employed and unemployed. Lone women with children in the home had the highest HR among employed women, while those lone without children showed the highest HR among those who were not employed. In the five-year follow up, on the other hand, living with children contributed in a consistent way to increasing the risk of later DP, particularly among working women.

The results for cohabiting mothers suggest that living with children was related to a beneficial health effect in the short term, which may be explained by a protective effect of social integration provided by living with a partner and children, which in turn can be due to a selection bias, a "healthy mother effect". On the other hand, in the five-year follow up, the cohabiting mothers were at a higher risk of receiving a DP compared to those without children. A portion of the cohabiting women who divorced within the five-year follow-up period may have experienced a difficult divorce or other setback, and this could possibly have been more common among mothers or particularly vulnerable mothers. Those who divorced during this follow up were thus "misclassified" part of the five-year follow-up period and their risk of DP may come closer to the pattern of single mothers (in the one-year follow up such misclassification was avoided). Lone working mothers had the highest risk of DP both in the short- and

long-term, which is in line with expectations. Previous studies have clearly pointed out the vulnerability of this group [15, 16], which may be explained by the heavy workload and greater responsibility that is shouldered by many of these women. The reasons behind the relatively high risk of receiving a DP that was found among lone women who were not employed and without children are not clear, but it is plausible that it may be connected to these individuals suffering from social isolation or marginalization that may have been the result of severe illness or handicap early in life.[17] Analyses of the medical diagnoses related to the DP could have helped explain these findings, but, unfortunately, such information on diagnosis-specific DP was not available for use in the study.

In the five-year follow up, we could at base line control for a bias that we have encountered in previous studies – the "healthy mother effect", by the requirement that all individuals should be "healthy" during the three year period preceding the exposure assessment. In the one-year follow up, where the exposure was assessed very close in time to the outcome, a comparable analysis seemed less appropriate. The requirement of no sickness absence so close in time to the DP should entail a selection of specific DP diagnoses where injuries and accidents in particular would remain.

The five-year predictive value of days of sickness absence was evident, and it was even stronger in the one-year follow up, which demonstrates the importance of the aspect of health for the developments leading up to DP, as well as the impact that the length of follow up has on the estimate. It was obvious that the link between sickness absence and DP varies according to the time span between the two measurements, and long-term sickness absence seems to be a precipitating factor for receiving a DP. The strong association found between sickness absence and receiving a DP was consistent with

previous findings from Sweden and other Nordic countries, including studies of municipal employees in Finland [18], of employees from the private sector in Denmark, [19], and of representative subpopulations in Sweden [20]. The transition from sickness absence to DP has also been previously studied among individuals who all had a long-term sickness absence [e.g., 21, 22]. To the best of our knowledge, no study has focused on young women in particular, the group with the largest increase in DP during the last decades.

The results show the complexity of the relation between family structure and DP. A considerable part of the social expenses due to DP should be attributed to lone working women with children. Their decreased work capacity may be explained by a heavy total workload and shortage of time, and may have health implications not only for the mothers but probably also for the children. The increased risk of receiving a DP among lone women without children and without a job could indicate that detrimental marginalization or social isolation is contributing to their work incapacity. Further, future studies should address the question about the potential health effects that may affect women who transition from cohabiting mothers to lone mothers. Studies similar to the present but with a focus on men are also warranted.

FUNDING

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COMPETING INTEREST

The authors declare no conflicts of interest.

STUDY APPROVAL

The study was approved by the regional research ethics committee in Stockholm (Dnr: 2010/176-31/5).

FIGURE LEGEND

Figure 1. Relative risks of going on DP according to family structure among employed and not employed women: a five-year follow up, excluding those with sickness absence within the three years before base line and controlling for potential confounders.

Table 1. Demographic factors, socioeconomic factors, and days of sickness absence related to disability pension in the one-year follow up during 1993–2003 among women in Sweden aged 20–43 years and born between 1960–1979.

	Person years	Crude rate[a]	Crude relative rate	Exp. cases	HR[b]	(95% CI)	
Total	10278639	39		39605			
Age group							
20–25 years	2909604	15	1.00	4345	1.00		
26–30 years	2964268	26	1.75	7755	1.66	1.60	1.72
31–35 years	2814482	47	3.14	13218	2.92	2.82	3.02
36+ years	1590285	90	6.02	14287	4.54	4.38	4.71
Residential area							
Sparsely populated areas	497386	44	1.00	2166	1.00		
Rural areas	507730	54	1.25	2755	1.28	1.21	1.35
City areas	5159644	41	0.94	21061	0.97	0.93	1.01
Metropolitan areas	4111669	33	0.76	13621	0.78	0.74	0.82
Country of birth							
Sweden	8807028	37	1.00	32678	1.00		
Denmark, Finland, Norway, Iceland	268139	53	1.43	1425	1.20	1.13	1.26
United Kingdom and Ireland	18296	21	0.56	38	0.49	0.36	0.68
Poland	62449	47	1.26	293	1.14	1.02	1.28
Eastern Europe incl. Romania, Hungary, former DDR and USSR	76647	30	0.81	229	0.71	0.62	0.80
Bosnia-Hercegovina	79481	35	0.94	276	0.83	0.74	0.94
Former Yugoslavia excl. Bosnia-Hercegovina	104404	76	2.05	794	1.72	1.60	1.84
Greece	11761	121	3.25	142	2.72	2.31	3.21
Western Europe incl. Germany	48946	25	0.67	121	0.60	0.50	0.71
Iraq	67727	42	1.13	283	0.98	0.87	1.10
Lebanon, Syria, and Turkey	143657	84	2.26	1204	2.24	2.12	2.38
South Central Asia incl. Iran	140861	53	1.43	746	1.34	1.25	1.44
Ethiopia and Somalia	57713	25	0.69	147	0.69	0.59	0.81
Africa excl. Ethiopia and Somalia	61247	46	1.25	283	1.12	1.00	1.26
East Asia incl. Thailand and Vietnam	144465	23	0.61	327	0.59	0.53	0.65
USA	25521	15	0.41	39	0.37	0.27	0.50
Chile	49665	48	1.29	237	1.27	1.12	1.44
South America excl. Chile	40229	32	0.87	130	0.84	0.71	1.00
Other Countries	70403	30	0.82	213	0.75	0.66	0.86
Education							
High, more than 12 years	3208713	17	1.00	5313	1.00		
Medium, 10–12 years	5674755	40	2.40	22577	2.72	2.64	2.80
Low, 9 years or less	1369063	83	5.04	11418	5.97	5.78	6.17

Employment							
Employed	8724849	23	1.00	19645	1.00		
Not employed	1553790	128	5.71	19960	6.76	6.63	6.90
Employment sector							
National public sector	672544	30	1.00	2042	1.00		
Local and County public sector	3417883	25	0.83	8649	0.83	0.79	0.88
Private sector	4082880	18	0.60	7435	0.66	0.63	0.70
Other sector	517698	29	0.95	1498	1.06	0.99	1.13
Days of unemployment							
0 days	7570643	42	1.00	31486	1.00		
1–15 days	273581	41	0.98	1114	1.25	1.18	1.33
16–30 days	238987	31	0.74	738	1.03	0.95	1.11
31–60 days	425404	28	0.68	1206	0.95	0.90	1.01
>60 days	1770024	29	0.69	5061	0.95	0.92	0.98
Income							
High, above 3rd quartile	2600723	34	1.00	8721	1.00		
Medium, 1st–3rd quartile	4937461	41	1.21	20095	1.59	1.55	1.63
Low, below 1st quartile	2554492	41	1.23	10559	2.32	2.25	2.39
Partner status							
Cohabiting	4750441	36	1.00	17304	1.00		
Lone	5528198	40	1.11	22301	1.82	1.79	1.86
Children							
Without (no) children	4886709	32	1.00	15464	1.00		
With children	5391930	45	1.41	24141	0.74	0.72	0.76
Number of children							
No Children	4886709	33	1.00	15464	1.00		
One child	1769317	38	1.16	6463	0.76	0.74	0.79
Two children	2504169	42	1.30	10573	0.66	0.65	0.68
Three or more children	1118444	64	1.95	7105	0.88	0.85	0.91
Days of sickness absence							
0 days	8741046	9	1.00	7432	1.00		
1–30 days	795630	9	1.02	688	1.03	0.95	1.11
31–90 days	368512	36	4.20	1317	4.17	3.93	4.42
91–180 days	171430	154	18.08	2635	17.68	16.90	18.49
181–300 days	98877	639	75.20	6322	71.22	68.79	73.73
301–365 days	103144	2056	241.87	21211	222.30	216.07	228.71

[a] Number of new disability pensions per 10,000 person years.

[b] Adjusted for age.

Table 2. Multivariate analyses relating the demographic and socioeconomic factors to disability pension in the one-year follow up during1993-2003 among the employed and not employed women.

	Employed				Not employed			
	Exp. cases	HR[a]	(95% CI)		Exp. cases	HR[b]	(95% CI)	
Age group								
All ages	19539				19742			
20–25 years	1425	1.00			2888	1.00		
26–30 years	3368	2.31	2.17	2.46	4342	1.60	1.53	1.68
31–35 years	6795	4.67	4.40	4.96	6340	2.65	2.54	2.77
36+ years	7951	7.45	7.00	7.93	6172	4.36	4.16	4.57
Residential area								
Sparsely populated areas	1183	1.00			974	1.00		
Rural areas	1428	1.30	1.21	1.41	1312	1.33	1.22	1.44
City areas	10341	0.96	0.91	1.02	10569	1.05	0.98	1.12
Metropolitan areas	6587	0.86	0.81	0.92	6887	0.96	0.90	1.03
Country of birth								
Sweden	16909	1.00			15643	1.00		
Denmark, Finland, Norway, Iceland	632	1.02	0.94	1.10	765	0.70	0.65	0.76
Other	1998	1.18	1.12	1.24	3334	0.30	0.29	0.32
Education								
High, more than 12 years	3406	1.00			1901	1.00		
Medium, 10–12 years	12034	2.40	2.31	2.50	10531	2.53	2.41	2.66
Low, 9 years or less	4099	4.91	4.69	5.15	7310	3.61	3.43	3.80
Income								
High, above 3rd quartile	5511	1.00						
Medium, 1st-3rd quartile	11262	1.31	1.26	1.35		.		
Low, below 1st quartile	2766	1.38	1.31	1.45		.		
Employment sector								
National public sector	2027	1.00						
Local and county public sector	8619	0.74	0.70	0.78		.		
Private sector	7403	0.53	0.50	0.56		.		
Other sector	1490	0.93	0.87	0.99		.		
Days of unemployment								
0 days	16629	1.00						
1–15 days	447	0.91	0.83	1.00		.		
16–0 days	294	0.77	0.69	0.87		.		
31–60 days	470	0.71	0.65	0.78		.		
>60 days	1699	0.70	0.66	0.73		.		

[a] The model included age, residential area, country of birth, education, income, employment sector, and days of unemployment.

[b] The model included age, residential area, country of birth, and education.

Table 3. Multivariate analyses relating family structure to disability pension in the one-year and five-year follow up during 1993-2003 among employed and not employed women.

	Employed				Not employed			
	Exp. cases	HR	(95% CI)		Exp. cases	HR	(95% CI)	
One-year follow up								
Family structure[a]								
Total	19645				19960			
Cohabiting+no children	785	1.00			654	1.00		
Cohabiting+children	9320	0.80	0.74	0.86	6545	0.88	0.81	0.96
Lone+no children	5853	1.08	1.00	1.17	8172	2.05	1.89	2.22
Lone+children	3687	1.35	1.25	1.46	4589	1.64	1.51	1.78
Family structure[b]								
Total	19539				19742			
Cohabiting+no children	780	1.00			648	1.00		
Cohabiting+children	9268	0.73	0.68	0.78	6460	0.63	0.59	0.69
Lone+no children	5835	1.07	0.99	1.16	8099	1.35	1.24	1.46
Lone+children	3656	1.23	1.14	1.33	4535	0.99	0.91	1.08
Five-year follow up								
Family structure[a]								
Total	20170				9598			
Cohabiting+no children	616	1.00			241	1.00		
Cohabiting+children	9893	1.31	1.21	1.42	3954	1.39	1.22	1.58
Lone+no children	5945	1.10	1.01	1.19	3070	1.89	1.66	2.16
Lone+children	3716	2.35	2.16	2.57	2333	2.45	2.15	2.80
Family structure[b]								
Total	20057				9598			
Cohabiting+no children	615	1.00			241	1.00		
Cohabiting+children	9804	1.13	1.04	1.23	3954	1.09	0.95	1.24
Lone+no children	5938	1.07	0.98	1.16	3070	1.44	1.26	1.65
Lone+children	3700	1.69	1.55	1.85	2333	1.62	1.41	1.85
Five-year follow up "Healthy" at start of follow up:								
Family structure[b]								
Total	6705				3871			
Cohabiting+no children	215	1.00			117	1.00		
Cohabiting+children	2778	1.24	1.08	1.43	1447	1.18	0.97	1.42
Lone+no children	2618	1.23	1.07	1.42	1467	1.83	1.51	2.22
Lone+children	1094	1.91	1.64	2.22	840	1.94	1.59	2.36

[a] Adjusted for age.

[b] The model for employed included age, residential area, country of birth, education, income, employment sector, and days of unemployment. The model for not employed included, age, residential area, country of birth, and education.

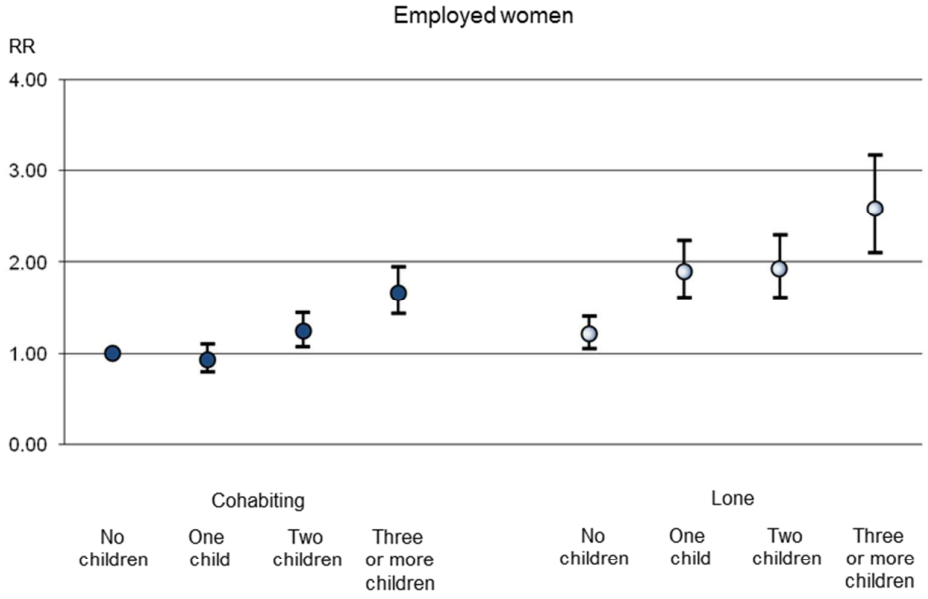
Table 4. Multivariate analyses relating days of sickness absence to disability pension in the one-year and five-year follow up during 1993-2003 among employed and not employed women.

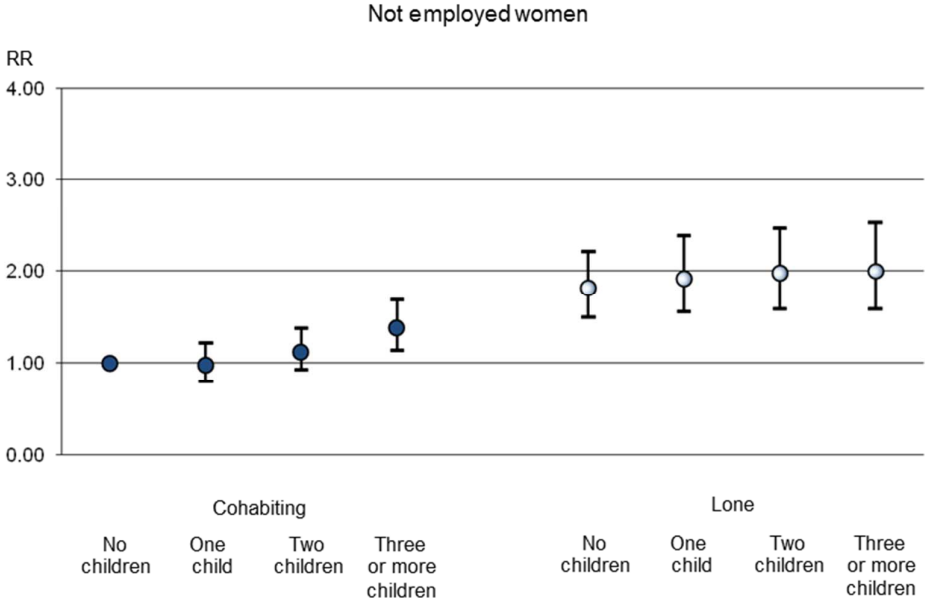
	Employed				Not employed			
	Exp. cases	HR	(95% CI)		Exp. cases	HR	(95% CI)	
One-year follow up								
Days of sickness absence[a]								
Total	19645				19960			
0 days	1556	1.00			5876	1.00		
1–30 days	404	2.67	2.39	2.98	284	0.80	0.71	0.90
31–90 days	801	11.23	10.31	12.24	516	3.21	2.94	3.52
91–180 days	1668	51.74	48.24	55.49	967	9.28	8.67	9.94
181–300 days	3953	230.80	217.30	245.13	2369	21.45	20.42	22.53
301–365 days	11263	768.25	726.67	812.21	9948	46.70	45.08	48.39
Days of sickness absence[b]								
Total	19539				19742			
0 days	1535	1.00			5771	1.00		
1–30 days	401	2.56	2.29	2.85	284	0.78	0.69	0.88
31–90 days	795	11.20	10.27	12.20	506	3.02	2.75	3.31
91–180 days	1665	51.09	47.62	54.81	960	8.48	7.91	9.09
181–300 days	3937	220.85	207.85	234.67	2364	18.56	17.64	19.52
301–365 days	11206	738.19	697.75	780.97	9857	39.33	37.90	40.82
Five-year follow up								
Days of sickness absence[a]								
Total	20170				9598			
0 days	11260	1.00			5862	1.00		
1–30 days	3175	3.14	3.02	3.27	988	2.06	1.93	2.21
31–90 days	2246	5.39	5.15	5.64	658	4.08	3.76	4.42
91–180 days	1584	10.00	9.48	10.54	626	7.75	7.13	8.42
181–300 days	1109	19.18	18.03	20.41	616	11.58	10.65	12.59
301–365 days	796	32.21	29.97	34.62	548	19.33	17.98	20.79
Days of sickness absence[b]								
Total	20057				9598			
0 days	11218	1.00			5862	1.00		
1–30 days	3149	2.76	2.65	2.88	988	1.86	1.73	1.99
31–90 days	2221	4.89	4.67	5.12	658	3.61	3.33	3.92
91–180 days	1574	8.90	8.43	9.38	626	6.70	6.16	7.29
181–300 days	1102	16.36	15.37	17.41	616	9.48	8.71	10.32
301–365 days	793	28.31	26.32	30.44	848	15.89	14.75	17.12
Five-year follow up "Healthy" at start of follow up								
Days of sickness absence[b]								
Total	6705				3871			

0 days	5051	1.00			3587	1.00		
1–30 days	748	2.74	2.53	2.96	114	1.28	1.06	1.54
31–90 days	437	4.34	3.93	4.79	74	3.13	2.48	3.94
91–180 days	256	8.19	7.22	9.29	38	4.08	2.96	5.63
181–300 days	172	20.11	17.26	23.43	39	9.28	6.76	12.74
301–365 days	41	27.44	20.17	37.34	19	15.64	9.95	24.57

[a] Adjusted for age.

[b] The model for employed included age, residential area, country of birth, education, income, employment sector, and days of unemployment. The model for not employed included age, residential area, country of birth, and education.





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STROBE Statement—checklist of items that should be included in reports of observational studies

	Item No	Recommendation
Title and abstract	1	(*a*) Indicate the study's design with a commonly used term in the title or the abstract
		(*b*) Provide in the abstract an informative and balanced summary of what was done and what was found
Introduction		
Background/rationale	2	Explain the scientific background and rationale for the investigation being reported
Objectives	3	State specific objectives, including any prespecified hypotheses
Methods		
Study design	4	Present key elements of study design early in the paper
Setting	5	Describe the setting, locations, and relevant dates, including periods of recruitment, exposure, follow-up, and data collection
Participants	6	(*a*) *Cohort study*—Give the eligibility criteria, and the sources and methods of selection of participants. Describe methods of follow-up *Case-control study*—Give the eligibility criteria, and the sources and methods of case ascertainment and control selection. Give the rationale for the choice of cases and controls *Cross-sectional study*—Give the eligibility criteria, and the sources and methods of selection of participants
		(*b*) *Cohort study*—For matched studies, give matching criteria and number of exposed and unexposed *Case-control study*—For matched studies, give matching criteria and the number of controls per case
Variables	7	Clearly define all outcomes, exposures, predictors, potential confounders, and effect modifiers. Give diagnostic criteria, if applicable
Data sources/ measurement	8*	For each variable of interest, give sources of data and details of methods of assessment (measurement). Describe comparability of assessment methods if there is more than one group
Bias	9	Describe any efforts to address potential sources of bias
Study size	10	Explain how the study size was arrived at
Quantitative variables	11	Explain how quantitative variables were handled in the analyses. If applicable, describe which groupings were chosen and why
Statistical methods	12	(*a*) Describe all statistical methods, including those used to control for confounding
		(*b*) Describe any methods used to examine subgroups and interactions
		(*c*) Explain how missing data were addressed
		(*d*) *Cohort study*—If applicable, explain how loss to follow-up was addressed *Case-control study*—If applicable, explain how matching of cases and controls was addressed *Cross-sectional study*—If applicable, describe analytical methods taking account of sampling strategy
		(*e*) Describe any sensitivity analyses

Continued on next page

Results		
Participants	13*	(a) Report numbers of individuals at each stage of study—eg numbers potentially eligible, examined for eligibility, confirmed eligible, included in the study, completing follow-up, and analysed
		(b) Give reasons for non-participation at each stage
		(c) Consider use of a flow diagram
Descriptive data	14*	(a) Give characteristics of study participants (eg demographic, clinical, social) and information on exposures and potential confounders
		(b) Indicate number of participants with missing data for each variable of interest
		(c) *Cohort study*—Summarise follow-up time (eg, average and total amount)
Outcome data	15*	*Cohort study*—Report numbers of outcome events or summary measures over time
		Case-control study—Report numbers in each exposure category, or summary measures of exposure
		Cross-sectional study—Report numbers of outcome events or summary measures
Main results	16	(*a*) Give unadjusted estimates and, if applicable, confounder-adjusted estimates and their precision (eg, 95% confidence interval). Make clear which confounders were adjusted for and why they were included
		(*b*) Report category boundaries when continuous variables were categorized
		(*c*) If relevant, consider translating estimates of relative risk into absolute risk for a meaningful time period
Other analyses	17	Report other analyses done—eg analyses of subgroups and interactions, and sensitivity analyses
Discussion		
Key results	18	Summarise key results with reference to study objectives
Limitations	19	Discuss limitations of the study, taking into account sources of potential bias or imprecision. Discuss both direction and magnitude of any potential bias
Interpretation	20	Give a cautious overall interpretation of results considering objectives, limitations, multiplicity of analyses, results from similar studies, and other relevant evidence
Generalisability	21	Discuss the generalisability (external validity) of the study results
Other information		
Funding	22	Give the source of funding and the role of the funders for the present study and, if applicable, for the original study on which the present article is based

*Give information separately for cases and controls in case-control studies and, if applicable, for exposed and unexposed groups in cohort and cross-sectional studies.

Note: An Explanation and Elaboration article discusses each checklist item and gives methodological background and published examples of transparent reporting. The STROBE checklist is best used in conjunction with this article (freely available on the Web sites of PLoS Medicine at http://www.plosmedicine.org/, Annals of Internal Medicine at http://www.annals.org/, and Epidemiology at http://www.epidem.com/). Information on the STROBE Initiative is available at www.strobe-statement.org.

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DISABILITY PENSION AMONG YOUNG WOMEN IN SWEDEN, WITH SPECIAL EMPHASIS ON FAMILY STRUCTURE: A DYNAMIC COHORT STUDY

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Keywords:	EPIDEMIOLOGY, PUBLIC HEALTH, SOCIAL MEDICINE

DISABILITY PENSION AMONG YOUNG WOMEN IN SWEDEN, WITH SPECIAL EMPHASIS ON FAMILY STRUCTURE ~~AND SICKNESS ABSENCE~~: A DYNAMIC COHORT STUDY

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Running head: Disability pension among young women

Contributorship statement:

Floderus B: Contributing to conception and design, acquisition of data, analysis and interpretation of data. Drafting the article.

Hagman M: Main contributor to acquisition of data and analysis.

Aronsson G: Contributing to analysis and interpretation of data. Revising the article critically for important intellectual content.

Gustafsson K: Contributing to analysis and interpretation of data. Revising the article critically for important intellectual content.

Marklund S: Contributing to analysis and interpretation of data. Revising the article critically for important intellectual content.

Wikman A: Contributing to analysis and interpretation of data. Revising the article critically for important intellectual content.

All authors have approved of this version (2012-01-16) of the article.

ARTICLE SUMMARY

Article focus:

- Explanations of the increasing rate of disability pension (DP) in young women in European countries.
- High demands due to family structure and work was expected to be a contributing factor.
- ~~A clear relation between DP and illness, measured by medically certified sickness absence was anticipated.~~

Key messages:

- Parenthood contributed to an increased risk of going on DP among young women. Lone working women with children had an increased risk of DP in both a one- and five-year perspective. Cohabiting working women with children had a lower risk of DP than other cohabiting women in a one-year perspective, while the opposite was shown in a five-year follow-up.
- The number of children among working women tended to increase the risk of DP five years later.
- ~~Medically certified long-term sickness absence was an exceptionally strong predictor of going on DP irrespective of age, demographic, and socioeconomic status.~~

Strengths:

- High representativity due to the population based study group and high statistical precision due to the study size.

- The possibility to utilize different time spans of follow-up and to ~~adapt to~~adjust for changes in the exposure and confounding factors during follow up.

Limitations:

- Lack of information on the diagnoses of disability pension.
- Lack of information on full time or part-time work.
- The generalizability is restricted to countries with a welfare system similar to that of Sweden, although the knowledge could also be a pointer for other countries developing or changing their welfare system.
- A similar study based on men is warranted.

DATA SHARING STATEMENT

In principle, data from the Swedish national registries are available to anyone within or outside the country who can present valid research funding and ethical approval of the research. Questions can be addressed to Statistics Sweden.

ABSTRACT

Objectives: The influence of family structure on the risk of going on disability pension (DP) was investigated among young women by analyzing its short- and long-term effect, controlling for potential confounding and the "healthy mother effect." ~~Further, the relation between medically certified sickness absence and DP was explored.~~

Design and Participants: This dynamic cohort study comprised all women born in Sweden between 1960 and 1979 (1.2 million), who were 20-43 years of age during follow-up. Their annual data were retrieved from national registers for the years 1993–2003. For this period, data on family structure, ~~sickness absence,~~ and potential confounders were related to the incidence of DP one year after the exposure assessment. Using a modified version of the COX proportional hazard regression, we took into account changes in the study variables of individuals over the years. In addition, a five-year follow up was used.

Results: Cohabiting working women with children ran a decreased risk of DP compared to ~~other~~ cohabiting working women without children in the one-year follow up, while the opposite was indicated in the five-year follow up. Lone working women with children showed an increased risk of DP in both the one- and five-year follow up. The risk of DP tended to increase with the number of children five years earlier for both cohabiting and lone working women. ~~Long-term sickness absence was an exceptionally strong predictor of DP irrespective of age, demographic, and socioeconomic status.~~

Conclusions: The study suggests that parenthood contributes to increasing the risk of going on DP among young women, which should be valuable knowledge to employers and other policy makers. It remains to be analyzed to what extent ~~The~~ the high numbers of young women exiting from working life may be counteracted by a) extended gender

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equality, b) fewer work hours among fathers and mothers of young children, and c) by financial support to lone women with children.

INTRODUCTION

The exiting from working life due to reduced work capacity that has been occurring in Sweden and other OECD countries has entailed a heavy socioeconomic burden.[1, 2] There is a shift in many countries in the gender structure of disability pensioners. The rates of DP tend to increase more (or fall less) in women, implying that women increases their share of new ~~A~~beneficiaries.[3] A marked increase in the number of young individuals on ~~disability pension (DP)~~DP based on psychiatric diagnoses has been observed, which has been most pronounced among young women.[3] ~~The incidence~~ In Swedish women aged 16-64 the incidence of DP ~~among women~~ with psychiatric diagnoses ~~tripled~~was 15 per 10^4 person years in ~~Sweden between~~ 1998 and 53 per 10^4 in ~~2005~~2004.~~, while m~~ Men showed an ~~two-fold increase~~increase from 14 to 30 per 10^4 person years during the same period.[4] Since 2004, the ~~numbers~~ inflow of new DPs have declined for the population as a whole, but the downward trend does not apply to individuals below 30 years of age, according to the Swedish Social Insurance Agency.[5] The long-term development has not been linear because of changes in the labor market along with changes in the criteria for being granted a DP. Also, in other Nordic countries with comparable social security systems, more and more young women have been granted a DP.[6-8]

In previous studies we have analyzed self-reported health [9, 10] and sickness absence [11] among young women with the purposes of testing the hypothesis that their work- and career-related demands along with the demands of their family life overextended their personal resources and thus contributed to impaired health and well-being. The first two studies on self-reported health were cross-sectional and based on face to face interviews. The third study with sickness absence as a measure of ill health was based

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on registry data with a prospective approach. The main finding was that the risk of sickness absence was higher in working mothers compared to those without children.[11] The present study is an extension of these studies, and the main objective was to explore the potential influence of family structure on the risk of being granted a DP among young women. Registry data were studied prospectively, and we analyzed short-term and long-term effects controlling for potential confounding factors and the possibility of a "healthy mother effect".

STUDY POPULATION AND METHODS

The study base was comprised of all of the women in Sweden born between 1960 and 1979 who had reached the age of 20 at base-line, which occurred between 1993 and 2003. The dynamic cohort consisted of 1,218,094 women who were between 20 and 43 years old during the follow up period. Data were retrieved from central registers integrated in the Longitudinal database for health insurance and labor market studies (LISA).

Outcome

Disability pension could either be full time or part time. Participants were recorded as being on DP the (first) year it was granted to them. In most cases, the women who went on DPs during the study period were issued permanent DPs. The diminished health and work capacity that is grounds for a DP in Sweden is assessed through different types of systematic medical examinations that have been approved of through Swedish social security legislation.

Exposures

Family structure was based on partner status and whether there were any children in the home who were 18 years old or younger. Cohabitation meant either married or cohabiting with children in common. Thus, if they were cohabiting without children in common they were classified as lone. Four categories (cohabiting with children, cohabiting without children, lone with children, and lone without children) were used. In a separate analysis, we also considered the number of children 18 years or younger (no children, one child, two children, and three or more children). ~~*Sickness absence (with sickness benefits) was treated as an exposure variable and comprised a medically certified sickness absence exceeding 14 days of sick leave from work. Sick leaves of fewer than 14 days are covered by the employer and such days are not included in the registration kept by the Social Insurance Agency. For each person and year, the total number of sickness absence days with sickness benefits from the insurance agency was calculated, and classified into: no days, 1–30, 31–90, 91–180,181–300, and 301–365 days. If one is unemployed, benefits from the Social Insurance Agency are paid from the second day, which causes a lack of comparability between employed and unemployed. Because of the very close relation between sickness absence and receiving DP, sickness absence was excluded from the multivariate analyses of family structure.*~~

Potential confounders

The following potential confounders were considered:

Employment was broken down into employed (including self-employed) according to one's income tax declaration (showing a registered employer), and not employed, indicated by not having returned a tax declaration with a registered employer. We used the term "not employed" instead of "unemployed" to separate the category from the variable below: days of unemployment part of the year (see below). To reduce potential

effects from parental leave, the women were classified as employed for the year of a birth if they were recorded as employed the year before as well as the year after the delivery. The analyses were stratified according to employment status because not all of the potential confounders were relevant for women without employment, and because of inconsistent measurements of sickness absence.

Days of unemployment was able to be assessed among women who had been employed sometime in the same year in which they became unemployed. The variable measured the number of days the individual had received unemployment benefits, 0 (reference), 1–15, 16–30, 31–60, and more than 60 days.

Sector of employment was also restricted to women classified as employed. It was divided into four groupings: national-level public sector (reference), local- and county-level public sector, private sector, and "other."

Country of birth originally included 37 different countries that were collapsed into 19 (Table 1) and subsequently into three more general categories: Sweden (reference), Nordic countries other than Sweden, and countries outside the Nordic region. *Residential area* was separated according to population density: metropolitan areas, city areas, rural areas, and sparsely populated areas (reference).

Other potential confounders were *Education*, divided into 9 years or less, 10–12 years, and more than 12 years (reference); annual *Income* was classified, with cut-off points at the first and third quartiles, into low, medium, and high income (reference). In 1998, the values at the two cut-off points were approximately € 9,200 and € 14,200, respectively.

Statistical methods

The analytical approach of the present study was to account for the way in which individuals' exposure variables and potential confounders changed over time. The analyses were based on the SAS MPHREG macro developed at the Channing Laboratory.[12] The program has been used in other studies[11, 13, 14] and the current application is analogous to the proportional hazard regression with time dependent repeated measurements with a counting process style of input. The difference from a traditional Cox proportional hazard regression was is that the units of observation did not correspond to individuals calculus was not based on the individuals' continuous time lines. Instead, an individual data record was created for each year in which the participant was at risk of receiving a DP, which allowed the individuals to change risk category status on an annual basis. study variables to change value each year of exposure classification. With this method, all of an individual's changes regarding, for example, family composition structure or level of education, could be was accounted for across time. The number of person years at risk for an exposure risk category categories in of a certain year was were linked to DP/no DP in a subsequent year. The hazard ratio (HR) for the total follow-up period was estimated by the pooled HR across the years with a 95% confidence interval. A joint control for age and calendar year was built into the program.

Two time-spans of follow up were used, one year and five years, to study the predictive value of the exposure variables – with a short (just before the decision of being granted a DP), and with a longer time of action.

One-year follow up: The exposure classification risk categorization was started in 1993 or the year of entry into the cohort, , provided that the woman had reached the age of 20. Follow up was discontinued at the year of DP, emigration, death or end of 2003,

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whichever came first. ~~Individuals were censored at the year of DP, emigration, or death.~~ Women with a DP at baseline were excluded.

Five-year follow up: The exposure variable~~s~~ (family structure ~~and sickness absence~~), ~~were~~ was analyzed in a five-year follow up, using a similar methodology as in the one-year follow up. For each year for which a five-year follow up was possible (1993–1998), individual's exposure values were assessed and linked to their case status (DP/no DP) five years later. Individuals who received a DP or who emigrated or died during the five-year period were not taken into account for this follow-up period or the following periods. ~~Further~~

In an additional analysis, the women were required to be "healthy" at base line in order to reduce the possibility of ~~reversed causation~~selection bias (i.e., ill health influencing exposure). This was ~~fulfilled~~ done by a restriction of the study base ~~not having~~to women without a registered sickness absence during the three-year period preceding the year of exposure classification. The ~~requirement~~ restriction was mainly meant to reduce the "healthy mother effect." [9] Sickness absence (with sickness benefits) ~~was treated as an exposure variable and comprised~~corresponded to a medically certified sickness absence exceeding 14 days of sick leave ~~from work~~. Sick leaves of fewer than 14 days ~~are covered by the employer and such days are not included in the registration kept by the Social Insurance Agency.~~were not considered.

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RESULTS

Exploration of potential confounders (Table 1, 2)

From 1993 to 2003, 39,605 women aged 20 to 43 were granted a DP, corresponding to a rate of 39 per 10^4 person years; 4,345 DPs were granted to 20 to 25 year old women. The rate increased with increasing age. DP was most common in rural areas and least common in metropolitan areas. Country of birth showed a considerable variation, with the highest rates for those born in Greece, Lebanon-Syria-Turkey, and the former Yugoslavia. The lowest rates were found for women born in the US, the UK/Ireland, East Asia including Thailand and Vietnam, and Western Europe including Germany (Table 1).

Women with low education were found to have an incidence of DP that was five times higher than for those with high education, and the same increase was found when comparing those who were not employed with those who were employed. Those employed in the national-level public sector had the highest incidence of DP, while the lowest rate was found for women in private employment. Number of days of unemployment tended to show an inverse relation to the risk of being granted a DP the following year. When it came to income, the rates were observed to increase as income level decreased (Table 1).

There was no remarkable difference between the crude rates for cohabiting and lone women, but the age-adjusted HR showed an 80 percent increase in risk for the lone women. Women with children had a somewhat higher crude rate of DP, but the age-adjusted results showed the opposite, a decreased HR compared to women without children. The crude relative rates increased by number of children, but controlling for age decreased HRs were seen for one or more children, with the lowest HR for two children (Table 1).

~~A powerful association was found between number of days of sickness absence in a year and the risk of receiving a DP the following year. HRs started to increase substantially at the level of 31–90 days of sickness absence and went up dramatically at higher levels (Table 1).~~

Multivariate models for predicting DP that included potential confounders were computed for employed and not employed women (Table 2). In employed the increasing risk of DP with age and the reversed association with days of unemployment was strengthened after control for other confounders, while the associations with low education and low income were somewhat weakened.

Among the employed, women born in countries outside of the Nordic region had a slightly higher adjusted risk of DP compared to women born in Sweden. Among women without employment, however, there was a markedly lower risk of receiving a DP for those who were born in these countries as compared to those born in Sweden. A decreased HR was also seen for not employed women from the Nordic countries (Table 2).

The results of the investigation of potential confounding factors caused us to keep all the variables in the multivariate analyses of family structure and sickness absence.

Family structure and disability pension (Table 3)

As can be seen in Table 1, it was apparent that being lone, and having no children were both related to increased HRs of DP. In the multivariate analyses, the variables of partner status and children were combined, and "cohabiting women without children" was used as the reference category (Table 3).

In the one-year follow up, the risk of DP among cohabiting women with children was lower than that of the reference group, regardless of employment status. A similar result emerged for the two types of models (adjusting for age only, and the full multivariate model). Overall, lone women showed higher HRs than cohabiting women, and among employed lone women, the HR was highest for those who had children. On the other hand, among lone women with no employment, the HR was highest for those with no children (Table 3).

In the five-year follow up, the pattern changed. Among both lone and cohabiting women, the HRs of receiving a DP tended to increase for women with children. This tendency was seen among both employed and not employed women. The pattern was similar for the two types of models, but the estimates were lower in the full multivariate models. The HRs of the full model were strengthened after controlling for health at the start of follow up, which ~~limited the women~~implied a restriction of the study group to those who had not had a medically certified sickness absence within the three years prior to the assessment of family structure (Table 3).

To further explore the validity of the effect of living with children, in the five-year follow up, we added an analysis of the number of children based on the full model controlling for health at baseline (Figure 1). The results suggested that the risk of DP increased with number of children for both lone and cohabiting working women, especially among lone working women. Among women without an employment, there was only a weak indication in the same direction among cohabiting women.

~~Sickness absence and disability pension (Table 4)~~

~~In the one-year follow up, a close relation between sickness absence and the risk of DP was apparent. The stratification according to employment showed that the association was particularly pronounced among the employed women, and that the figures only changed marginally in the multivariate analysis. It can also be noted that comparatively few days of sickness absence in a year (0-30 days) were predictive of DP in the following year, controlling for demographic and socioeconomic factors (Table 4).~~

~~In the five-year follow up, the predictive strength of sickness absence was attenuated but still evident, with a four- to five-fold increase in the risk of DP at the level of 31–90 days of sickness absence, and a thirty-fold increase for the highest level of absence among employed women. Controlling for the potential confounders produced only minor changes (Table 4).~~

DISCUSSION

Because of the size of the study base, there was a high degree of representativity and statistical precision. This also allowed us to evaluate the importance of different time spans between exposure and outcome. Potential confounding factors were considered, and an attempt was made to reduce the possibility of selection bias – that the exposure status could be caused by foregoing impaired health. The chosen methodology took into account changes in individuals' exposure variables (and covariates); ~~in~~ in ~~all~~ the one-year follow-up analyses~~-~~ this was done on an annual basis.

The relations between family structure and DP were inconsistent and varied according to employment status and the time of follow up. In the one-year follow up, cohabiting women with children had the lowest risk of receiving a DP, with only a marginal

difference being observed between the employed and unemployed. Lone women with children in the home had the highest HR among employed women, while those lone without children showed the highest HR among those who were not employed. In the five-year follow up, on the other hand, living with children contributed in a consistent way to increasing the risk of later DP, particularly among working women.

The results for cohabiting mothers suggest that living with children was related to a beneficial health effect in the short term, which may be explained by a protective effect of social integration provided by living with a partner and children, which in turn can be due to ~~a~~ uncontrolled selection bias, a "healthy mother effect". On the other hand, in the five-year follow up, the cohabiting mothers were at a higher risk of receiving a DP compared to those without children. A portion of the cohabiting women who divorced within the five-year follow-up period may have experienced a difficult divorce or other setback, and this could possibly have been more common among mothers or particularly vulnerable mothers. Those who divorced during this follow up were thus "misclassified" part of the five-year follow-up period and their risk of DP may come closer to the pattern of single mothers (in the one-year follow up such misclassification was avoided). Lone working mothers had the highest risk of DP both in the short- and long-term, which is in line with expectations. Previous studies have clearly pointed out the vulnerability of this group [15, 16], which may be explained by the heavy workload and greater responsibility that is shouldered by many of these women. The reasons behind the relatively high risk of receiving a DP that was found among lone women who were not employed and without children are not clear, but it is plausible that it may be connected to these individuals suffering from social isolation or marginalization that may have been the result of severe illness or handicap early in life.[17] Analyses of the

medical diagnoses related to the DP could have helped explain these findings, but, unfortunately, such information on diagnosis-specific DP was not available for use in the study.

In the five-year follow up, we could at base line control for a bias that we have encountered in previous studies – the "healthy mother effect", by the requirement that all individuals should be "healthy" during the three year period preceding the exposure assessment. In the one-year follow up, where the exposure was assessed very close in time to the outcome, a comparable analysis seemed less appropriate. The requirement of no sickness absence so close in time to the DP should entail a selection of specific DP diagnoses where injuries and accidents in particular would remain.

~~The five-year predictive value of days of sickness absence was evident, and it was even stronger in the one-year follow up, which demonstrates the importance of the aspect of health for the developments leading up to DP, as well as the impact that the length of follow-up has on the estimate. It was obvious that the link between sickness absence and DP varies according to the time span between the two measurements, and long-term sickness absence seems to be a precipitating factor for receiving a DP. The strong association found between sickness absence and receiving a DP was consistent with previous findings from Sweden and other Nordic countries, including studies of municipal employees in Finland [18], of employees from the private sector in Denmark, [19], and of representative subpopulations in Sweden [20]. The transition from sickness absence to DP has also been previously studied among individuals who all had a long-term sickness absence [e.g., 21, 22]. To the best of our knowledge, no study has focused on young women in particular, the group with the largest increase in DP during the last decades.~~

The results show the complexity of the relation between family structure and DP. A considerable part of the social expenses due to DP should be attributed to lone working women with children. Their decreased work capacity may be explained by a heavy total workload and shortage of time, and may have health implications not only for the mothers but probably also for the children. The increased risk of receiving a DP among lone women without children and without a job could indicate that detrimental marginalization or social isolation is contributing to their work incapacity. Further, future studies should address the question about the potential health effects that may affect women who transition from cohabiting mothers to lone mothers. Studies similar to the present but with a focus on men are also warranted.

FUNDING

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COMPETING INTEREST

The authors declare no conflicts of interest.

STUDY APPROVAL

The study was approved by the regional research ethics committee in Stockholm (Dnr: 2010/176-31/5).

FIGURE LEGEND

Figure 1. Relative risks of going on DP according to family structure among employed and not employed women: a five-year follow up, excluding those with sickness absence within the three years before base line, and controlling for potential confounders.

Table 1. Demographic factors, socioeconomic factors, and days of sickness absence related to disability pension in the one-year follow up during 1993–2003 among women in Sweden aged 20–43 years and born between 1960–1979.

	Person years	Crude rate[a]	Crude relative rate	Exp. cases	HR[b]	(95% CI)	
Total	10278639	39		39605			
~~Age group~~Ages during follow up							
20–25 years	2909604	15	1.00	4345	1.00		
26–30 years	2964268	26	1.75	7755	1.66	1.60	1.72
31–35 years	2814482	47	3.14	13218	2.92	2.82	3.02
36+ years	1590285	90	6.02	14287	4.54	4.38	4.71
Residential area							
Sparsely populated areas	497386	44	1.00	2166	1.00		
Rural areas	507730	54	1.25	2755	1.28	1.21	1.35
City areas	5159644	41	0.94	21061	0.97	0.93	1.01
Metropolitan areas	4111669	33	0.76	13621	0.78	0.74	0.82
Country of birth							
Sweden	8807028	37	1.00	32678	1.00		
Denmark, Finland, Norway, Iceland	268139	53	1.43	1425	1.20	1.13	1.26
United Kingdom and Ireland	18296	21	0.56	38	0.49	0.36	0.68
Poland	62449	47	1.26	293	1.14	1.02	1.28
Eastern Europe incl. Romania, Hungary, former DDR and USSR	76647	30	0.81	229	0.71	0.62	0.80
Bosnia-Hercegovina	79481	35	0.94	276	0.83	0.74	0.94
Former Yugoslavia excl. Bosnia-Hercegovina	104404	76	2.05	794	1.72	1.60	1.84
Greece	11761	121	3.25	142	2.72	2.31	3.21
Western Europe incl. Germany	48946	25	0.67	121	0.60	0.50	0.71
Iraq	67727	42	1.13	283	0.98	0.87	1.10
Lebanon, Syria, and Turkey	143657	84	2.26	1204	2.24	2.12	2.38
South Central Asia incl. Iran	140861	53	1.43	746	1.34	1.25	1.44
Ethiopia and Somalia	57713	25	0.69	147	0.69	0.59	0.81
Africa excl. Ethiopia and Somalia	61247	46	1.25	283	1.12	1.00	1.26
East Asia incl. Thailand and Vietnam	144465	23	0.61	327	0.59	0.53	0.65
USA	25521	15	0.41	39	0.37	0.27	0.50
Chile	49665	48	1.29	237	1.27	1.12	1.44
South America excl. Chile	40229	32	0.87	130	0.84	0.71	1.00
Other Countries	70403	30	0.82	213	0.75	0.66	0.86
Education							
High, more than 12 years	3208713	17	1.00	5313	1.00		
Medium, 10–12 years	5674755	40	2.40	22577	2.72	2.64	2.80
Low, 9 years or less	1369063	83	5.04	11418	5.97	5.78	6.17

Employment							
Employed	8724849	23	1.00	19645	1.00		
Not employed	1553790	128	5.71	19960	6.76	6.63	6.90
Employment sector							
National public sector	672544	30	1.00	2042	1.00		
Local and County public sector	3417883	25	0.83	8649	0.83	0.79	0.88
Private sector	4082880	18	0.60	7435	0.66	0.63	0.70
Other sector	517698	29	0.95	1498	1.06	0.99	1.13
Days of unemployment							
0 days	7570643	42	1.00	31486	1.00		
1–15 days	273581	41	0.98	1114	1.25	1.18	1.33
16–30 days	238987	31	0.74	738	1.03	0.95	1.11
31–60 days	425404	28	0.68	1206	0.95	0.90	1.01
>60 days	1770024	29	0.69	5061	0.95	0.92	0.98
Income							
High, above 3rd quartile	2600723	34	1.00	8721	1.00		
Medium, 1st–3rd quartile	4937461	41	1.21	20095	1.59	1.55	1.63
Low, below 1st quartile	2554492	41	1.23	10559	2.32	2.25	2.39
Partner status							
Cohabiting	4750441	36	1.00	17304	1.00		
Lone	5528198	40	1.11	22301	1.82	1.79	1.86
Children							
Without (no) children	4886709	32	1.00	15464	1.00		
With children	5391930	45	1.41	24141	0.74	0.72	0.76
Number of children							
No Children	4886709	33	1.00	15464	1.00		
One child	1769317	38	1.16	6463	0.76	0.74	0.79
Two children	2504169	42	1.30	10573	0.66	0.65	0.68
Three or more children	1118444	64	1.95	7105	0.88	0.85	0.91
~~Days of sickness absence~~							
~~0 days~~	~~8741046~~	~~9~~	~~1.00~~	~~7432~~	~~1.00~~		
~~1–30 days~~	~~795630~~	~~9~~	~~1.02~~	~~688~~	~~1.03~~	~~0.95~~	~~1.11~~
~~31–90 days~~	~~368512~~	~~36~~	~~4.20~~	~~1317~~	~~4.17~~	~~3.93~~	~~4.42~~
~~91–180 days~~	~~171430~~	~~154~~	~~18.08~~	~~2635~~	~~17.68~~	~~16.90~~	~~18.49~~
~~181–300 days~~	~~98877~~	~~639~~	~~75.20~~	~~6322~~	~~71.22~~	~~68.79~~	~~73.73~~
~~301–365 days~~	~~103144~~	~~2056~~	~~241.87~~	~~21211~~	~~222.30~~	~~216.07~~	~~228.71~~

[a] Number of new disability pensions per 10,000 person years.

[b] Adjusted for age.

Table 2. Multivariate analyses relating the demographic and socioeconomic factors to disability pension in the one-year follow up during1993-2003 among the employed and not employed women.

	Employed				Not employed			
	Exp. cases	HR[a]	(95% CI)		Exp. cases	HR[b]	(95% CI)	
~~Age group~~Total	19539				19742			
~~All ages~~Ages during follow up	~~19539~~				~~19742~~			
20–25 years	1425	1.00			2888	1.00		
26–30 years	3368	2.31	2.17	2.46	4342	1.60	1.53	1.68
31–35 years	6795	4.67	4.40	4.96	6340	2.65	2.54	2.77
36+ years	7951	7.45	7.00	7.93	6172	4.36	4.16	4.57
Residential area								
Sparsely populated areas	1183	1.00			974	1.00		
Rural areas	1428	1.30	1.21	1.41	1312	1.33	1.22	1.44
City areas	10341	0.96	0.91	1.02	10569	1.05	0.98	1.12
Metropolitan areas	6587	0.86	0.81	0.92	6887	0.96	0.90	1.03
Country of birth								
Sweden	16909	1.00			15643	1.00		
Denmark, Finland, Norway, Iceland	632	1.02	0.94	1.10	765	0.70	0.65	0.76
Other	1998	1.18	1.12	1.24	3334	0.30	0.29	0.32
Education								
High, more than 12 years	3406	1.00			1901	1.00		
Medium, 10–12 years	12034	2.40	2.31	2.50	10531	2.53	2.41	2.66
Low, 9 years or less	4099	4.91	4.69	5.15	7310	3.61	3.43	3.80
Income								
High, above 3rd quartile	5511	1.00						
Medium, 1st-3rd quartile	11262	1.31	1.26	1.35		.		
Low, below 1st quartile	2766	1.38	1.31	1.45		.		
Employment sector								
National public sector	2027	1.00						
Local and county public sector	8619	0.74	0.70	0.78		.		
Private sector	7403	0.53	0.50	0.56		.		
Other sector	1490	0.93	0.87	0.99		.		
Days of unemployment								
0 days	16629	1.00						
1–15 days	447	0.91	0.83	1.00		.		
16–0 days	294	0.77	0.69	0.87		.		
31–60 days	470	0.71	0.65	0.78		.		
>60 days	1699	0.70	0.66	0.73		.		

[a] The model included age, residential area, country of birth, education, income, employment sector, and days of unemployment.

[b] The model included age, residential area, country of birth, and education.

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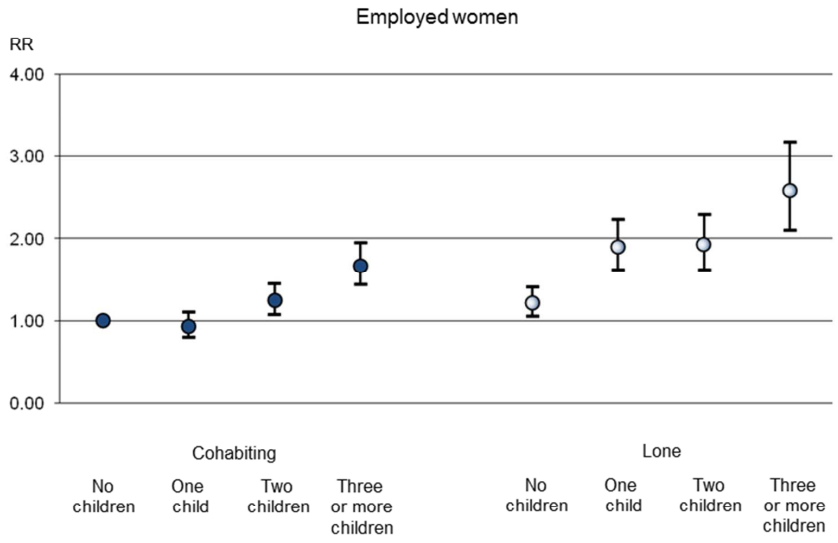
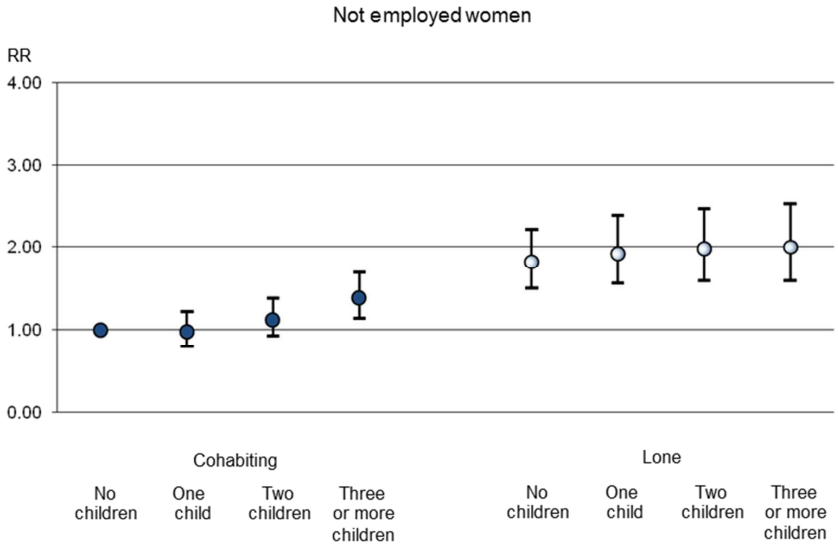
Table 3. Multivariate analyses relating family structure to disability pension in the one-year and five-year follow up during 1993-2003 among employed and not employed women.

	Employed				Not employed			
	Exp. cases	HR	(95% CI)		Exp. cases	HR	(95% CI)	
One-year follow up								
Family structure[a]								
Total	19645				19960			
Cohabiting+no children	785	1.00			654	1.00		
Cohabiting+children	9320	0.80	0.74	0.86	6545	0.88	0.81	0.96
Lone+no children	5853	1.08	1.00	1.17	8172	2.05	1.89	2.22
Lone+children	3687	1.35	1.25	1.46	4589	1.64	1.51	1.78
Family structure[b]								
Total	19539				19742			
Cohabiting+no children	780	1.00			648	1.00		
Cohabiting+children	9268	0.73	0.68	0.78	6460	0.63	0.59	0.69
Lone+no children	5835	1.07	0.99	1.16	8099	1.35	1.24	1.46
Lone+children	3656	1.23	1.14	1.33	4535	0.99	0.91	1.08
Five-year follow up								
Family structure[a]								
Total	20170				9598			
Cohabiting+no children	616	1.00			241	1.00		
Cohabiting+children	9893	1.31	1.21	1.42	3954	1.39	1.22	1.58
Lone+no children	5945	1.10	1.01	1.19	3070	1.89	1.66	2.16
Lone+children	3716	2.35	2.16	2.57	2333	2.45	2.15	2.80
Family structure[b]								
Total	20057				9598			
Cohabiting+no children	615	1.00			241	1.00		
Cohabiting+children	9804	1.13	1.04	1.23	3954	1.09	0.95	1.24
Lone+no children	5938	1.07	0.98	1.16	3070	1.44	1.26	1.65
Lone+children	3700	1.69	1.55	1.85	2333	1.62	1.41	1.85
Five-year follow up "Healthy" at start of follow up:								
Family structure[b]								
Total	6705				3871			
Cohabiting+no children	215	1.00			117	1.00		
Cohabiting+children	2778	1.24	1.08	1.43	1447	1.18	0.97	1.42
Lone+no children	2618	1.23	1.07	1.42	1467	1.83	1.51	2.22
Lone+children	1094	1.91	1.64	2.22	840	1.94	1.59	2.36

[a] Adjusted for age.

[b] The model for employed included age, residential area, country of birth, education, income, employment sector, and days of unemployment. The model for not employed included age, residential area, country of birth, and education.





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STROBE Statement—checklist of items that should be included in reports of observational studies

	Item No	Recommendation
Title and abstract	1	(*a*) Indicate the study's design with a commonly used term in the title or the abstract
		(*b*) Provide in the abstract an informative and balanced summary of what was done and what was found
Introduction		
Background/rationale	2	Explain the scientific background and rationale for the investigation being reported
Objectives	3	State specific objectives, including any prespecified hypotheses
Methods		
Study design	4	Present key elements of study design early in the paper
Setting	5	Describe the setting, locations, and relevant dates, including periods of recruitment, exposure, follow-up, and data collection
Participants	6	(*a*) *Cohort study*—Give the eligibility criteria, and the sources and methods of selection of participants. Describe methods of follow-up *Case-control study*—Give the eligibility criteria, and the sources and methods of case ascertainment and control selection. Give the rationale for the choice of cases and controls *Cross-sectional study*—Give the eligibility criteria, and the sources and methods of selection of participants
		(*b*) *Cohort study*—For matched studies, give matching criteria and number of exposed and unexposed *Case-control study*—For matched studies, give matching criteria and the number of controls per case
Variables	7	Clearly define all outcomes, exposures, predictors, potential confounders, and effect modifiers. Give diagnostic criteria, if applicable
Data sources/ measurement	8*	For each variable of interest, give sources of data and details of methods of assessment (measurement). Describe comparability of assessment methods if there is more than one group
Bias	9	Describe any efforts to address potential sources of bias
Study size	10	Explain how the study size was arrived at
Quantitative variables	11	Explain how quantitative variables were handled in the analyses. If applicable, describe which groupings were chosen and why
Statistical methods	12	(*a*) Describe all statistical methods, including those used to control for confounding
		(*b*) Describe any methods used to examine subgroups and interactions
		(*c*) Explain how missing data were addressed
		(*d*) *Cohort study*—If applicable, explain how loss to follow-up was addressed *Case-control study*—If applicable, explain how matching of cases and controls was addressed *Cross-sectional study*—If applicable, describe analytical methods taking account of sampling strategy
		(*e*) Describe any sensitivity analyses

Continued on next page

Results		
Participants	13*	(a) Report numbers of individuals at each stage of study—eg numbers potentially eligible, examined for eligibility, confirmed eligible, included in the study, completing follow-up, and analysed
		(b) Give reasons for non-participation at each stage
		(c) Consider use of a flow diagram
Descriptive data	14*	(a) Give characteristics of study participants (eg demographic, clinical, social) and information on exposures and potential confounders
		(b) Indicate number of participants with missing data for each variable of interest
		(c) *Cohort study*—Summarise follow-up time (eg, average and total amount)
Outcome data	15*	*Cohort study*—Report numbers of outcome events or summary measures over time
		Case-control study—Report numbers in each exposure category, or summary measures of exposure
		Cross-sectional study—Report numbers of outcome events or summary measures
Main results	16	(*a*) Give unadjusted estimates and, if applicable, confounder-adjusted estimates and their precision (eg, 95% confidence interval). Make clear which confounders were adjusted for and why they were included
		(*b*) Report category boundaries when continuous variables were categorized
		(*c*) If relevant, consider translating estimates of relative risk into absolute risk for a meaningful time period
Other analyses	17	Report other analyses done—eg analyses of subgroups and interactions, and sensitivity analyses
Discussion		
Key results	18	Summarise key results with reference to study objectives
Limitations	19	Discuss limitations of the study, taking into account sources of potential bias or imprecision. Discuss both direction and magnitude of any potential bias
Interpretation	20	Give a cautious overall interpretation of results considering objectives, limitations, multiplicity of analyses, results from similar studies, and other relevant evidence
Generalisability	21	Discuss the generalisability (external validity) of the study results
Other information		
Funding	22	Give the source of funding and the role of the funders for the present study and, if applicable, for the original study on which the present article is based

*Give information separately for cases and controls in case-control studies and, if applicable, for exposed and unexposed groups in cohort and cross-sectional studies.

Note: An Explanation and Elaboration article discusses each checklist item and gives methodological background and published examples of transparent reporting. The STROBE checklist is best used in conjunction with this article (freely available on the Web sites of PLoS Medicine at http://www.plosmedicine.org/, Annals of Internal Medicine at http://www.annals.org/, and Epidemiology at http://www.epidem.com/). Information on the STROBE Initiative is available at www.strobe-statement.org.

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DISABILITY PENSION AMONG YOUNG WOMEN IN SWEDEN, WITH SPECIAL EMPHASIS ON FAMILY STRUCTURE: A DYNAMIC COHORT STUDY

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ABSTRACT

Objectives: The influence of family structure on the risk of going on disability pension (DP) was investigated among young women by analyzing a short- and long-term effect, controlling for potential confounding and the "healthy mother effect."

Design and Participants: This dynamic cohort study comprised all women born in Sweden between 1960 and 1979 (1.2 million), who were 20-43 years of age during follow-up. Their annual data were retrieved from national registers for the years 1993–2003. For this period, data on family structure, and potential confounders were related to the incidence of DP the year after the exposure assessment. Using a modified version of the COX proportional hazard regression, we took into account changes in the study variables of individuals over the years. In addition, a five-year follow up was used.

Results: Cohabiting, working women with children showed a decreased risk of DP in a one-year perspective compared to cohabiting working women with no children , while the opposite was indicated in the five-year follow up. Lone, working women with children had an increased risk of DP in both the short- and long-term perspective. The risk of DP tended to increase with the number of children for both cohabiting and lone working women in the five-year follow up.

Conclusions: The study suggests that parenthood contributes to increasing the risk of going on DP among young women, which should be valuable knowledge to employers and other policy makers. It remains to be analyzed to what extent the high numbers of young women exiting from working life may be counteracted by a) extended gender equality, b) fewer work hours among fathers and mothers of young children, and c) by financial support to lone women with children.

INTRODUCTION

The exiting from working life due to reduced work capacity that has been occurring in Sweden and other OECD countries has entailed a heavy socioeconomic burden.[1-3] In many countries a shift in the gender structure of disability pensioners has occurred. The rates of DP tend to increase more (or fall less) in women, implying that women increase their share of new beneficiaries.[3] A marked increase in the number of young individuals on DP based on psychiatric diagnoses has been observed, which has been most pronounced among young women.[3-4] This trend has been particularly pronounced in Sweden and was an incentive for the present study focusing on young women (Figure 1). The long-term development has not been linear because of changes in the labor market along with changes in the criteria for being granted a DP. Since 2004, the numbers of new DPs have declined for the population as a whole, but the downward trend does not apply to individuals below 30 years of age, according to the Swedish Social Insurance Agency.[5] Also, in other Nordic countries more and more young women have been granted a DP.[6-8]

The time trends may to some extent be related to health effects among women combining a demanding work and a family life with children. Different measures have been used to study the so called "double burden" hypothesis: multiple roles, paid and unpaid work, work-to-family and family-to-work conflicts (spillover). The outcome measures as well as methodology have varied extensively, [e.g. 9-13] and many but not all studies[14-15] have supported the hypothesis.

With respect to DP, studies have reported results on marital status and prevalence of children in relation to risk of DP,[16] often based on individuals initially on long-term sick leave [17-20] and without a simultaneous consideration of work status. To the best of our

knowledge this is the first study analyzing the effect of family structure and work on DP, based on a representative group of young women.

Previously, we have analyzed self-reported health [21-22] and sickness absence [23] among young women with the purposes of testing the hypothesis that their work- and career-related demands along with the demands of their family life overextended their personal resources and thus contributed to impaired health and well-being. The first two studies were cross-sectional and based on face to face interviews. They showed that women with children more often than others reported poor health. The associations were most pronounced among full time workers[21], but did also apply to students and job seekers[22]. The third study with sickness absence as a measure of ill health was based on registry data with a prospective approach. The main finding was that the risk of sickness absence was higher in working mothers compared to those without children.[23] The present study is an extension of these studies, and the main objective has been to explore if the health effects previously observed could develop into illness entailing reduced work capacity and DP. Registry data were studied prospectively, and we analyzed short-term and long-term effects controlling for potential confounding factors and the possibility of a "healthy mother effect". The short-term follow up gives a characterization of young women just before they are granted a DP, while the long-term follow-up shows if family status can predict the risk of DP five years later.

STUDY POPULATION AND METHODS

The study base was comprised of all of the women in Sweden born between 1960 and 1979 who had reached the age of 20 at base-line, which occurred between 1993 and

2003. The dynamic cohort consisted of 1,218,094 women who were between 20 and 43 years old during the follow up period. Data were retrieved from central registers integrated in the Longitudinal database for health insurance and labor market studies (LISA).

Outcome

Disability pension could either be full time or part time. Participants were recorded as being on DP the (first) year it was granted to them. In most cases, the women who went on DPs during the study period were issued permanent DPs. The diminished health and work capacity that is grounds for a DP in Sweden is assessed through different types of systematic medical examinations that have been approved of through Swedish social security legislation.

Exposure

Family structure was based on partner status and whether there were any children in the home who were 18 years old or younger. Cohabitation meant either married or cohabiting with children in common. Thus, if they were cohabiting without children in common they were classified as lone. The effect of this coding should be conservative (working against the hypothesis). Four categories (cohabiting with children, cohabiting without children, lone with children, and lone without children) were used. In a separate analysis, we also considered the number of children 18 years or younger (no children, one child, two children, and three or more children).

Potential confounders

The following potential confounders were considered:

Employment was broken down into employed (including self-employed) according to one's income tax declaration (showing a registered employer), and not employed, indicated by not having returned a tax declaration with a registered employer. We used the term "not employed" instead of "unemployed" to separate the category from the variable below: days of unemployment part of the year (see below). To reduce potential effects from parental leave, the women were classified as employed for the year of a birth if they were recorded as employed the year before as well as the year after the delivery. The analyses were stratified according to employment status because not all of the potential confounders were relevant for women without employment, and because of inconsistent measurements of sickness absence.

Days of unemployment was assessed among women who had been employed sometime in the same year in which they became unemployed. The variable measured the number of days the individual had received unemployment benefits, 0 (reference), 1–15, 16–30, 31–60, and more than 60 days.

Sector of employment was also restricted to women classified as employed. It was divided into four groupings: national-level public sector (reference), local- and county-level public sector, private sector, and "other."

Country of birth originally included 37 different countries that were collapsed into 19 (Table 1) and subsequently into three more general categories: Sweden (reference), Nordic countries other than Sweden, and countries outside the Nordic region.

Residential area was separated according to population density: metropolitan areas, city areas, rural areas, and sparsely populated areas (reference).

Other potential confounders were *Education*, divided into 9 years or less, 10–12 years, and more than 12 years (reference); annual *Income* was classified, with cut-off points at the first and third quartiles, into low, medium, and high income (reference). In 1998, the values at the two cut-off points were approximately € 9,200 and € 14,200, respectively.

Statistical methods

The analytical approach of the present study was to account for the way in which individuals' exposure variables and potential confounders changed over time. The analyses were based on the SAS MPHREG macro developed at the Channing Laboratory.[24]The program has been used in other studies[23,25-26] and the current application is analogous to the proportional hazard regression with time dependent repeated measurements of time dependent variables with the counting process style of input. The importance of methodologies taking changes over time into consideration in epidemiological studies has been emphazised.[27] The difference from a traditional Cox proportional hazard regression was that the calculus was not based on the individuals' exposure at start of follow up. Instead, an individual data record was created for each year in which the participant was at risk of receiving a DP, which allowed the individuals to change risk category status on an annual basis. With this method, all of an individual's changes regarding, for example, family structure or level of education were accounted for across time. The risk categories of a certain year were linked to DP/no DP in a subsequent year. The hazard ratio (HR) for the total follow-up period was estimated by the pooled HR across the years with a 95% confidence interval. A joint control for age and calendar year was built into the program.

Two time-perspectives were used, a one-year follow up analysing the exposure situation just before being granted a DP, and a five-year follow up analysing the predictive value

of the exposure with a longer time of action. *One-year follow up:* The risk categorization was started in 1993 or the year of entry into the cohort, provided that the woman had reached the age of 20. Follow up was discontinued at the year of DP, emigration, death or end of 2003, whichever came first. Women with a DP at baseline were excluded.

Five-year follow up: Family structure was analyzed in the five-year follow up, using a similar methodology as in the one-year follow up. For each year for which a five-year follow up was possible (1993–1998), individual's exposure values were assessed and linked to their case status (DP/no DP) five years later. Individuals who received a DP or who emigrated or died before the end of a five-year period were deleted and also excluded from further follow up.

In an additional analysis, the women were required to be "healthy" at base line in order to reduce the possibility of selection bias (i.e., ill health influencing exposure). This was done by restricting the study base to women without a registered sickness absence during the three-year period preceding the year of exposure classification. The restriction was mainly meant to reduce the "healthy mother effect." [9] Sickness absence (with sickness benefits) corresponded to a medically certified sickness absence exceeding 14 days of sick leave. Sick leaves of fewer than 14 days were not considered.

RESULTS

Exploration of potential confounders (Table 1, 2)

From 1993 to 2003, 39,605 women aged 20 to 43 were granted a DP, corresponding to a rate of 39 per 10^4 person years; 4,345 DPs were granted to 20 to 25 year old women. The rate increased with increasing age.

DP was most common in rural areas and least common in metropolitan areas. Country of birth showed a considerable variation, with the highest rates for those born in Greece, Lebanon-Syria-Turkey, and the former Yugoslavia. The lowest rates were found for women born in the US, the UK/Ireland, East Asia including Thailand and Vietnam, and Western Europe including Germany (Table 1).

Women with low education were found to have an incidence of DP that was five times higher than for those with high education, and the same increase was found when comparing those who were not employed with those who were employed. Those employed in the national-level public sector had the highest incidence of DP, while the lowest rate was found for women in private employment. Number of days of unemployment tended to show an inverse relation to the risk of being granted a DP the following year. When it came to income, the rates were observed to increase as income level decreased (Table 1).

The results caused us to keep all the variables as potential confounders in the multivariate analyses of family structure.

Family structure and disability pension (Table 1, 2)

There was no remarkable difference between the crude rates for cohabiting and lone women, but the age-adjusted HR showed an 80 percent increase in risk for the lone women. Women with children had a somewhat higher crude rate of DP, but the age-adjusted results showed the opposite, a decreased HR compared to women without

children. The crude relative rates increased by number of children, but controlling for age decreased HRs were seen for one or more children, with the lowest HR for two children (Table 1).

In the one-year perspective (Table 2), the risk of DP among cohabiting women with children was lower than that of the reference group (cohabiting without children), regardless of their working status. A similar result emerged for the two types of models (adjusting for age only, and the full multivariate model). Overall, lone women showed higher HRs than cohabiting women, and among employed lone women, the HR was highest for those who had children. On the other hand, among lone women with no employment, the HR was highest for those with no children.

In the five-year follow up (Table 2), the pattern changed. Among both lone and cohabiting women, the HRs of receiving a DP tended to increase for women with children. This tendency was seen among both employed and not employed women. The pattern was similar for the two types of models, but the estimates were lower in the full multivariate models. The HRs of the full model were strengthened after controlling for health at the start of follow up, which implied a restriction of the study group to those who had not had a medically certified sickness absence within the three years prior to the assessment of family structure..

To further explore the validity of the effect of living with children in the five-year follow up, we added an analysis of the number of children based on the full model controlling for health at baseline (Figure 2). The results suggested that the risk of DP increased with number of children for both lone and cohabiting working women, especially among lone working women. Among women without an employment, there was only a weak indication in the same direction among cohabiting women.

DISCUSSION

The relations between family structure and DP were inconsistent and varied according to employment status and the time of follow up. Close in time to the outcome, cohabiting working women with children had the lowest risk of receiving a DP, while lone working women with children had the highest risk. The result was marginally changed when controlling for confounding. In the five-year follow up, on the other hand, living with children contributed in a consistent way to increasing the risk of later DP among working women.

The results for cohabiting working mothers suggested that living with children was related to a beneficial health effect when judged close in time to the outcome, which may be explained by a protective effect of social integration provided by living with a partner and children, but it may also be consequence of the short time perspective. These living conditions may show a beneficial effect for the near future but not necessarily in the long run. This was supported by the results of the five-year follow up, where the cohabiting working mothers were at a higher risk of receiving a DP compared to those without children. A portion of the cohabiting women who divorced within the five-year follow-up period may have experienced a difficult divorce or other setback. Those who divorced during this follow up were thus "misclassified" part of the five-year period and their risk of DP may therefore come closer to the pattern of lone mothers (in the one-year follow up they were classified as lone). Lone working mothers had the highest risk of DP both in the short- and long-term, which is in line with expectations. Previous studies have clearly pointed out the vulnerability of this group,

[28-29] which may be explained by the heavy workload and greater responsibility that is shouldered by many of these women, as well as weak financial resources.

The results suggest that the health effects observed in previous studies on this group of young women[21-23] may develop into illness entailing reduced work capacity and DP, particularly among lone working mothers.

The reasons behind the relatively high risk of receiving a DP that was found among lone women who were not employed and without children are not clear, but it is plausible that it may be connected to these individuals suffering from social isolation or marginalization that may have been the result of severe illness or handicap early in life.[30-32] Analyses of the medical diagnoses related to the DP could have helped explain these findings, but, unfortunately, such information on diagnosis-specific DP was not available for use in the study.

In the five-year follow up, we could at base line control for a selection bias that we have encountered in previous studies – the "healthy mother effect", implying that both partner status and the prevalence of children could be influenced by preceding illness causing the DP. The restriction of the study base to "healthy" women at start of a follow-up period strengthened the effect of having children in both cohabiting and lone working women. This suggests that selection bias should be considered in studies of family structure and health. In the one-year follow up, where the exposure was assessed very close in time to the outcome, a comparable analysis seemed less appropriate. The requirement of no sickness absence so close in time to the DP should entail a selection of specific DP diagnoses where injuries and accidents in particular would remain.

The results show the complexity of the relation between work-family structure and DP. Because of the size of the study base, there was a high degree of representativity and statistical precision. It also allowed us to evaluate the importance of different time spans between exposure and outcome. Potential confounding factors were explored, and their relation to DP was reported. This information adds to previous knowledge on predictors of DP [33,6] particularly due to the high precision at hand, and the availability and use of repeated measurements.

A considerable part of the social expenses due to DP should be attributed to lone working women with children. Their illness and decreased work capacity have implications not only for the mothers but probably also for the children. The increased risk of receiving a DP among lone women without children and without a job could indicate a different trajectory in that marginalization or social isolation may contribute to their health status and work incapacity, which needs further study. In addition, future studies should address the question about the potential health effects that may affect women who change their partner status from cohabiting mothers to lone mothers. Studies similar to the present but with a focus on men are also warranted.

FUNDING

The study was supported by the Swedish Council for Working Life and Social Research, Grant nr 2009-0453.

COMPETING INTEREST

The authors declare no conflicts of interest.

STUDY APPROVAL

The study was approved by the regional research ethics committee in Stockholm (Dnr: 2010/176-31/5).

FIGURE LEGENDS

Table 1. Demographic and socioeconomic factors related to disability pension in a one-year follow up during 1993–2003 among women in Sweden aged 20–43 years and born between 1960–1979.

	Person years	Crude rate[a]	Crude relative rate	Exp. cases	HR[b]	(95% CI)	
Total	10278639	39		39605			
Ages during follow up							
20–25 years	2909604	15	1.00	4345	1.00		
26–30 years	2964268	26	1.75	7755	1.66	1.60	1.72
31–35 years	2814482	47	3.14	13218	2.92	2.82	3.02
36+ years	1590285	90	6.02	14287	4.54	4.38	4.71
Residential area							
Sparsely populated areas	497386	44	1.00	2166	1.00		
Rural areas	507730	54	1.25	2755	1.28	1.21	1.35
City areas	5159644	41	0.94	21061	0.97	0.93	1.01
Metropolitan areas	4111669	33	0.76	13621	0.78	0.74	0.82
Country of birth							
Sweden	8807028	37	1.00	32678	1.00		
Denmark, Finland, Norway, Iceland	268139	53	1.43	1425	1.20	1.13	1.26
United Kingdom and Ireland	18296	21	0.56	38	0.49	0.36	0.68
Poland	62449	47	1.26	293	1.14	1.02	1.28
Eastern Europe incl. Romania, Hungary, former DDR and USSR	76647	30	0.81	229	0.71	0.62	0.80
Bosnia-Hercegovina	79481	35	0.94	276	0.83	0.74	0.94
Former Yugoslavia excl. Bosnia-Hercegovina	104404	76	2.05	794	1.72	1.60	1.84
Greece	11761	121	3.25	142	2.72	2.31	3.21
Western Europe incl. Germany	48946	25	0.67	121	0.60	0.50	0.71
Iraq	67727	42	1.13	283	0.98	0.87	1.10
Lebanon, Syria, and Turkey	143657	84	2.26	1204	2.24	2.12	2.38
South Central Asia incl. Iran	140861	53	1.43	746	1.34	1.25	1.44
Ethiopia and Somalia	57713	25	0.69	147	0.69	0.59	0.81
Africa excl. Ethiopia and Somalia	61247	46	1.25	283	1.12	1.00	1.26
East Asia incl. Thailand and Vietnam	144465	23	0.61	327	0.59	0.53	0.65
USA	25521	15	0.41	39	0.37	0.27	0.50
Chile	49665	48	1.29	237	1.27	1.12	1.44
South America excl. Chile	40229	32	0.87	130	0.84	0.71	1.00
Other Countries	70403	30	0.82	213	0.75	0.66	0.86

Education							
High, more than 12 years	3208713	17	1.00	5313	1.00		
Medium, 10–12 years	5674755	40	2.40	22577	2.72	2.64	2.80
Low, 9 years or less	1369063	83	5.04	11418	5.97	5.78	6.17

Employment							
Employed	8724849	23	1.00	19645	1.00		
Not employed	1553790	128	5.71	19960	6.76	6.63	6.90
Employment sector							
National public sector	672544	30	1.00	2042	1.00		
Local and County public sector	3417883	25	0.83	8649	0.83	0.79	0.88
Private sector	4082880	18	0.60	7435	0.66	0.63	0.70
Other sector	517698	29	0.95	1498	1.06	0.99	1.13
Days of unemployment							
0 days	7570643	42	1.00	31486	1.00		
1–15 days	273581	41	0.98	1114	1.25	1.18	1.33
16–30 days	238987	31	0.74	738	1.03	0.95	1.11
31–60 days	425404	28	0.68	1206	0.95	0.90	1.01
>60 days	1770024	29	0.69	5061	0.95	0.92	0.98
Income							
High, above 3rd quartile	2600723	34	1.00	8721	1.00		
Medium, 1st–3rd quartile	4937461	41	1.21	20095	1.59	1.55	1.63
Low, below 1st quartile	2554492	41	1.23	10559	2.32	2.25	2.39
Partner status							
Cohabiting	4750441	36	1.00	17304	1.00		
Lone	5528198	40	1.11	22301	1.82	1.79	1.86
Children							
Without (no) children	4886709	32	1.00	15464	1.00		
With children	5391930	45	1.41	24141	0.74	0.72	0.76
Number of children							
No Children	4886709	33	1.00	15464	1.00		
One child	1769317	38	1.16	6463	0.76	0.74	0.79
Two children	2504169	42	1.30	10573	0.66	0.65	0.68
Three or more children	1118444	64	1.95	7105	0.88	0.85	0.91

[a] Number of new disability pensions per 10,000 person years.
[b] Adjusted for age.

Table 2. Multivariate analyses relating family structure to disability pension in a one-year and five-year follow up during 1993-2003 among employed and not employed young women.

	Employed				Not employed			
	Exp. cases	HR	(95% CI)		Exp. cases	HR	(95% CI)	
One-year follow up								
Family structure[a]								
Total	19645				19960			
Cohabiting+no children	785	1.00			654	1.00		
Cohabiting+children	9320	0.80	0.74	0.86	6545	0.88	0.81	0.96
Lone+no children	5853	1.08	1.00	1.17	8172	2.05	1.89	2.22
Lone+children	3687	1.35	1.25	1.46	4589	1.64	1.51	1.78
Family structure[b]								
Total	19539				19742			
Cohabiting+no children	780	1.00			648	1.00		
Cohabiting+children	9268	0.73	0.68	0.78	6460	0.63	0.59	0.69
Lone+no children	5835	1.07	0.99	1.16	8099	1.35	1.24	1.46
Lone+children	3656	1.23	1.14	1.33	4535	0.99	0.91	1.08
Five-year follow up								
Family structure[a]								
Total	20170				9598			
Cohabiting+no children	616	1.00			241	1.00		
Cohabiting+children	9893	1.31	1.21	1.42	3954	1.39	1.22	1.58
Lone+no children	5945	1.10	1.01	1.19	3070	1.89	1.66	2.16
Lone+children	3716	2.35	2.16	2.57	2333	2.45	2.15	2.80
Family structure[b]								
Total	20057				9598			
Cohabiting+no children	615	1.00			241	1.00		
Cohabiting+children	9804	1.13	1.04	1.23	3954	1.09	0.95	1.24
Lone+no children	5938	1.07	0.98	1.16	3070	1.44	1.26	1.65
Lone+children	3700	1.69	1.55	1.85	2333	1.62	1.41	1.85
Five-year follow up "Healthy" at start of follow up:								
Family structure[b]								
Total	6705				3871			
Cohabiting+no children	215	1.00			117	1.00		
Cohabiting+children	2778	1.24	1.08	1.43	1447	1.18	0.97	1.42
Lone+no children	2618	1.23	1.07	1.42	1467	1.83	1.51	2.22
Lone+children	1094	1.91	1.64	2.22	840	1.94	1.59	2.36

[a] Adjusted for age.

[b] The model for employed included age, residential area, country of birth, education, income, employment sector, and days of unemployment. The model for not employed included age, residential area, country of birth, and education.

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STROBE Statement—checklist of items that should be included in reports of observational studies

	Item No	Recommendation
Title and abstract	1	(*a*) Indicate the study's design with a commonly used term in the title or the abstract
		(*b*) Provide in the abstract an informative and balanced summary of what was done and what was found
Introduction		
Background/rationale	2	Explain the scientific background and rationale for the investigation being reported
Objectives	3	State specific objectives, including any prespecified hypotheses
Methods		
Study design	4	Present key elements of study design early in the paper
Setting	5	Describe the setting, locations, and relevant dates, including periods of recruitment, exposure, follow-up, and data collection
Participants	6	(*a*) *Cohort study*—Give the eligibility criteria, and the sources and methods of selection of participants. Describe methods of follow-up *Case-control study*—Give the eligibility criteria, and the sources and methods of case ascertainment and control selection. Give the rationale for the choice of cases and controls *Cross-sectional study*—Give the eligibility criteria, and the sources and methods of selection of participants
		(*b*) *Cohort study*—For matched studies, give matching criteria and number of exposed and unexposed *Case-control study*—For matched studies, give matching criteria and the number of controls per case
Variables	7	Clearly define all outcomes, exposures, predictors, potential confounders, and effect modifiers. Give diagnostic criteria, if applicable
Data sources/ measurement	8*	For each variable of interest, give sources of data and details of methods of assessment (measurement). Describe comparability of assessment methods if there is more than one group
Bias	9	Describe any efforts to address potential sources of bias
Study size	10	Explain how the study size was arrived at
Quantitative variables	11	Explain how quantitative variables were handled in the analyses. If applicable, describe which groupings were chosen and why
Statistical methods	12	(*a*) Describe all statistical methods, including those used to control for confounding
		(*b*) Describe any methods used to examine subgroups and interactions
		(*c*) Explain how missing data were addressed
		(*d*) *Cohort study*—If applicable, explain how loss to follow-up was addressed *Case-control study*—If applicable, explain how matching of cases and controls was addressed *Cross-sectional study*—If applicable, describe analytical methods taking account of sampling strategy
		(*e*) Describe any sensitivity analyses

Continued on next page

Results		
Participants	13*	(a) Report numbers of individuals at each stage of study—eg numbers potentially eligible, examined for eligibility, confirmed eligible, included in the study, completing follow-up, and analysed
		(b) Give reasons for non-participation at each stage
		(c) Consider use of a flow diagram
Descriptive data	14*	(a) Give characteristics of study participants (eg demographic, clinical, social) and information on exposures and potential confounders
		(b) Indicate number of participants with missing data for each variable of interest
		(c) *Cohort study*—Summarise follow-up time (eg, average and total amount)
Outcome data	15*	*Cohort study*—Report numbers of outcome events or summary measures over time
		Case-control study—Report numbers in each exposure category, or summary measures of exposure
		Cross-sectional study—Report numbers of outcome events or summary measures
Main results	16	(*a*) Give unadjusted estimates and, if applicable, confounder-adjusted estimates and their precision (eg, 95% confidence interval). Make clear which confounders were adjusted for and why they were included
		(*b*) Report category boundaries when continuous variables were categorized
		(*c*) If relevant, consider translating estimates of relative risk into absolute risk for a meaningful time period
Other analyses	17	Report other analyses done—eg analyses of subgroups and interactions, and sensitivity analyses
Discussion		
Key results	18	Summarise key results with reference to study objectives
Limitations	19	Discuss limitations of the study, taking into account sources of potential bias or imprecision. Discuss both direction and magnitude of any potential bias
Interpretation	20	Give a cautious overall interpretation of results considering objectives, limitations, multiplicity of analyses, results from similar studies, and other relevant evidence
Generalisability	21	Discuss the generalisability (external validity) of the study results
Other information		
Funding	22	Give the source of funding and the role of the funders for the present study and, if applicable, for the original study on which the present article is based

*Give information separately for cases and controls in case-control studies and, if applicable, for exposed and unexposed groups in cohort and cross-sectional studies.

Note: An Explanation and Elaboration article discusses each checklist item and gives methodological background and published examples of transparent reporting. The STROBE checklist is best used in conjunction with this article (freely available on the Web sites of PLoS Medicine at http://www.plosmedicine.org/, Annals of Internal Medicine at http://www.annals.org/, and Epidemiology at http://www.epidem.com/). Information on the STROBE Initiative is available at www.strobe-statement.org.

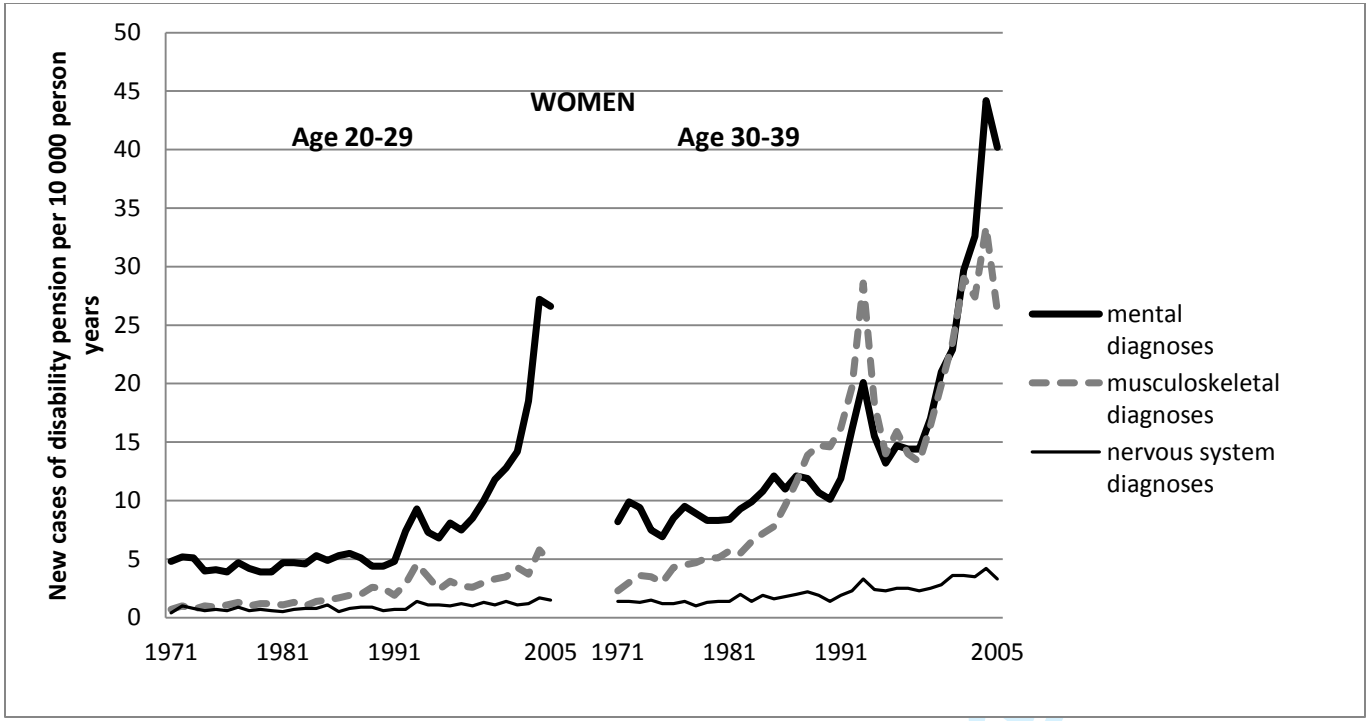

Figure 1. New cases of disability pension among women 20-29 and 30-39 years of age, due to mental diagnoses (ICD-10: F00-F99), musculoskeletal diagnoses (ICD-10: M00-M99), and diagnoses of the nervous system (ICD-10: G00-G99). Sweden 1971-2005. Data source: The Swedish Social Insurance Agency (reference 4). (Differences in ICD coding during the time period were harmonized).

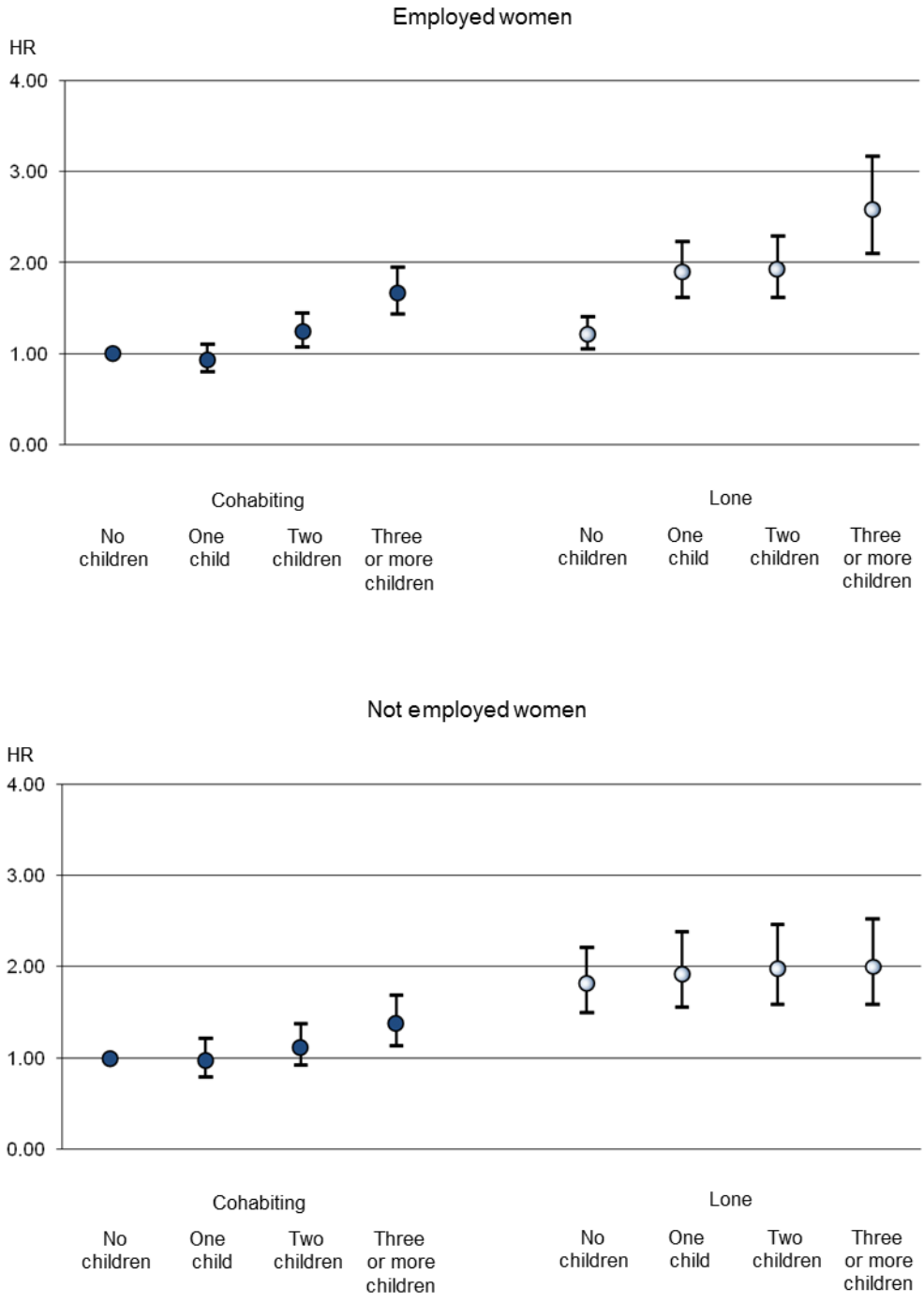

Figure 2. Hazard ratios of DP according to family structure among employed and not employed young women: a five-year follow up based on women with no sickness absence during the three years before exposure assessment, and with control for potential confounders.