The Effect of Unemployment on Health and Mortality: a Longitudinal Study on Workplace Downsizing and Closure.

Multiple prior studies have recognized that unemployment is associated with negative health outcomes. [1-3] Albeit the extensive literature, the degree to which this association is causal, or a result of direct or indirect health-related selection remains contested. One way to tackle the problem of causal inference is to use workplace closure or downsizing as a natural experiment. Closures and severe downsizings cannot be assumed to be dependent on the health of the workers. Therefore, the resulting unemployment can be considered reasonably exogenous to the individual. Selection into unemployment is reduced, and causal inference is stronger. [4]

Recently, several longitudinal, general population studies have utilized the natural experiment design to address the association between health and exposure to the experience of downsizing or closure. [5-7] However, few have adopted it to address unemployment explicitly: not all displaced workers subsequently become unemployed. Survey studies on unemployment due to closure and subjective health have produced conflicting results. [8-10] Additionally, one register study explored psychotropic drug use and unemployment resulting from downsizing, [11] and one all-cause mortality by the level of workforce reductions in the workplace from which the individual became unemployed. [12] Together these five studies indicate that unemployment has limited effects on total mortality and all-cause hospitalization, but the results for mental health, and some somatic conditions are conflicting. Furthermore, causes such as injuries due to violence, or substance use related injuries and diseases warrant further investigation.

The purpose of this study is to use workplace closure and downsizing as a natural experiment to make causal inferences about the relationship between unemployment and health, using a large longitudinal general population sample from administrative registers. Individuals unemployed from stable, downsizing and closing workplaces are compared to unexposed controls. If health deteriorates only or more strongly among the individuals unemployed from stable workplaces, the results would imply health selection.

The study design and data make it possible to address several limitations of previous studies. [4] The data is annual, the study period lengthy, and the sample large and heterogeneous. An additional strength of the register data is that there is no recall bias concerning sensitive measures, or non-random attrition. [8-10] Various clinically relevant physical and mental health outcomes are analyzed. [12,13] Furthermore, we consider measures related to the workplace context, and the individual's health status prior to the onset of unemployment. While some suggest that the study design itself already controls for health-related selection into unemployment, and thus no additional controlling for baseline differences is necessary, we believe these to be an important addition. [4,8,14]

Data and methods

The analytical sample is derived from a longitudinal, nationally representative 11% random sample of Finnish residents at the end of any of the years 1987– 2007, supplemented with an 80% random sample of all deaths during the study period. The individual-level data from various administrative register sources is linked using a personal identification number assigned to all permanent residents, and then further joined with the Finnish Longitudinal Employer-Employee Data, using which we identified the individual's workplace annually. The workplace data contain information on the workplace workforce size, and industry sector for the full sample.

We restricted our analyses to men and women aged 25 to 63, who were at a point between 1988 and 2008 employed at a privately-owned workplace that had a workforce of five or more

employees. Individuals entered the analytical sample after first meeting these criteria, and exited at age 64, emigration or death. Those unemployed or retired throughout the study period were excluded. The final sample consists of 302,165 individuals (2,687,695 person years), all employed in a workplace that met the inclusion criteria at the end of the year preceding baseline, and observed for a maximum of 20 years. The preliminary analyses were conducted for men and women separately using multivariate Cox's proportional hazard regression models on Stata 13.0.

The individual labor force status is recorded at the end of each calendar year. Hence, the *exposure group* was considered unemployed following the year at the end of which they were first registered as such. They were further categorized as unemployed from stable, downsized or closed workplaces. Workplaces were considered downsized when they reduced their staff by a minimum of 30% over two consecutive calendar years. Closed workplaces terminated the entire workforce or seized to exist in the register. Conversely, the *control group* consists of individuals who during the study period did not become unemployed from a workplace, although they were allowed episodes outside the workforce (e.g. due to parental leave).

The outcome was first-incidence hospitalization, or death. The preliminary analyses were conducted for the following ICD9/ICD10 main diagnoses: 1) ischemic heart disease, 2) other somatic conditions, 3) substance use related injury and disease, 4) psychiatric conditions and self-harm, 5) violence, and 6) and accidents. Workplace sickness absences, and annual hospitalizations for these same health problems preceding the baseline were used as indicators of prior health status. Other pre-baseline characteristics were education, marital status, workplace tenure and industry sector, region of residence, annual regional unemployment level, age and calendar year.

Preliminary results

The groups exposed to unemployment were slightly older and had less often completed higher education when compared to the employed controls (Table 1). The unemployed men were also less often married or cohabiting. Generally, the individuals unemployed from stable workplaces had poorer pre-baseline health, most notably as measured by hospitalizations related to substance use.

Table 1. Selected Sample Characteristics, Finnish Men and Women Aged 25 to 63 between 1989 and 2009, by Baseline Employment Conditions. Obtained from Pooled Person Years.

		Employed, controls	Unemployed. Workplace ..		
			Stable	Downsized	Closed
Men	N. of individuals	119,439	36,297	18,676	8,215
	Age at baseline, mean [SD]	40.3[11.6]	43.4[11.5]	42.2[10.6]	42.9[10.4]
	Completed tertiary education, %	28.6	17.6	13.6	15.3
	Married, cohabiting, %	54.0	44.2	46.5	48.5
	Hospitalized prior to baseline, %				
	Ischemic heart disease	0.2	0.2	0.1	0.2
	Other somatic conditions	3.8	4.7	4.1	3.9
	Substance use related	0.2	0.6	0.5	0.3
	Psychiatric, self-harm	0.1	0.2	0.2	0.2
	Accidents, exposure	0.9	1.1	1.1	1.2
	Violence	<0.1	0.1	<0.1	<0.1
	Days off sick at t-2, mean [SD]	1.7[12.2]	3.0[15.7]	2.3[14.2]	2.2[12.8]

		Employed, controls	Unemployed. Workplace ..		
			Stable	Downsized	Closed
Women	N. of individuals	83,621	23,252	8,186	4,296
	Age at baseline, mean [SD]	39.3[11.7]	43.8[11.4]	43.8[10.7]	44.6[10.3]
	Completed tertiary education, %	36.3	23.4	18.3	15.9
	Married, cohabiting, %	50.3	50.2	53.4	55.3
	Hospitalized prior to baseline, %				
	Ischemic heart disease	<0.1	0.1	<0.0	<0.1
	Other somatic conditions	4.9	6.2	6.1	6.7
	Substance use related	0.1	0.2	0.1	0.1
	Psychiatric, self-harm	0.2	0.3	0.3	0.3
	Accidents, exposure	0.4	0.7	0.6	0.3
	Violence	<0.1	<0.1	<0.1	<0.1
	Days off sick at t-2, mean [SD]	2.2[13.5]	3.8[17.6]	3.0[15.5]	2.6[12.8]

Table 2. Multivariate Cox's Regression of Unemployment on First-Incidence Hospitalization or Death for Finnish Men and Women aged 25 to 63 in 1989-2009.

			Men				Women			
			Model 1 [a]		Model 2 [b]		Model 1 [a]		Model 2 [b]	
			HR	CI 95%	HR	CI 95%	HR	CI 95%	HR	CI 95%
Ischemic heart disease	Employed		ref.		ref.		ref.		ref.	
	Unemployed	Stable	0.90	(0.84,0.97)	0.81	(0.75,0.88)	0.97	(0.82,1.15)	0.89	(0.75,1.07)
		Downsized	0.91	(0.83,0.99)	0.78	(0.71,0.85)	0.91	(0.73,1.13)	0.81	(0.65,1.01)
		Closed	0.86	(0.76,0.97)	0.76	(0.67,0.86)	0.99	(0.75,1.31)	0.91	(0.69,1.21)
Other somatic	Employed	ref.	ref.		ref.		ref.		ref.	
	Unemployed	Stable	0.98	(0.96,1.00)	0.93	(0.91,0.95)	1.00	(0.97,1.02)	0.95	(0.93,0.97)
		Downsized	0.94	(0.92,0.97)	0.87	(0.85,0.90)	0.93	(0.89,0.96)	0.87	(0.84,0.90)
		Closed	0.92	(0.88,0.95)	0.86	(0.83,0.90)	0.86	(0.82,0.90)	0.81	(0.77,0.85)
Substance use related	Employed	ref.	ref.		ref.		ref.		ref.	
	Unemployed	Stable	4.06	(3.78,4.36)	3.19	(2.96,3.44)	3.83	(3.31,4.44)	3.58	(3.07,4.18)
		Downsized	2.68	(2.44,2.94)	2.06	(1.87,2.27)	2.66	(2.16,3.29)	2.55	(2.06,3.15)
		Closed	2.64	(2.31,3.01)	2.15	(1.88,2.46)	1.76	(1.26,2.43)	1.62	(1.15,2.26)
Psychiatric, self-harm	Employed	ref.	ref.		ref.		ref.		ref.	
	Unemployed	Stable	1.71	(1.55,1.87)	1.53	(1.39,1.69)	1.63	(1.45,1.83)	1.48	(1.31,1.68)
		Downsized	1.14	(1.00,1.29)	1.07	(0.94,1.23)	1.27	(1.07,1.50)	1.17	(0.98,1.39)
		Closed	1.14	(0.95,1.36)	1.08	(0.90,1.29)	0.75	(0.58,0.97)	0.69	(0.53,0.89)
Accidents	Employed	ref.	ref.		ref.		ref.		ref.	
	Unemployed	Stable	1.26	(1.21,1.31)	1.15	(1.10,1.19)	1.14	(1.07,1.21)	1.09	(1.02,1.16)
		Downsized	1.14	(1.09,1.19)	0.99	(0.94,1.05)	0.98	(0.89,1.08)	0.93	(0.85,1.03)
		Closed	1.08	(1.00,1.16)	0.97	(0.90,1.04)	0.89	(0.78,1.01)	0.85	(0.75,0.97)
Violence	Employed	ref.	ref.		ref.		ref.		ref.	
	Unemployed	Stable	4.33	(3.64,5.16)	3.65	(3.04,4.37)	3.38	(2.50,4.58)	3.01	(2.19,4.14)
		Downsized	3.29	(2.66,4.07)	2.69	(2.15,3.38)	1.86	(1.17,2.97)	1.63	(1.01,2.64)
		Closed	2.50	(1.88,3.34)	2.07	(1.54,2.77)	1.95	(1.02,3.73)	1.74	(0.90,3.35)
N. of person years		1,611,265					1,050,624			

Abbrevation: CI, confidence interval; HR, hazard ratio.
[a] Adjusted for age and calendar year.
[b] Adjusted for age, calendar year, and pre-baseline education, marital status, region of residence, workplace tenure and industry sector, annual regional unemployment level and health measures.

In our preliminary analyses (Table 2), unemployment was not found consistently associated with deteriorating health. For substabce use related conditions and violence, the hazard ratio for hospitalization or death was higher for the unemployed irrespective of their workplace category when compared to the controls. Contrarily, unemployment appeared to have a very weak, but beneficial effect on ischemic heart disease among men, and on other somatic conditions among both men and women. While previous studies have found displacement strongly associated with mental health, [2] we discovered a higher hazard ratio only for the individuals unemployed from stable workplaces. In other words, we observed a gradient by the baseline workplace categories. The health deterioration was stronger among those unemployed from stable workplaces, and weakest among those from closing ones, suggesting that health selection plays an important role in the association. For example, women unemployed from stable workplaces were over 3.5 times as likely as the controls to become hospitalized or die from substance use related causes, while women unemployed from closed workplaces were 1.6 times more likely to do so.

Adjusting for the pre-baseline individual and workplace characteristics somewhat attenuated the association between unemployment and substance use or violence related outcomes. In the case of accidents and psychiatric conditions for men unemployed from downsized or closed workplaces, the weak association observed in the crude models disappeared after adjusting for differences in baseline characteristics.

In summary, the preliminary results suggest that in Finland, unemployment is associated with hospitalization or death due to substance use and violence. Additionally, the health deterioration is stronger among the individuals unemployed from stable workplaces. The next steps in our study include sensitivity analyses (e.g. regarding the health measures, downsizing categories) and further interpreting the results. The paper will contribute to our knowledge of the dynamics of health inequalities, in addition to having policy implications for the employers, public policy makers and health promoters.

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