Participation in a follow up study of health among unemployed and employed people after a company closedown: drop outs and selection bias

LARS IVERSEN¹ AND SVEND SABROE²

From the Institute of Social Medicine,¹ University of Copenhagen, Denmark; and the Institute of Social Medicine,² University of Aarhus, Denmark

SUMMARY This article presents an analysis of study loss in a three year longitudinal study of 1816 employees at two Danish shipyards, one of which closed just before the start of the study. The aim of the study was to elucidate the health consequences of a company closedown and the subsequent job loss.

The study population responded to an identical questionnaire in 1983, 1984 and 1985. The participation rate in 1983 was 73%. The percentage of drop outs in 1984 and 1985 was 15–20% of the total numbers responding in the first year. We examined this study loss in relation to the characteristics of the respondents, using the first round of data collection as a baseline. In a multivariate analysis, age and seniority at the shipyard were the only variables that were significantly associated with non-participation in 1984 and 1985.

It is concluded that the drop outs did not appear to introduce a serious risk of selection bias in 1984 and 1985. A comparison between drop outs and late respondents in 1984 and 1985 did not support the supposition that information about late respondents can be extrapolated to drop outs.

Experience has shown that the rate of non-participation in studies using several rounds of data collection can be high. Longitudinal studies on unemployment and health have reported a study loss from the initial study population ranging from about a third¹ to half or more than half.^{2–4}

Regardless of the extent, study loss must always give rise to considerations about selection bias. Several studies have shown that non-participants can be markedly different from participants with regard to, for example, occupation, marital status, age, health status and lifestyle, eg, alcohol use and smoking.^{5–11} The information available on this issue is, however, not consistent. Consequently, non-participants cannot a priori be considered to be a random sample of the total study population, even though in practice most studies have no alternative to this assumption because the study loss cannot be described more precisely in relation to the aims of the study, owing to the lack of information.

Selection bias is only a problem for the calculated risk estimates if participation is associated with exposure and outcome variables or with confounding factors.^{12 13} In studies on the health consequences of unemployment the difference between the health

status of employed and unemployed people can be misjudged if non-participation is associated with both health and employment status. If study loss is especially high among unemployed people in poor health, this will imply an underestimation of the difference, whereas if study loss is especially high among employed people in good health, this will imply an overestimation of the difference.

In longitudinal studies in which data collection is based on interviews or questionnaires, study loss can be divided¹³ into *non-respondents*, who did not participate in the first round of data collection and who consequently will not be included in the study; and *drop outs*, who participated in the first round of data collection but not in the subsequent rounds. The empirical possibilities for examining these two types of non-participant differ greatly. In the best situation, non-respondents can be described through the standard information gained from other data sources, for example the registers that have provided the basis for establishing the study population. Typically, one can describe how the non-respondents differ from the respondents with respect to sex, age, occupation, social class and the like. Obviously, information is not provided on the ways in which non-respondents differ

from respondents with regard to central variables such as the outcome variables. The value of such study loss analyses is therefore limited. Other studies of non-respondents use different data collection methods, for example self administered questionnaires supplemented by telephone interviews or personal contacts with the non-respondents.

Analyses of drop outs differ in that several items of information are available from the first round, which makes it possible to evaluate whether the number and type of drop out have affected the main results of the study to any significant degree. Drop out analyses can, however, only clarify whether drop outs have introduced any extra bias apart from the bias that may already exist owing to non-respondents who did not reply in the first round and who therefore cannot be incorporated in the study.

This article presents an analysis of drop outs in a three year longitudinal study of employees at two Danish shipyards, one of which closed just before the first round of data collection. The aim of the study was to elucidate the health consequences of job loss following a company closedown. Data collection was undertaken over a three year period by means of yearly mail questionnaires. The study loss analyses presented here concern those people who participated in the first round (T1) but in only one or none of the subsequent rounds (T2 and T3). Results from the main study have been published elsewhere.^{14 15} Drop outs have been compared with participants in relation to a number of factors central to the aim of the study. A comparison between late respondents at T2 and T3 and drop outs was carried out as well.

Methods

The study population was established on the basis of personnel registers from Helsingør and Dannebrog Shipyards. Helsingør Shipyard closed down in 1983, whereas Dannebrog Shipyard is still operating. The study population from Helsingør Shipyard comprised all the salaried staff and all the male wage earners who in 1982 had been employed at the shipyard for at least 6 months. The study population from Dannebrog Shipyard comprised all the male wage earners who were employed in September 1983.

Questionnaires in Danish were dispatched to the study population, which only comprised people with Danish citizenship. (More than 10 different nationalities were represented at the two shipyards in 1983.) The final study population in the first round (T1) in 1983 consisted of 2504 people, 1816 of whom responded to the questionnaire. The participation rate was 73%. The number of non-respondents among the wage earners at Helsingør Shipyard was particularly high. The 1816 respondents were then included in the

second and third rounds in 1984 (T2) and 1985 (T3) respectively. This population comprised several subpopulations, as it included male salaried staff (273), male wage earners (1328), female salaried staff (61) and people outside the labour market (154, primarily early retirement pensioners and students).

We chose to carry out study loss analyses of the male salaried staff and wage earners at T1 (1601), as the group of female salaried staff was quite small and the group of people outside the labour market had no relevance to the aim of the study. Table 1 shows the size of the study population at each round of data collection, and the participation rate. Before each round people who in the intervening period had either retired or left the labour market for other reasons (eg, emigrated or died) were excluded. It can be seen that the 1601 participants in 1983 were reduced to 1594 in 1984 and finally to 1532 in 1985, the participation rate being 83.6% in 1984 and 80.4% in 1985.

Table 1 Study population, respondents and participation rate in 1983 (T1), 1984 (T2) and 1985 (T3)

	Study population	Respondents	Participation rate (%)
T1 1983	1601	1601	—
T2 1984*	1594	1333	83.6
T3 1985†	1532	1231	80.4

* Excluded in 1984: emigrated (2); died (5); total 7

† Excluded in 1985: retired (25); students (13); others (14); unknown (3); Emigrated (1); died (6); total 62

In November 1983, 1984 and 1985 a questionnaire was dispatched, consisting of about 70 questions on, for example, employment status, health (eg, chronic self reported health problems, psychological well being, psychosomatic symptoms and cardiovascular symptoms), social support, life events, alcohol use and drinking problems, tobacco use and use of doctor and hospital.

Psychological well being was measured through the 12 item version of the General Health Questionnaire.^{16 17} The questions concerned conditions such as self confidence, ability to concentrate, depression and lack of initiative. The total score for all 12 questions can range from 0 to 36. The score was dichotomised at 0–14 and 15–36 points. A low score represents positive well being. Psychosomatic symptoms were limited to headaches, stomach complaints and sleeplessness. Life events cover 17 different events such as a seriously ill spouse or child, death of a close family member and serious conflicts in the family or at work. Social support was measured through five questions: whether the person lived with someone else, whether he had frequent contact with family and friends and whether he had

someone to confide in. A social support variable has been established that includes both quantitative and qualitative aspects of social support. The variable assumes a value of 1 if a person lives with someone else or has frequent contact with family and friends (several times a week), and if he has someone to confide in. If none of these conditions are fulfilled, the social support variable assumes a value of 0.¹⁵

At each data collection round two postal reminders were dispatched at two week intervals, enclosing an additional questionnaire, a prepaid reply envelope and a request from the participant's union representative to join in the study.

STATISTICAL ANALYSIS

We have used the χ^2 test with Yates' correction for continuity and Cochran's test for trends in the bivariate analyses. Logistic regression has been used for the multivariate analyses.

Results

It can be seen from table 2 that age, seniority at the shipyard, duration of unemployment in 1983 and financial difficulties were associated with lower participation in 1984. In 1985, non-participation was further associated with occupation, social support and alcohol problems. Participation in 1984 and 1985 was not associated with psychological well being, psychosomatic symptoms, chronic health problems or number of doctors' consultations in 1983.

Several of these variables are interrelated. This applies, for example, to age and seniority. It was therefore necessary to carry out a multivariate analysis, with the aim of estimating the significance of each individual variable in relation to participation after adjusting for the other variables. The variables we chose for this analysis were ones that on a bivariate level proved to be significantly associated with participation. In addition, we chose variables that were considered particularly essential in relation to the aim of the study. This applies especially to the outcome variables "psychological well being" and "psychosomatic symptoms" in 1983, which were not associated with responding to the questionnaire in 1984 or 1985.

Table 3 shows that the relative risk of non-participation in 1983 was significantly higher for people with under 10 years of seniority (odds ratio [OR] = 1.57), 11-12 months' unemployment in 1983 (OR = 2.15) and aged 30-49 years (OR = 1.63). In 1985 the significance of seniority increased considerably whereas the significance of unemployment decreased. Furthermore, the risk of non-participation increased significantly for wage earners (OR = 1.57) and people lacking social support

(OR = 1.54). The outcome variables "psychological well being" and "psychosomatic symptoms" did not appear to play any role with regard to non-participation in the multivariate analyses.

DROP OUTS COMPARED WITH LATE RESPONDENTS

Extrapolating from late respondents to non-respondents has been referred to on occasion as an indirect method for investigating study loss. It has been assumed that characteristics of late respondents can, to a certain extent, also be used to characterise non-respondents. To test this assumption in connection with longitudinal studies, the questionnaires that were returned in 1984 and 1985 were divided into three categories according to the date of return (1-2 weeks, 3-4 weeks and 5+ weeks after being dispatched to the participants). In 1984 no significant differences from 1983 could be established with regard to late return of questionnaires on questions concerning occupation, seniority, unemployment, financial difficulties, psychological well being, psychosomatic symptoms and alcohol problems. In 1985 there was a significantly greater number of late respondents among people who in 1983 had low seniority, alcohol problems and low scores for psychological well being.

The only factors common to both non-response and late response in 1984 and 1985 were the presence of alcohol problems and low seniority. The other variables associated with late response were not associated with a similarly increased rate of non-response in the two data collection rounds. There was no simple correlation between those who became late respondents and those who became drop outs. Consequently, this study cannot support the assumption that information about late respondents can be extrapolated to non-respondents.

Discussion

In this study the number of drop outs in the second and third rounds represented 15-20% of the total number of respondents in the first round. Information from the first round was used as a baseline for describing drop outs. In a multivariate analysis age and seniority were the only variables that proved to be significantly associated with participation rate in the second and third data collection rounds. Other studies have also found that the older participants are more willing to reply.⁵

The picture of study loss that emerges shows that drop outs in 1984 differed from respondents in that they were younger, had relatively low seniority at the shipyard and had more frequent and longer periods of unemployment. Their attachment to the shipyard and

Table 2 Participation rates in T2 and T3 distributed according to selected variables from T1 (n = 1601)

	T2 (1984)			T3 (1985)		
	n	% of initial participation	p value	n	% of initial participation	p value
Shipyard						
Helsingør	1153	82.9		1118	80.9	
Dannebrog	441	85.5	0.24*	414	79.0	0.41*
Occupation						
Salaried worker	272	87.1		265	87.2	
Wage earner	1322	82.9	0.10*	1267	78.9	<0.01*
Seniority at shipyard						
0-9 years	804	80.5		623	84.8	
10-19 years	281	84.7		233	92.7	
20+ years	489	88.3	<0.01†	415	95.4	<0.01†
Employment status						
Employed	1017	83.9		983	80.8	
Unemployed	577	83.2	0.78*	549	79.6	0.63*
Unemployment in 1983						
0-2 months	1015	84.9		831	90.4	
3-10 months	475	82.7		381	90.0	
11-12 months	97	74.2	0.01†	70	82.9	0.22†
Age						
16-29 years	412	79.9		392	72.7	
30-49 years	724	82.5		717	80.2	
50-72 years	458	88.9	<0.01†	423	87.7	<0.01†
Social support						
Good (score 1)	1330	83.5		1275	82.2	
Poor (score 0)	263	82.1	0.73*	249	71.5	<0.01*
Life events in 1983						
No (0)	1059	84.1		1022	80.6	
Yes (1+)	464	83.8	0.94*	442	81.9	0.62*
Financial difficulties						
No	1312	84.9		1261	82.5	
Yes	211	79.1	0.04*	203	71.9	<0.01*
Chronic health problems						
No	1097	83.3		1058	79.9	
Yes	478	84.5	0.60*	456	81.4	0.55*
Psychological well being						
No (0-14 points)	1388	83.8		1331	80.8	
Yes (15-36 points)	200	83.0	0.86*	196	77.6	0.34*
Psychosomatic symptoms						
0-2 symptoms	1208	83.4		1162	80.6	
3-6 symptoms	376	84.3	0.93*	361	79.2	0.70*
Alcohol problems						
No	1466	83.7		1410	81.2	
Yes	92	84.8	0.90*	90	72.2	0.05*
Number of doctor consultations						
0	1111	83.4		1077	80.9	
1+	424	84.7	0.56*	398	79.6	0.60*

* χ^2 test with Yates' correction for continuity

† Cochran's test for trend

the labour market was therefore not as strong as that of the respondents, which presumably affected their motivation to participate in a study of this type.

At the next round of data collection in 1985 the difference between drop outs and respondents was even greater in that there was a larger number of drop outs who were wage earners and who had poor social support. This could indicate a more general selection

process. If further data collection rounds had been undertaken this difference would presumably have been even more apparent.

Our purpose in carrying out these study loss analyses was to examine whether non-participation was associated both with exposure variables, such as unemployment in 1983, and with outcome variables, such as psychological well being and psychosomatic

Table 3 Predictors for 1983 for non participation in 1984 and 1985 (men, n = 1432). Logistic regression: odds ratio and 95% confidence interval

Predictors in 1983	1984		1985	
	Odds ratio	95% confidence interval	Odds ratio	95% confidence interval
Shipyard				
Dannebrog	1		1	
Helsingør	1.43	0.97-2.12	1.11	0.77-1.59
Occupation				
Salaried worker	1		1	
Wage earner	1.43	0.92-2.23	1.57	1.00-2.46
Seniority at shipyard				
20+ years	1		1	
10-19 years	1.15	0.71-1.89	0.88	0.53-1.48
0-9 years	1.57	1.03-2.41	1.86	1.23-2.82
Unemployment in 1983				
0-2 months	1		1	
3-10 months	1.13	0.79-1.62	0.93	0.65-1.33
11-12 months	2.15	1.22-3.79	1.71	0.97-3.01
Age				
50+ years	1		1	
30-49 years	1.63	1.07-2.48	1.65	1.08-2.51
16-29 years	1.62	0.97-2.71	1.68	1.03-2.76
Social support				
Good	1		1	
Poor	0.98	0.66-1.45	1.54	1.09-2.19
Financial difficulties				
No	1		1	
Yes	1.18	0.77-1.80	1.42	0.95-2.11
Psychological well being				
Good	1		1	
Poor	1.04	0.65-1.66	1.09	0.70-1.69
Psychosomatic symptoms				
0-2 symptoms	1		1	
3-6 symptoms	0.92	0.64-1.32	0.94	0.70-1.26
Alcohol problems				
No	1		1	
Yes	0.74	0.39-1.44	1.15	0.65-2.02

Basic odds (1984) 0.05, (1985) 0.06. Model specification: G^2 (1984) 357, (1985) 385; Df (1984) 345, (1985) 342; p (1984) 0.32, (1985) 0.05.

symptoms. If that was the case, there would be a serious risk of selection bias. However, no such association could be established in 1984 or 1985, as in neither round were outcome variables associated with non-participation.

In our estimation drop outs did not appear to introduce any serious bias in our results on the health consequences of job loss. Our assessment is in agreement with other studies on similar problems.¹⁻³ This conclusion must, however, be modified with respect to two points. In the first place we have examined the study loss at T2 and T3 using T1 as the starting point. Circumstances—both with regard to employment and health—could have changed for part of the study population by the time of the next data collection rounds, and we do not know whether drop outs experienced particular changes in relation to participants, and whether these changes had any

bearing on whether a person participated at T2 and T3. Secondly, it is important to point out that we analysed only about half of the total study loss. We know very little about the initial 27% study loss at T1, and the bias that may thus have been introduced is not modified by the fact that later drop outs probably did not introduce any further significant bias. It should also be mentioned that our study did not support the use of the indirect method by which drop outs are described by extrapolating from information on late respondents. Late respondents (5+ weeks after dispatch) did not significantly differ from early respondents (1-4 weeks after dispatch), and the method did not provide any basis for identifying the groups that had a lower response rate at T2 and T3.

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Address for correspondence and reprints: Associate Professor Lars Iversen, Institute of Social Medicine, University of Copenhagen, Panum Institute, Blegdamsvej 3, DK-2200 Copenhagen, Denmark.

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