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► **To cite this version:**

Margit Kriegbaum, Anne Mette Larsen, Ulla Christensen, Rikke Lund, Merete Osler. Reduced probability of smoking cessation in men with increasing number of job losses and partnership breakdowns. *Journal of Epidemiology and Community Health*, 2010, 65 (6), pp.511. 10.1136/jech.2009.100446 . hal-00591156

HAL Id: hal-00591156

<https://hal.science/hal-00591156>

Submitted on 7 May 2011

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Title: Reduced probability of smoking cessation in men with increasing number of job-losses and partnership breakdowns

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Keywords: unemployment; marital status; smoking cessation; life-course

Word count: main text 2988 words, abstract 234 words, 3 tables

Abstract

Background: Unemployment and partnership breakdowns are common stressful life events, but their association with smoking cessation has been investigated in a few studies only. *Objective:* To investigate how history of employment and cohabitation affect the probability of smoking cessation and to study joint exposure to both. *Methods:* Birth-cohort study of smoking cessation of 6,232 Danish men born in 1953 with follow-up at age 51 (response rate 66.2 %). History of unemployment and cohabitation was measured annually using register data. Information on smoking cessation was obtained by questionnaire. *Results:* Probability of smoking cessation decreased with number of job-losses (ranging from 1 OR 0.54 95% CI (0.46-0.64) to 3+ OR 0.41 95% CI (0.30-0.55)) and of broken partnerships (ranging from 1 OR 0.74 95% CI (0.63-0.85) to 3+ OR 0.50 95% CI (0.39-0.63)). Furthermore, smoking cessation was associated with the duration of the periods of unemployment (ranging from 1-5 years OR 0.75 95% CI (0.65-0.85) to 10-23 years OR 0.29 95% CI (0.22-0.38)) and with living without a partner for more than five years (ranging from 6-9 years to 10 to 23 years OR 0.80 95% CI (0.66-0.97) to 10-23 years OR 0.44 95% CI (0.37-0.52)). Those who never cohabited and experienced one or more job-losses had a particular low chance of smoking cessation (OR 0.19 95% CI (0.12-0.30)). *Conclusion:* Number of job-losses and of broken partnerships were both inversely associated with probability of smoking cessation.

INTRODUCTION

Smoking is recognized as one of the most important causes of morbidity and premature mortality in industrialised countries. [1;2] Smoking cessation has an important impact in improving health. [3] Most smokers start in their teenage years [4] and while the majority of those who start continue to smoke throughout their adult lives, [5] some smokers quit spontaneously. Socioeconomic differences exist in smoking cessation with the more advantaged being more likely to quit. [6;7] Other factors such as stressful life-events might play a role in smoking cessation. Some studies suggest that smoking is used to cope with stress and stressful life-events. [8;9] Unemployment and divorce or partnership breakdown are stressful life-events which may impede a change of lifestyle and hinder attempts to quit smoking. Few studies have focused on the association between these events and smoking cessation. Unemployed individuals have been reported to be less likely to quit smoking. [10;11] However, other studies did not find statistically significant differences. [12] Among unemployed Fagan et al. [13] found that the probability of quitting was higher among those unemployed for more than 6 months than for those unemployed for a shorter period. Furthermore, some studies have found that smoking predicted unemployment. [12;14] Married people have more success in quitting smoking compared to the never married, separated, and divorced. [12;15;16] Broms et al. [17] found that living with a partner was not associated with smoking cessation.

However, in the same study, getting, or remaining married was associated with higher chances of smoking cessation in men compared to those who remain single in men. In a panel study by Nystedt [15] getting divorced was associated with lower chances of smoking cessation.

In life-course epidemiology the accumulation hypothesis states that the risk of poor health outcomes increases with the number of risk factors or duration of the exposure. This hypothesis has been tested related to cardiovascular disease, for which smoking is a major risk factor. To our knowledge, no studies have related accumulation of specific stressful life-events to smoking behaviours. In this study we examined the influence of history of unemployment and cohabitation over 22 years on smoking cessation. The aim of our study was to investigate the association between the history of unemployment and cohabitation and smoking cessation in mid-life and to assess whether any association depends on the number of events or the duration of an unfavourable situation. Additionally, we set out to study how the joint exposure to history of unemployment and cohabitation is related to the probability of smoking cessation.

METHODS

This study is based on a subpopulation of the metropolit project, which comprises all 12,270 boys born within the metropolitan area of Copenhagen in 1953. In 1968, the Danish Civil Registration System (CRS) was established, and each Danish resident was registered with a personal identification number (PIN): The 11,532 members of the original metropolit population who survived until 1968 were given identification numbers by the authorities. Data from birth certificates were gathered in 1965. In 2004 the members of the cohort who were still alive and living in Denmark were sent a questionnaire about health behaviours social networks etc. Of the 9,507 eligible cohort members 6,292 (66.2 %) responded. Furthermore, the cohort was linked to registers with socioeconomic information in Statistics Denmark 1980-2003 using the PIN as a key and also with the Central Psychiatric Register and, the Central Hospital Register. We included only those from the 2004 survey participants who in addition to answering the questionnaire had a full record of register-data for the years 1980-2003 (N=6,232).

Outcome variables

The measure of smoking cessation was based on self-reported information from the 2004 survey. A recent review [18] of the accuracy of self reported smoking found that there was under-reporting compared to its prevalence found by measurement of cotinine. The under-reporting of current

smoking was more pronounced in groups in which smoking was stigmatized such as pregnant women and heart patients. The present study was based on middle-aged men from the general population and we do not judge that under-reporting is particularly pronounced in this group. The response to the question “Do you smoke?” was used to divide the participants into 3 groups: 1) current smokers (smoke on a daily basis and smoke but not every day) 2) ex-smokers 3) never smokers. The analyses of factors associated with smoking cessation were based on comparisons between ex- and current smokers, omitting the last category.

Assessment of history of cohabitation and labour-market participation

Information on history of unemployment and cohabitation was based on annual records from Statistics Denmark for the period 1980 to 2003 when cohort members were between 28 and 49 years old. Hence, it is possible to study the change of labour-market attainment as well as cohabitation status from one calendar-year to the next. Based on this information we constructed four exposure variables: *number of job-losses*, *years unemployed*, *number of broken partnerships* and *years living without a partner*.

Job-loss was defined as a change in individual labour-market participation that involved a period of unemployment and was categorized as follows: no job-losses (ref), one job-loss, two job-losses, three or more job-losses. Job-loss status was assigned to the categories based on change of employer’s identification code. We restricted the category of job-loss to men who had been unemployed for at least three months of the calendar-year in order to exclude those who changed job with short or no intervening period of unemployment. Men with no job-losses were classified as continuously employed. Few (n=18) in the cohort were permanently outside the labour-market during the entire period and this group was pooled with the reference group i.e. those with no job-losses. [19] *Years unemployed* was based on information from Statistics Denmark about labour-market status for each calendar-year, which was determined by the main source of income for that year. The group of unemployed **comprises both individuals who were unemployed the entire calendar-year and those who had short spells of employment, but were mainly unemployed**. We grouped the men as either working (employed or self employed) or not working (due to unemployment or for health reasons). *Years unemployed* was the sum of years in the non-working group between the ages of 28 and 49. This information was classified into four groups: no unemployment (ref), 1 to 5 years, 6 to 9 years and over 9 years of unemployment.

In this study, men living within either marriages (**heterosexual and homosexual (allowed since 1989)**) or consensual unions (**heterosexual only**) were grouped. Two individuals living at the same address were classified as a consensual union if they had common children *or* were of opposite sex, *and* both were at least 16 years old, *and* the age-difference was less than 15 years, *and* they were not related, *and* there were no other adults in the household. The partner's identification-number enabled to follow changes from one partner to another. We divided the cohort members into five groups according to their history of cohabitation between 1980 and 2003: 1) consistently cohabiting with the same partner (**ref**), 2) never cohabited, not living with a partner at any time during this period, 3) one broken partnership, 4) two broken partnerships, 5) three or more broken partnerships. We maintained the "never cohabited" as a separate group because of its size (n=314) and because other studies of this cohort [20] and of other populations [21] have indicated high mortality in this group. A *broken partnership* was defined as the end of cohabitation. The classification comprises individuals who were formerly cohabiting but during any year were living without a partner or with a new partner. Very few of the married men became widowers (n=40) during follow-up and these cases were classified as broken partnerships. [19] *Years living without a partner* was based on information from Statistics Denmark about cohabiting partners for each calendar-year assessed as described above. The sum of years in the ages 28-49 years the individual lived without a partner was classified in four groups (always living with a partner (**ref**), 1 to 5 years, 6 to 9 years and above 9 years).

Assessment of covariates

In this study we included information about psychiatric admissions that occurred before the measurement of job-losses and broken partnerships as confounders, while later admissions, which might be a consequence of these events, were not included. Information about *admission to a psychiatric ward* was obtained from the Central Psychiatric Register for the period 1968 to 1981, when the cohort members were 15 to 28 years old. We coded the admissions as either no admissions or at least one admission. From the social registers from 1980, we used '*educational attainment*' coded into 'high' (at least secondary education) and 'low' (primary education only). *Age at smoking initiation* has been related to later "smoking career". [22] Those who start to smoke early may experience poor health at a young age which might influence their labour-market participation and family-life. However, there is no agreement about which age of smoking initiation is critical for later smoking outcomes. We included information on *age at smoking initiation* as

reported in the questionnaire from 2004 and used different cut-points between the ages of 11 and 16 and found that the younger at smoking initiation the less likelihood of quitting smoking. However, the choice of cut-point did not change the association between exposures and smoking cessation. In the final analyses, we used 13 years as the cut-point. This corresponds to 22 % of the cohort-members. We included the amount of tobacco smoked (currently for current smokers and in the past for ex-smokers) from self-reported accounts of numbers of cigarettes, pipes, cigarillos, and cigars per day and calculated the amount of tobacco per day in grams.

Statistical methods

We used logistic regression to analyse the associations between smoking cessation and history of cohabitation and job-losses. The analyses were based on men who had smoked at some time (n=4,665), i.e. leaving out never smokers. We analysed the four exposure variables (*number of job-losses, number of broken partnerships, length of periods of unemployment living without a partner*) in a series of separate models (one to five) where the covariates were included one at the time. In a sixth model we adjusted *number of job-losses* for *number of broken partnerships* and *years without employment for years living without a partner*.

The score test in 'proc logistic' was used to test for trend (Cochran Armitage test) in models with exposure-variables included as continuous variables. Statistical interaction was tested by adding an interaction term to the models. However, the separate and joint effects were showed as by two new composite variables 1) the categories of job-loss were grouped as none versus any; and the categories of broken partnerships were grouped as none, never cohabited, and at least one broken partnership. The variables for job-losses and broken partnerships were combined leaving six combinations, the doubly-unexposed group being used as reference group. 2) time unemployed and time living without a partner was combined as unexposed to both, exposed to unemployment (1 or more years), exposed to living alone (1 or more years) and exposed to both. SAS (ver. 9,1) was used for all analysis.

RESULTS

Of the 6,262 cohort members included in this study 2,646 (42.5 %) were smokers at the time of the survey, 2,019 (32.4 %) had quit smoking, and 1,567 (25.1 %) had never smoked. Table 1 shows the distribution of smoking status in relation to job-losses, broken partnerships, years of unemployment, years living without a partner, educational attainment, psychiatric admissions, age at smoking

initiation and mean amount of tobacco consumed. Compared to ex-smokers and to never smokers, current smokers more often experienced job-losses, broken partnerships, and longer periods of unemployment or of living without a partner. Those with less education, psychiatric admissions, and those who started smoking at age 13 or younger were more likely to be current smokers.

Table 1: Distribution (in number and %) of history of job-losses and history of cohabitation (age 28-50 years), educational attainment and psychiatric admission in relation to smoking in men aged 51

History of job-losses/unemployment (1980-2003)	Current smoker 2646	Ex smoker 2019	Never smoker 1567
No job-losses	1672 (63.2%)	1586 (78.6%)	1297 (82.8 %)
1 job-loss	547 (20.7%)	278 (13.8 %)	178 (11.4 %)
2 job-losses	250 (9.5%)	93 (4.6 %)	52 (3.3 %)
3+ job-losses	177 (6.7%)	62 (3.1 %)	40 (2.6 %)
Time unemployed	1162 (43.9%)	1169 (57.9 %)	1038 (66.2 %)
1-5 years	924 (34.9%)	673 (33.3 %)	445 (28.4 %)
6-9 years	228 (8.6%)	88 (4.4 %)	49 (3.1 %)
10-23 years	332 (12.6%)	89 (4.4 %)	35 (2.2 %)
Continuously cohabited (1980-2003)	947 (35.8%)	970 (48.0 %)	752 (48.0 %)
Never cohabited 1980-2003	202 (7.6%)	69 (3.4 %)	103 (6.6 %)
1 Broken partnership	790 (29.3%)	599 (29.7 %)	435 (27.8 %)
2 Broken partnership	426 (13.9%)	251 (12.4 %)	187 (11.9 %)
3+ Broken partnership	281 (10.6%)	130 (6.4 %)	90 (5.7 %)
Time living without a partner	697 (26.3%)	685 (33.9 %)	495 (31.6 %)
1-5 years	703 (26.6%)	672 (33.3 %)	490 (31.3 %)
6-9 years	346 (13.1%)	269 (13.3 %)	200 (12.8 %)
10-23 years	900 (34.0%)	393 (19.5 %)	382 (24.4 %)
High educational attainment	1534 (58.0%)	1395 (69.1 %)	1205 (76.9 %)
Low educational attainment	1112 (42.0%)	624 (30.9 %)	362 (23.1 %)
No psychiatric admissions	2535 (95.8%)	1975(97.8 %)	1553 (99.1 %)
Psychiatric admissions	111 (4.2%)	44 (2.2 %)	14 (0.9 %)
Started smoking at 14 or older	1988 (77.7 %)	1569 (83.8 %)	NA
Started smoking at 13 or younger	571 (22.3 %)	304 (16.3 %)	NA
Nicotine consumption g/day mean (SD)	20.8 (13.0)	21.3 (16.5)	NA

Table 2 shows the crude and adjusted odds of smoking cessation. The probability of smoking cessation decreases with the number of job-losses and broken partnerships. Living without a partner for more than five years was associated with poorer chance of smoking cessation, and this was further decreased among those living without a partner for more than nine years. However, living without a partner for between one and five years was not associated with smoking cessation. All estimates indicated that the risk of smoking increased with the number of stressful events or duration of exposure. The tests for trend all confirmed this association ($p < 0.0001$). We found that the covariates attenuated the associations to a smaller extent. Finally, we included job-losses and broken partnerships in the same model and similarly for years unemployed and years living without a partner which attenuated the estimates to a larger degree.

Table 2: The association (Odds Ratios) of history of job-losses and history of cohabitation (age 28-50 years), educational attainment and psychiatric admission with smoking cessation in men aged 51

History of unemployment and cohabitation (1980-2003)	Model 1	Model 2	Model 3	Model 4	Model 5	Model 6
Number of events						
No job-losses	1 (ref)	1 (ref)	1 (ref)	1 (ref)	1 (ref)	1 (ref)
1 Job-loss	0.53 (0.45-0.63)	0.54 (0.46-0.63)	0.54 (0.46-0.64)	0.55 (0.46-0.65)	0.54 (0.46-0.64)	0.60 (0.50-0.71)
2 Job-losses	0.41 (0.32-0.53)	0.42 (0.33-0.54)	0.44 (0.34-0.57)	0.44 (0.34-0.57)	0.44 (0.34-0.57)	0.49 (0.38-0.63)
3+ Job-losses	0.38 (0.28-0.51)	0.39 (0.29-0.53)	0.41 (0.30-0.55)	0.41 (0.30-0.56)	0.41 (0.30-0.55)	0.47 (0.34-0.64)
Continuously cohabited (1980-2003)						
Never cohabited 1980-2003	1 (ref)	1 (ref)	1 (ref)	1 (ref)	1 (ref)	1 (ref)
1 Broken partnership	0.31 (0.23-0.42)	0.32 (0.23-0.43)	0.32 (0.23-0.43)	0.32 (0.24-0.44)	0.32 (0.23-0.43)	0.38 (0.28-0.52)
2 Broken partnership	0.73 (0.63-0.84)	0.74 (0.64-0.85)	0.73 (0.64-0.85)	0.74 (0.64-0.85)	0.73 (0.63-0.85)	0.79 (0.68-0.91)
3+ Broken partnership	0.59 (0.49-0.71)	0.59 (0.49-0.71)	0.59 (0.49-0.71)	0.60 (0.50-0.72)	0.59 (0.49-0.72)	0.65 (0.54-0.79)
	0.48 (0.38-0.61)	0.50 (0.39-0.62)	0.50 (0.40-0.63)	0.50 (0.40-0.63)	0.50 (0.39-0.63)	0.56 (0.44-0.71)
Duration of exposure						
Time unemployed	1 (ref)	1 (ref)	1 (ref)	1 (ref)	1 (ref)	1 (ref)
1-5 years	0.74 (0.65-0.85)	0.75 (0.66-0.85)	0.75 (0.66-0.86)	0.75 (0.66-0.86)	0.75 (0.65-0.85)	0.79 (0.69-0.91)
6-9 years	0.40 (0.31-0.52)	0.41 (0.32-0.54)	0.42 (0.32-0.55)	0.42 (0.32-0.55)	0.42 (0.32-0.55)	0.50 (0.38-0.66)
10-23 years	0.27 (0.21-0.35)	0.28 (0.22-0.36)	0.30 (0.23-0.38)	0.30 (0.23-0.39)	0.29 (0.22-0.38)	0.41 (0.31-0.54)
Time living without a partner	1 (ref)	1 (ref)	1 (ref)	1 (ref)	1 (ref)	1 (ref)
1-5 years	1.01 (0.86-1.17)	1.01 (0.87-1.18)	0.97 (0.83-1.14)	0.98 (0.84-1.14)	0.98 (0.84-1.14)	1.03 (0.88-1.20)
6-9 years	0.83 (0.68-1.01)	0.83 (0.68-1.01)	0.80 (0.65-0.97)	0.80 (0.65-0.97)	0.80 (0.66-0.97)	0.88 (0.72-1.08)
10-23 years	0.44 (0.38-0.52)	0.45 (0.38-0.53)	0.44 (0.37-0.52)	0.45 (0.38-0.53)	0.44 (0.37-0.52)	0.56 (0.47-0.67)

Model 1 unadjusted model

Model 2 adjusted for age at smoking initiation

Model 3 adjusted for age at smoking initiation and educational attainment

Model 4 adjusted for age at smoking initiation, educational attainment, and psychiatric admissions

Model 5 adjusted for age at smoking initiation, educational attainment, psychiatric admissions, and daily nicotine consumption

Model 6 adjusted for age at smoking initiation, educational attainment, psychiatric admissions, daily nicotine consumption, number of job-losses adjusted for number of broken partnerships and vice versa, years without employment adjusted for years living without a partner and vice versa

We tested statistical interaction between history of unemployment and history of cohabitation in the probability of smoking cessation in two models: interaction between job-losses and broken partnership ($p=0.04$) and interaction between years unemployed and years living without a partner ($p=0.76$). Table 3 shows the separate and joint effects. Those with combined exposure of job-loss and broken partnership have a low probability of smoking cessation compared to the reference group and to those with just one of the exposures. Moreover, the never cohabitant who experienced one or more job-losses had a five times lower probability of smoking cessation compared to the doubly-unexposed group. The combined exposure to time living without a partner and time without employment was also associated with lower probability of smoking cessation.

Table 3: Adjusted Odds Ratios (OR) and 95 % Confidence Intervals (CI) for smoking cessation in relation to combinations of history of cohabitation and job-losses (age 28-39)

	No of cases	OR (95 % CI)
No broken partnerships, no job-loss	707	1 (ref.)
Never cohabitant, no job-loss	83	0.43 (0.29-0.65)
Broken partnership, No job-loss	825	0.77 (0.66-0.89)
No broken partnership,+ job-loss	213	0.68 (0.53-0.86)
Never cohabitant, + job-loss	113	0.19 (0.12-0.30)
Broken partnership, + job-loss	618	0.37 (0.31-0.45)
Time unemployed and living with a partner		
No years unemployed and no years living without a partner	456	1 (ref.)
No years unemployed, 1+ year living without a partner	617	0.81 (0.68-0.96)
1+ year unemployed, no years living without a partner	176	0.69 (0.55-0.88)
1+ year unemployed and 1+ year living without a partner	624	0.50 (0.43-0.59)

DISCUSSION

In this study we found consistent support for the accumulation hypothesis as both number of job-loss and broken partnerships were inversely related to smoking cessation. Furthermore, the chance of smoking cessation decreased with duration of unemployment and of living without a partner. Those with exposure to both job-losses and broken partnerships had low probability of smoking cessation; and particularly the never cohabiting with job-losses had low probability of smoking cessation.

We found no studies that investigated accumulation of the same factors related to smoking cessation. However, some studies have focused on related issues and some have linked accumulation of social risk factors to health behaviours. Nystedt [15] investigated the associations between smoking behaviour and marital life-course changes. He found that those who divorced or had never cohabited were less likely to cease smoking while this did not apply to those with multiple changes in marital status. However, multiple marital changes and divorce was associated with starting to smoke. The multiple marital changes in Nystedt's study are not entirely comparable to the present study as they might involve multiple changes in an out of marriage as a result of divorce, remarriage and widowhood while the present study considered only cessation of partnerships. Montgomery et al. [23] found that the risk of being a smoker increased with time spent unemployed between the ages of 16 and 33. Although these studies use different smoking outcomes, they both agree with the present study in that the accumulation of exposures related to the labour-market is associated with smoking behaviours.

Strengths and limitations

This study used prospectively collected information; the measures of history of employment and cohabitation were based on register data, which provided complete histories of cohabitation and employment from 1980 to 2003 of all cohort members who were alive and living in Denmark during this period. This allows studying both number of events and duration of exposures in a 22-year period. However, register data was limited in that they are based on annual information only. Register data were not available before 1980 when the cohort members were 28 years old; however we believe that the participation in labour-market and family-life is important in the ages 28 to 49 years. The non-respondents of the questionnaire had poorer socioeconomic characteristics than responders. However, a previous study of loss to follow-up in the same population showed that the association with smoking outcomes was similar in respondents and non-respondents. [24] This

study included only men and **mainly heterosexual relationships**, and it is very likely that exposures related to labour-market and family-life affect women differently. [25] **Smoking status can change several times and these changes have been related to job-losses and broken partnerships in other studies. [26;27] However, smoking was measured only once in the metropolit project and we were not able to study how exposures were related to changes in smoking behaviours.**

We found that the association between history of unemployment and smoking cessation differed when history of cohabitation was included and vice versa. In this study design it was not possible to determine whether they each acted as confounders or as mediators for each other as they were measured during the same time span. We found that the associations between history of unemployment and partnership and smoking were affected to a small degree by inclusion of psychiatric admissions. However, this might be due to the fact that only the more severe cases of psychiatric illness are registered in hospital records. Milder cases of mental disorders might influence on the results, but unfortunately this information was unavailable. **Further, factors such as social support, depression and nicotine dependence were either unmeasured or measured simultaneous with the outcome. Thus, future studies with information on the temporal order of these factors could spread light on the role of these in relation to accumulated events and smoking behaviours.** Future life-course studies that include both disease outcomes and behavioural variables could focus on the question of whether the association between accumulated social risk factors and disease are mediated by health behaviours.

In conclusion, the results of the present study indicate that exposure to accumulated stressful life events, or longer periods of exposure are associated with lower probability of smoking cessation. Those unemployed for more than nine years have a low probability of ceasing to smoke. As this group has no, or very infrequent, contact with the labour-market they do not benefit from smoking-reduction programmes provided at work. The never cohabited also have low probability of smoking cessation; job-loss worsens the chance of quitting. These groups could be targets for special attention from general practitioners. Furthermore, universal policies such as regulation of tobacco could have an effect on these groups.

Acknowledgement:

The authors thank K Svalastoga, E Høgh, P Wolf, T Rishøj, G Strande-Sørensen, E Manniche, B Holten, I A Weibull and A Ortmann who established the data between 1965 and 1983.

Competing interests: All authors have nothing to declare.

Funding:

The Danish Medical Research Council, The Danish Health Insurance Fund, Wedell-Wedellsborg Foundation, Krista and Viggo Petersen Foundation. The funding bodies have not influenced the analysis of data or their interpretation.

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