Title: Return to the Workforce Following First Hospitalization for Heart Failure – a Danish Nationwide Cohort Study

Short title: Return to work in heart failure

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ABSTRACT

Background: Return to work is important financially, as a marker of functional status and for self-esteem in patients developing chronic illness. We examined return to work after first heart failure (HF) hospitalization.

Methods: By individual-level linkage of nationwide Danish registries, we identified 21455 patients of working age (18-60 years) with a first HF hospitalization in the period of 1997-2012. Of these 11880 (55%) were in the workforce prior to HF hospitalization and comprised the study population. We applied logistic regression to estimate odds ratios (OR) for associations between age, sex, length of hospital stay, level of education, income, comorbidity and return to work.

Results: One year after first HF hospitalization, 8040 (67.7%) returned to the workforce, 2981 (25.1%) did not, 805 (6.7%) died and 54 (0.5%) emigrated. Predictors of return to work included younger age (18-30 vs. 51-60 years, OR 3.12; 95% CI 2.42-4.03), male sex (OR 1.22 [1.18-1.34]) and level of education (long-higher vs. basic school OR 2.06 [1.63-2.60]). Conversely, hospital stay >7 days (OR 0.56 [0.51-0.62]) and comorbidity including history of stroke (OR 0.55 [0.45-0.69]), chronic kidney disease (OR 0.46 [0.36-0.59]), chronic obstructive pulmonary disease (OR 0.62 [0.52-0.75]), diabetes (OR 0.76 [0.68-0.85]) and cancer (OR 0.49 [0.40-0.61]) were all significantly associated with lower chance of return to work.

Conclusions: Patients in the workforce prior to HF hospitalization had low mortality but high risk of detachment from the workforce one year later. Young age, male sex, and higher level of education were predictors of return to work.

Keywords: HF, labour market, prognosis, epidemiology, quality of life.

CLINICAL PERSPECTIVE

What is new? In the present study we investigated return to work (or recovery to the point of being able to work) among younger patients following a first hospitalization for heart failure. Loss of employment is an important consequence of chronic illness, both for the individual patient, as well as financially for society as a whole.

What are the clinical implications? One out of three patients, who were employed/able to work prior to their first heart failure hospitalization, were not in the workforce one year later, despite a relatively low one-year mortality (7%) among these patients. We believe that our findings shed light on a hidden consequence of heart failure. By drawing attention to the high rate of non-return to work of younger patients, we hope to stimulate more research into why this happens and whether it can be avoided. Interventions which maintain employment in these patients could have beneficial effects on both their physical and mental health.

INTRODUCTION

Heart failure (HF) is associated with considerable morbidity, reduced quality of life and a 5-year mortality of more than 50%.[1-4] The gradual introduction of beneficial pharmacological treatment and cardiac devices has led to significant improvements in prognosis and life expectancies of patients with HF during the last 30 years.[5] The improved prognosis combined with better treatment and survival for patients with congenital and acute cardiovascular diseases, has resulted in lower incidence, but increasing prevalence of HF and led to HF being a major public health concern.[4, 6, 7] However, most information on HF including the high mortality is derived from studies of older patients and there is a major knowledge gap regarding the consequences of living with HF in younger patients. Information on life expectancy and quality of life in younger patients with HF is limited. But information on another very important aspect of life in younger individuals with HF, ability to remain in employment, is lacking. The ability to maintain a full-time job addresses a vital indirect consequence and cost of HF, beyond the usual clinical parameters such as mortality and hospitalization. Ability to work is more than just another measure of performance status. As well as its financial importance, employment is crucial for self-esteem and quality of life in patients with chronic illness.[8] Detachment from the workforce increases the risk of depression and predicts trajectories of future mental health problems, and has even been associated with an increased risk of suicide.[9-11] Obtaining information on workforce inclusion should, therefore, shed light on an unstudied consequence of heart failure and provide a novel perspective on the impact of HF on the lives of those who, perhaps, have most to lose from this condition. Hopefully better understanding of return to work after HF hospitalization might also allow development of strategies to facilitate this important aspect of life in patients of working age with HF.

In this study, we used Danish health and administrative registers to examine return to work and associated predictors including age, level of education and comorbidity, following first HF hospitalization in a nationwide cohort of patients.

METHODS

Data sources

A unique personal identification number is assigned to all residents in Denmark. This number is used in all Danish health and administrative registries and allows individual-level linkage of information.[12] In this study we combined data from: 1) The Danish database on all public welfare payments, which contains weekly follow-up of all public welfare payment since 1991, including sickness pension, disability benefits. It has previously been validated for the study of the social and economic consequences of disease.[13] 2) Danish nationwide administrative registries which holds information on sociodemographic characteristics, income and education level. 3) The Danish National Patient Registry which holds information of all admissions to hospitals since 1978, and outpatient visits since 1995, coded according to the International Classification of Diseases (ICD)-8 and ICD-10.[14] 4) The Danish Register of Medicinal Product Statistics (the national prescription registry) with information on all dispensed prescriptions since 1995. 5) The National Population Registry which holds information on vital status. 6) The Danish Cause of Death Registry, which holds information about the primary and underlying cause of death.

Study population and baseline variables

The study population comprised patients aged 18-60 years at time of first hospitalization for HF in the period 1997-2012, who were members of the workforce (employed or available to work) prior to hospitalization (Figure 1). Due to the study outcome of return to work, only younger patients were relevant for inclusion in this study. First hospitalization for HF was identified by a primary- or secondary discharge diagnosis of HF (Appendix 1) in the studied period, and those with a prior HF hospitalization (1978-1996) were excluded. Each contact is coded by one main reason for hospitalization as the primary diagnosis and although there is no maximum number of secondary diagnoses, most are recorded with up to 4 diagnoses in total. The study population was stratified into four age groups (18-30, 31-40, 41-50, and 51-60 years, respectively).

Patients were followed in the Danish database on all public welfare payments for up to 16 years. We used a follow-up period of 4 years. In this period no patients crossed the age where they could receive full state pension. Comorbidities i.e. ischemic heart disease, cancer, atrial fibrillation, chronic kidney disease, chronic obstructive pulmonary disease (COPD), diabetes mellitus, hypertension and stroke were identified by at least one hospitalization in a 10 year period prior to and including index HF hospitalization (Appendix 1). History of diabetes mellitus was additionally identified by at least one filled prescription for glucose lowering drugs 6 months prior to first HF hospitalization. Medical therapy prior to first HF hospitalization was defined by at least one filled prescription of the drug in the preceding 6 months. We assessed the use of the following drugs; angiotensin-converting enzyme inhibitors (ACE-I) and angiotensin-II receptor blockers (ARB), aspirin, calcium channel blockers, digoxin, clopidogrel, mineralocorticoid receptor antagonists, statins, beta-blockers and loop-diuretics. Average 5-year family income prior to first HF hospitalization was calculated and summarized in quartiles.

Outcome Measures

Work status at time of HF hospitalization was determined based on the five weeks leading up to the first HF hospitalization. Subsequently we evaluated work status in five-week periods, 6 months after discharge, and repeated this evaluation at fixed time points for every 6 months up to a total of four years of follow-up. The primary outcome was return to the workforce estimated in the five-week period one year after first HF hospitalization. Patients who were not on paid sickness leave, had not taken early retirement or were receiving any support due to reduced working capability were classified as able to work, as were patients receiving state educational grants, paid maternity leave or on some other leave of absence, as these social benefits are for persons who are capable of working. We used five-week evaluation periods to reduce misclassification, i.e. to ensure that patients with short-term sick leave were not classified as excluded from the workforce, a method that has been described previously.[15] Therefore, in the main analyses, only patients with sick leave of more than 3 out of the 5 evaluated weeks were classified as detached from the workforce. Importantly, persons could return to work at later evaluations and in 4 years of follow-up we recorded up to 6 changes between attachment and detachment to the workforce per person. In sensitivity analyses we altered

our criterion for detachment from the workforce to 2 out of 5 and 4 out of 5 weeks, respectively. Subsequently we assessed maintenance of work capability after first time return to work defined as a minimum of 3 consecutive weeks at any time during follow-up. In these patients, maintenance of work capability was evaluated by estimating time to 1, 3, and 12 weeks of consecutive detachment. In sensitivity subgroup analyses, we separately assessed patients with and without significant comorbidities and those available to the workforce one year prior to first HF hospitalization.

Statistics

Baseline age was grouped (18-30, 31-40, 41-50, 51-60). Baseline patient characteristics were summarized separately for age groups. Differences between age groups were assessed by χ^2-tests or Wilcoxon test. Return to work within 1 year since first HF hospitalization was analysed by multiple logistic regression adjusting for age, sex, income, education level and comorbidities (ischemic heart disease, cancer, atrial fibrillation, chronic kidney disease, COPD, diabetes, hypertension and stroke). Sex and comorbidity effects were tested for interactions with age group by likelihood ratio test. Patients were followed until date of emigration, death, or December 31st, 2013. Patients who were not followed for 1 year due to emigration were set to be detached from the workforce in logistic regression analyses. The percentages of patients who were available to the workforce were estimated at 6 months intervals in the first 4 years after the initial hospitalization. Early end of follow-up due to emigration and administrative censoring on December 31st, 2013, was dealt with by estimating state occupation probabilities in an illness-death model with recovery.[16] Among patients who returned to the workforce for at least 3 consecutive weeks, we computed the risk of workforce detachment, defined as any detachment, respectively minimum 3 or 12 weeks of consecutive detachment using the Aalen-Johansen method.[17] For all analyses, a p-value < 0.05 was considered statistically significant. The SAS statistical software package, version 9.2 (SAS Institute, Chapel Hill, NC, USA) and R, version 3.0.2 (R development Core Team) was used for all analyses.

Ethics

The study was approved by the Danish Data Protection Agency (2007-58-0015, GEH- 2014-017, I-Suite-nr. 02735). In Denmark, ethical approval is not required for register-based studies.

RESULTS

Baseline characteristics of the study population

We identified 21455 patients aged 18-60 years with a first HF hospitalization between 1997 and 2012. Of these, 11880 (55%) were in the workforce at the time of admission (Table 1) and these individuals formed the study cohort. Among these patients, 429 (4%) were in the youngest age group (18-30 years). Demographics and clinical characteristics according to age group are shown in Table 2. There were more men than women in all age groups, and the proportion of women decreased with age, from 36% in youngest to 23% in the oldest age group. All comorbidities were most common in the oldest age group (51-60 years), with the exception of chronic kidney disease, and the oldest age group received the most pharmacotherapy (Table 2). Baseline characteristics of all patients with a first hospitalization for HF (n=21455) stratified by workforce availability and age group are shown in Table 3. At baseline 9575 (45%) patients were not in the workforce. Compared with those in the workforce, these patients had higher frequency of ischemic heart disease, cancer, chronic kidney disease, COPD, diabetes and stroke. Post-discharge use of medication is shown in Table 4.

Return to the workforce following first HF hospitalization

The fraction of individuals' employed or available to work at the time of first HF hospitalization, and every 6 months thereafter, in each age group, is depicted in Figure 1. During 1 year prior to first HF admission a decrease in the workforce fraction were seen in all age groups, 15% in the oldest group, 11% in patients aged 41-50 and 9% in the two youngest groups. One year after first HF hospitalization, 8040 (67.7%) returned to the workforce, 2981 (25.1%) did not, 805 (6.7%) died and 54 (0.5%) emigrated, with return to work most likely among the youngest patients (81%). Notably, however, among patients alive 1 year after first HF hospitalization, 27% of patients were detached from the workforce. By contrast, one year mortality was low, ranging from 4-8% and highest in the oldest age group (Figure 1). We assessed return to work among patients with (n=9385) and without (n=2495) significant comorbidity, i.e. no history of stroke, diabetes,

chronic kidney disease, COPD, and cancer. During four years of follow-up patients without comorbidity had a lower mortality and higher attachment to the workforce (Figure 2). Follow-up of return to work on all patients are depicted in Supplementary Figure I. Among patients not in the workforce at baseline 1151 (12%) died during the first year after first HF hospitalization.

Predictors of return to the workforce

We estimated the odds ratios (OR) with 95% confidence intervals (CI) for return to the workforce at 1 year in a multiple regression model among patients in the workforce before first HF hospitalization (Figure 3). Younger age, male gender, higher educational attainment and higher income were associated with a higher likelihood of returning to the workforce. Conversely, several comorbidities such as stroke, diabetes, chronic kidney disease, COPD and cancer were associated with a lower chance of returning to the workforce. However, this association was not found for ischemic heart disease, atrial fibrillation or hypertension.

Time to return to the workforce and maintenance of work

During 4 years of follow-up 10324 patients (87%) returned to work. More than half was back to work shortly after their first HF hospitalization, and after 26 weeks 75% had returned to work. Among patients who returned to work for a minimum of 3 consecutive weeks, 52 % were detached from the workforce after 3 years when no sickness leave from the workforce was accepted. When sickness leave up to 3 and 12 weeks was accepted, 46% and 38% respectively, were detached from the workforce after 3 years. Of these patients 52 % were detached from the workforce after 3 years when no sickness leave from the workforce was accepted. When sickness leave up to 3 and 12 weeks was accepted, 46% and 38% respectively, were detached from the workforce after 3 years.

Sensitivity analyses

We analyzed return to the workforce in patients with HF as primary diagnosis and found no significant difference in 1 year return to workforce compared to patients with HF as a secondary diagnosis at first hospitalization for HF (p=0.33). No differences in terms of return to work at 1 year was seen when we required 2 or 4 out of 5 weeks of sick leave to be classified as detached from the workforce, data not shown.

In a multiple logistic regression model including cardiovascular medications we found that ACE-I/ ARB, beta-blockers and digoxin were significantly associated with increased likelihood of return to work. Conversely, loop-diuretics and MRAs were significantly associated with lower likelihood of return to work (Supplementary Figure II).

DISCUSSION

We investigated the association between first hospitalization for HF and subsequent return to the workforce in patients of working age. One year after first HF hospitalization, the proportion of patients who returned to the workforce, as either employed or available to the workforce was markedly reduced from before admission in all age groups, with nearly a third of patients no longer capable of working. In multiple regression analyses, younger age, male sex, higher income, and higher level of education were positively associated with return to work, whereas certain comorbidity (stroke, diabetes, cancer, COPD, and chronic kidney disease) was associated with detachment from the workforce.

Work capability among HF patients has to our knowledge not been assessed before. HF has been shown to reduce quality of life, based on standardised questionnaires.[3] The Danish database on social benefits offers a unique opportunity to assess an objective measure of disease impact in the form of loss of employment, and provision of disability benefits and sick pensions. We believe that inclusion in the workforce is not only a tangible measurement of quality of life and performance status but also a consequence likely to have broader implications for self-esteem and mental health in these younger patients of working age.[9, 11] The relation between health status and inclusion in the workforce may be two-ways, as changes in employment has been related to worsened self-reported health measures.[18, 19] Likewise, sick leave per se, is associated with increased risk of unemployment and disability pension independent of health status.[20]

At time of first hospitalization for HF, nearly half of the patients have been detached from the workforce. Evidently, some of the patients have already been diagnosed and treated for HF in outpatient clinics or by their general practitioner, whereas others might have had HF undiagnosed which likely could have led to impaired functional level and failure to meet the physical requirements of full-time employment. In this study we focused on the patients employed or available to work up till the time of HF hospitalization and discharged from the hospital alive. In this study we focused on the patients employed or available to work up till the time of HF hospitalization and discharged from the hospital alive. Our primary endpoint was return to

the workforce but mortality is of great importance. Compared with other HF studies we found a low mortality rate.[4] This may be explained by the fact that we exclusively examined patients between 18-60 years, i.e. young patients with better prognosis. The MAGGIC meta-analysis reported a similar one year mortality of between 6.5 and 7.5% in patients aged less than 60 years.[21, 22] Another explanation might be that our patients were part of the workforce prior to admission and thus healthier than even those in a general "all-comers" population of young patients with HF. In accordance with this we found mortality to be nearly twice as high among patients not in the workforce prior to hospitalization.

Among patients in the workforce prior to hospitalization we found that a significant fraction was detached from the workforce when evaluated one year later. These findings seen across all age groups confirm that HF significantly reduces a patient's capacity to maintain a normal life and live independently. Other diseases with putative severe consequences on work capability have been investigated, using the same Danish data.[15, 23] Strikingly, a higher proportion of patients surviving pneumococcal meningitis and viral encephalitis were working 1 year after hospitalization (93% and 84%, respectively) than of those hospitalized for HF.[23] Return to work of HF patients were more in line with patients alive 30 days after an out-of-hospital cardiac arrest in which 58% were capable of working one year after their cardiac arrest.[15] It is, therefore, clearly important to try and better understand why this detachment from the workforce occurs. For example, is it solely due to reduced functional capacity or might it reflect the psychological or other consequences of a diagnosis of heart failure? Might it reflect fear among physicians (to advise return to work because of perhaps inappropriate concerns about risk) or employers (perhaps to take back patients thought, wrongly, to be at high risk of death) rather than just among patients, their families and care-givers? Better understanding of the causes might suggest whether loss of working capacity might be prevented by, for example, intensive rehabilitation, psychological, educational or some other therapeutic intervention. This is of great importance because removal from the labour market and dependence on public benefits has great economic consequences, which go beyond the already significant economic burden these patients place on the health care system, as well as potentially many other social, psychological and medical implications. Perhaps not surprisingly, the youngest age group had the highest proportion returning to and maintaining capability of

working, which could be due to a lower prevalence of comorbidities, and greater determination to stay employed. This is in accordance with other studies on work capability.[15, 23]

The presence of comorbidities was associated with a reduced chance of return to work one year after HF hospitalization. Cancer, chronic kidney disease, COPD and stroke showed the strongest associations but also diabetes had a significant association with reduced chance of return to work. These findings emphasize the importance of a multi-disciplinary approach to the management of HF patients.[24, 25] For example, in a young person with cancer and heart failure as a result of chemotherapy, it may be the cancer rather than heart failure that prevents full functional and psychological recovery and return to work. Along this line, we did see a strong correlation between comorbidity and lower chance of return to work, but also that a large proportion of those with HF and no comorbidity did not return to the workforce (Figure 2).

Contribution of National Policies Regarding Health Care Insurance and Employment

Our results are based on the Danish healthcare and social systems and may not be applicable to other countries. The Danish healthcare system is run and managed by the state and is tax financed. Access to healthcare services is not affected by employment status and is free of charge. Denmark has low percentage of unemployment compared with other western countries. No one is forced to retire but people can receive full state funded pension at the age of 65 if born before the 1st of January 1959 otherwise at the age of 67.

Strengths and limitations

The main strength of our study was the completeness of data, and the combination of detailed weekly updated information of patients' occupational status and data on vital status and hospitalizations. The main limitation of the study is the lack of important clinical information on patients, perhaps most importantly left ventricular ejection fraction, and symptoms including New York Heart Association (NYHA) functional class. Also, we chose to look at first hospitalization and disregarded prior outpatient contacts due to HF. This means some patients have diagnosed and treated HF, but we chose this approach in order to ensure to include patients with similar severity of disease, i.e. in need of a hospitalization. We identified patients by a primary- or secondary discharge diagnosis of HF at first hospitalization with HF and no significant difference in 1

year return to work was found between these groups of patients. Occupational status could be subject to misclassification. However, our results were essentially unchanged when we changed our criterion of sick leave. Due to the reliance on prior hospitalizations to identify comorbidity we may have underestimated the burden of disorders usually dealt with by the patients' general practitioners such as hypertension and depression. Finally, our study is observational; thus we report associations and not necessarily causal connections. HF is a diagnosis with different causes and pathophysiology in different age groups. Therefore results from comparison of HF patients in different age groups have to be interpreted with some caution. The motivation for return to work probably changes with age. Older patients closer to retirement age might not return to work due to lack of necessity and not because of poor performance status. Due to emigration the one year outcome was not available for 54 patients (0.5%). In our logistic regression analyses these patients were set to be detached to the workforce. This potentially incurred a small bias.

Conclusion

Among individuals in the workforce prior to first HF hospitalization, we found that despite a low mortality, more than 30% were not in the workforce one year later. Younger age, male sex and higher level of education and income were associated with return to work whereas comorbidity and longer hospital stays reduced chance of returning to work. Inability to return to work might be an additional quality metric for the care of HF patients and to address this could have high public health and socioeconomic impact and improve quality of life and prognosis.

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Disclosures

None

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Tables and figures

Table 1 Occupational status at time of first HF hospitalization according to age group

Age group	All n=21455	18-30 n=572	31-40 n=1558	41-50 n=5073	51-60 n=14252
In the workforce:	11880 (55%)	429 (75%)	1064 (68%)	3059 (61%)	7328 (51%)
Employed	9262 (43%)	217 (38%)	731 (47%)	2393 (47%)	5921 (42%)
Study/maternity leave	492 (2%)	98 (17%)	63 (4%)	27 (1%)	304 (2%)
Unemployed	2126 (10%)	114 (20%)	270 (17%)	639 (13%)	1103 (8%)
Not in the workforce:	9575 (45%)	143 (25%)	494 (32%)	2014 (40%)	6924 (49%)
Sick leave	2346 (11%)	57 (10%)	153 (10%)	571 (11%)	1565 (11%)
Subsidized work	615 (3%)	8 (1%)	28 (2%)	153 (3%)	426 (3%)
Early retirement	6614 (31%)	78 (14%)	313 (20%)	1290 (25%)	4933 (34%)

Table 2 Baseline characteristics of patients in the workforce prior to first hospitalization for HF (n=11880)

Age group	18-30	31-40	41-50	51-60	p-value
No. Patients	429	1064	3059	7328	
Age, mean (SD)	24.9 ± 3.7	36.2 ± 2.9	46.3 ± 2.8	56.1 ± 2.8	<0.0001
Male	274 (64%)	732 (69%)	2323 (76%)	5660 (77%)	
Predicted 1-y mortality					<0.0001
<5%	379 (88%)	923 (87%)	1838 (60%)	2692 (37%)	
>5%	50 (12%)	141 (13%)	1221(40%)	4636 (63%)	
Highest education Level					<0.0001
Basic school <10 yrs	201 (47%)	341 (32%)	1006 (33%)	2367 (32%)	
High school, +3yrs	59 (14%)	58 (5%)	140 (5%)	217 (3%)	
Vocational Education	91 (21%)	386 (36%)	1209 (40%)	3043 (42%)	
Short/medium higher, +2-4 yrs	35 (8%)	144 (14%)	396 (13%)	1049 (14%)	
Long higher, +≥5 yrs	2 (0.4%)	61 (6%)	125 (4%)	337 (5%)	
Unknown	41 (7%)	74 (7%)	183 (6%)	315 (4%)	
Income group #					<0.0001
Q1 (lowest)	294 (69%)	219 (21%)	475 (16%)	1059 (14%)	
Q4 (highest)	16 (4%)	288 (27%)	1057 (35%)	2725 (37%)	
Hospital stay					<0.0001
0-2 days	161 (38%)	348 (33%)	1057 (35%)	2343 (32%)	
3-7 days	124 (29%)	350 (33%)	1106 (36%)	2849 (39%)	
> 7 days	144 (34%)	366 (34%)	896 (29%)	2136 (29%)	
Comorbidity (%)					
Ischemic heart disease	16 (4%)	109 (10%)	613 (20%)	1742 (24%)	<0.0001
Atrial fibrillation	19 (4%)	74 (7%)	239 (8%)	951 (13%)	<0.0001
Cancer	10 (2%)	10 (1%)	60 (2%)	259 (4%)	<0.0001
COPD	0 (0%)	11 (1%)	87 (3%)	401 (5%)	<0.0001
Diabetes	14 (3%)	60 (6%)	305 (10%)	1040 (14%)	<0.0001
Hypertension	26 (6%)	106 (10%)	524 (17%)	1391 (19%)	<0.0001
Chronic kidney disease	15 (4%)	35 (3%)	65 (2%)	143 (2%)	0.002
Stroke	5 (1%)	16 (2%)	74 (2%)	234 (3%)	<0.0001
Pharmacotherapy* (%)					
Loop diuretics	110 (26%)	432 (41%)	1475 (48%)	4172 (57%)	<0.0001
Antiplatelets, any	26 (6%)	237 (22%)	1187 (39%)	3325 (45%)	<0.0001
Beta blockers	143 (33%)	528 (50%)	1742 (57%)	4228 (58%)	<0.0001
Statins	10 (2%)	155 (15%)	886 (29%)	2519 (34%)	<0.0001
ACE-I/ARB	180 (42%)	610 (57%)	2112 (69%)	5110 (70%)	<0.0001
Thiazides	21 (5%)	104 (10%)	334 (11%)	1078 (15%)	<0.0001
Ca^{2+} channel blockers	22 (5%)	90 (8%)	406 (13%)	1329 (18%)	<0.0001
Digoxin	46 (11%)	159 (15%)	529 (17%)	1643 (22%)	<0.0001

MRA	49 (11%)	191 (18%)	618 (20%)	1585 (22%)	<0.0001

COPD - chronic obstructive pulmonary disease; MRA - mineralocorticoid receptor antagonists;
ACE-I angiotensin-converting enzyme inhibitors, ARB- angiotensin-II receptor blockers;
*Filled in prescriptions 180 days prior to admission;
#Average 5-year family income prior to event, in quartiles;

Table 3 Baseline characteristics of all patients with a first hospitalization for HF from 1997-2012 (n=21455)

Workforce availability	Yes	Yes	No	No
Age group	18-40	41-60	18-40	41-60
No. Patients	1493	10387	637	8938
Age, mean (SD)	32.9 ± 6.0	53.2 ± 5.3	34.2 ± 5.4	54.2 ± 4.9
Male	1006 (67%)	7983 (77%)	393 (62%)	5787 (65%)
Highest education Level				
Basic school <10 yrs	542 (36%)	3373 (32%)	351 (55%)	4434 (50%)
High school, +3yrs	117 (8%)	357 (3%)	37 (6%)	209 (2%)
Vocational Education	477 (32%)	4252 (41%)	169 (27%)	3050 (34%)
Short/medium higher, +2-4 yrs	179 (12%)	1445 (14%)	29 (5%)	777 (9%)
Long higher, +≥5 yrs	63 (4%)	462 (4%)	11 (2%)	138 (5%)
Unknown	115 (8%)	498 (5%)	40 (6%)	330 (4%)
Income group #				
Q1 (lowest)	513 (34%)	1534 (15%)	255 (40%)	3061 (34%)
Q4 (highest)	304 (20%)	3782 (36%)	53 (8%)	1225 (14%)
Hospital stay				
0-2 days	509 (34%)	3400 (33%)	253 (40%)	3174 (36%)
3-7 days	474 (32%)	3955 (38%)	188 (30%)	2988 (33%)
> 7 days	510 (34%)	3032 (29%)	196 (31%)	2776 (31%)
Comorbidity (%)				
Ischemic heart disease	125 (8%)	2355 (23%)	82 (13%)	2615 (29%)
Atrial fibrillation	93 (6%)	1190 (11%)	30 (5%)	970 (11%)
Cancer	20 (1%)	319 (3%)	22 (3%)	588 (7%)
COPD	11 (1%)	488 (5%)	16 (3%)	942 (11%)
Diabetes	74 (5%)	1345 (13%)	89 (14%)	2067 (23%)
Hypertension	132 (9%)	1915 (18%)	81 (13%)	2113 (24%)
Chronic kidney disease	50 (3%)	208 (2%)	43 (7%)	493 (6%)
Stroke	21 (1%)	308 (3%)	19 (3%)	681 (8%)

COPD - chronic obstructive pulmonary disease;
#Average 5-year family income prior to event, in quartiles;

Table 4 Pharmacotherapy 90 days after discharge among those who are still alive (n=11501) defined by filled prescriptions. Ejection fraction is not known.

Age group	18-30	31-40	41-50	51-60	p-value
No. Patients	421	1042	2991	7047	
Pharmacotherapy (%)					
Loop diuretics	138 (33%)	503 (48%)	1604 (54%)	4234 (60%)	<0.0001
Antiplatelets, any	32 (8%)	263 (25%)	1193 (40%)	3221 (46%)	<0.0001
Beta blockers	193 (46%)	647 (62%)	2020 (68%)	4603 (65%)	<0.0001
Statins	15 (4%)	172 (18%)	961 (32%)	2626 (37%)	<0.0001
ACE-I/ARB	212 (50%)	697 (67%)	2288 (77%)	5308 (75%)	<0.0001
Thiazides	26 (6%)	86 (8%)	281 (9%)	686 (10%)	<0.0001
Ca^{2+} channel blockers	25 (6%)	108 (10%)	338 (11%)	989 (14%)	<0.0001
Digoxin	47 (11%)	185 (18%)	590 (20%)	1712 (24%)	<0.0001
MRA	70 (17%)	264 (25%)	805 (27%)	1898 (27%)	<0.0001

ACE-I - angiotensin-converting enzyme inhibitors, ARB - angiotensin-II receptor blockers;
MRA - mineralocorticoid receptor antagonists;

Figure 1 Distribution of patient outcome following first HF hospitalization in patients employed/available to the workforce before hospitalization (18-30 years n=429, 31-40 years 31-40 n=1064, 41-50 years n=3059, 51-60 years n=7328). The estimates account for early end of follow-up and are updated every 6 months.

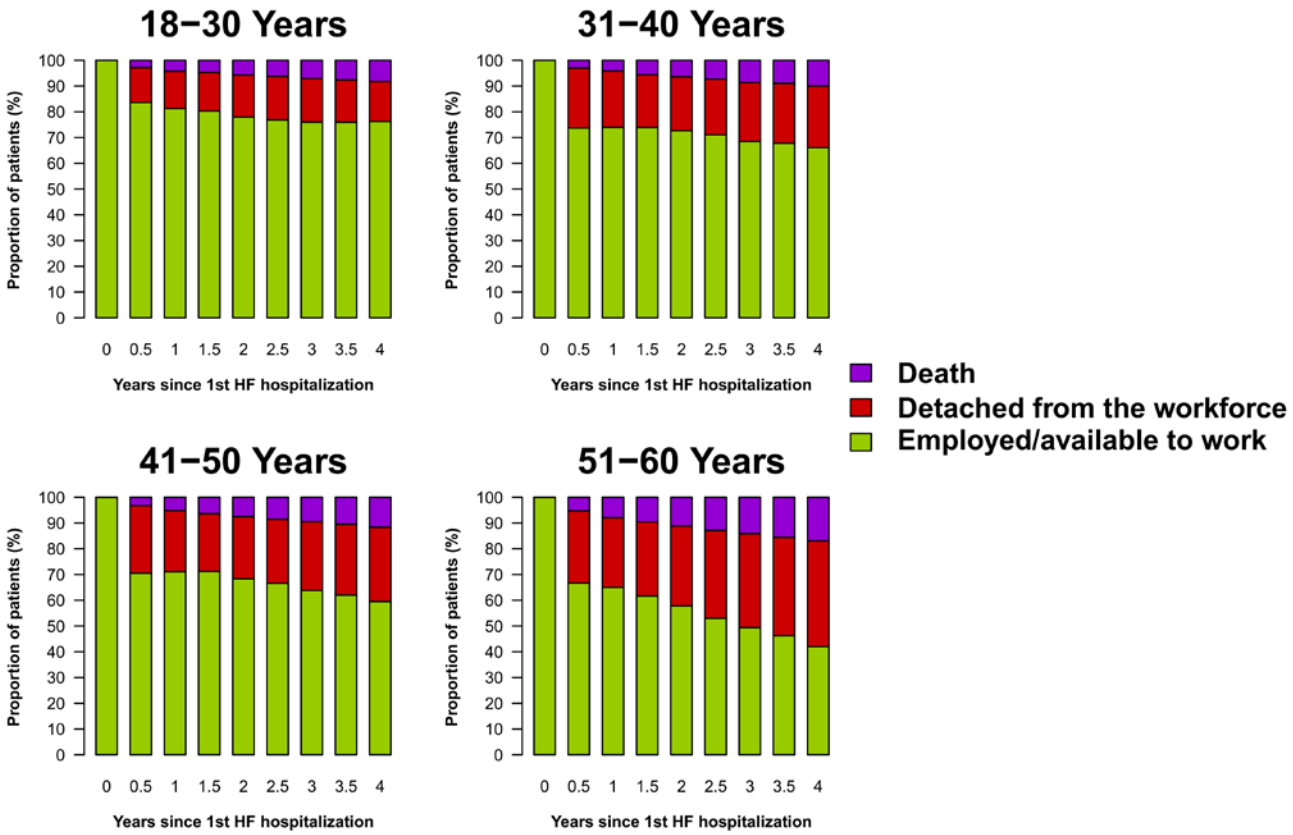
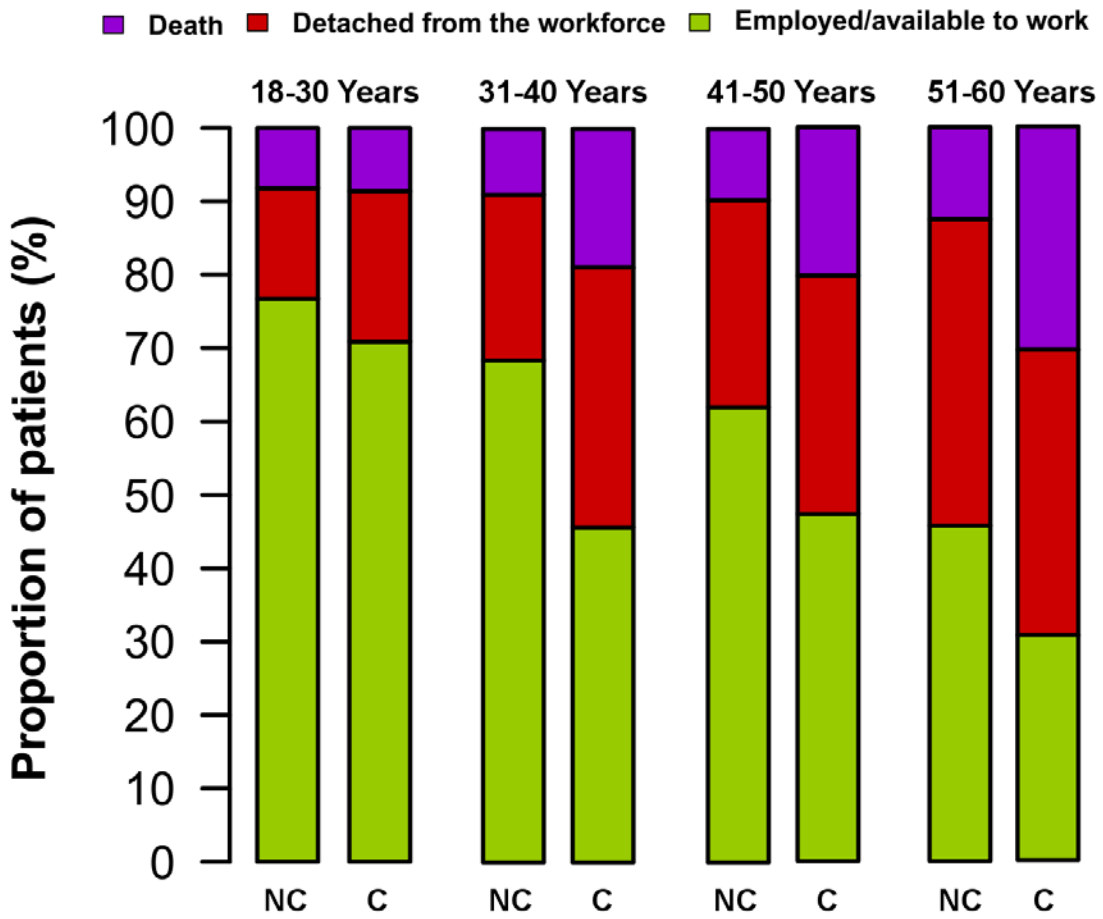
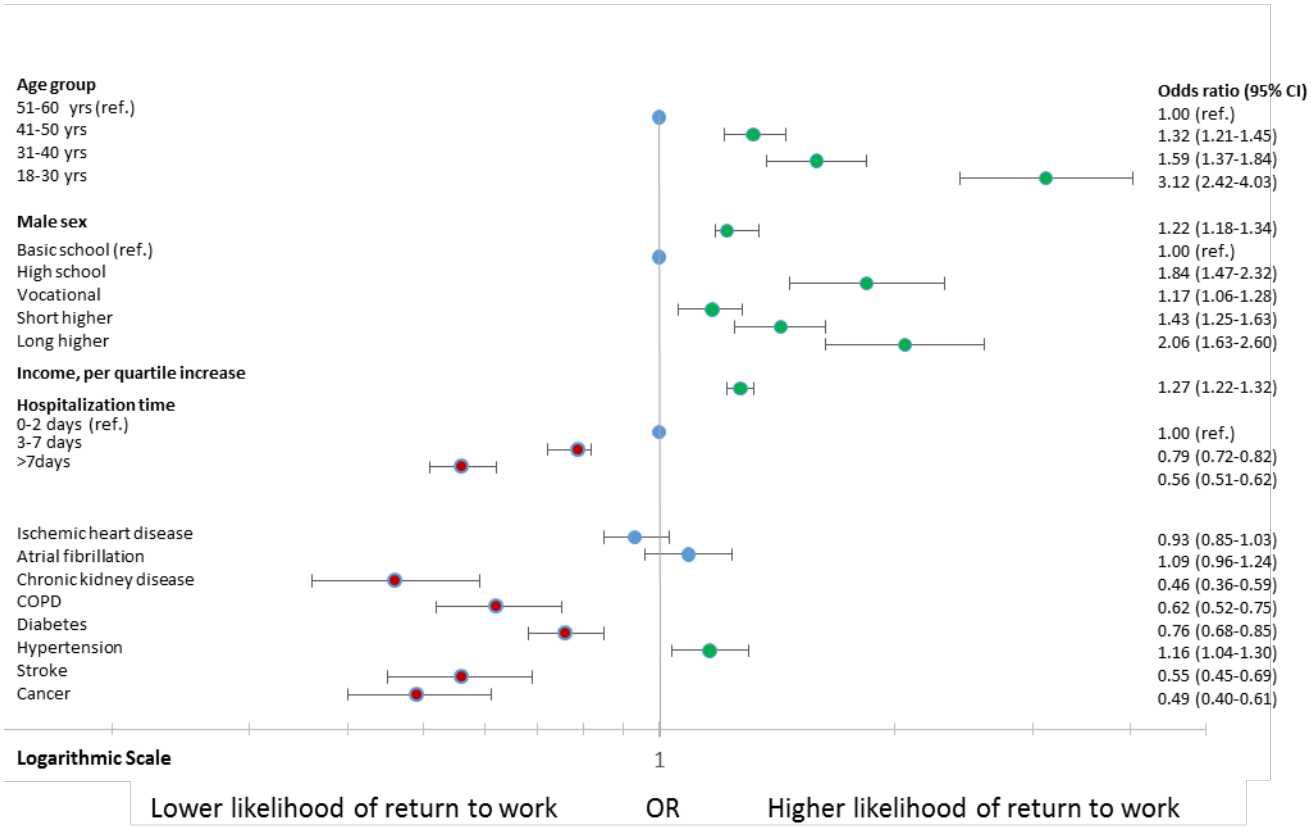


Figure 2 Outcome after 4 years. Distribution of four years outcomes following first HF hospitalization in patients employed/available to the workforce with (n=2495) and without (n=9385) history of chronic kidney disease, COPD, diabetes, stroke or cancer. The estimates account for early end of follow-up.



NC - No comorbidity;
C - Comorbidity;

Figure 3 Multiple logistic regression model of predictors of return to the workforce 1 year after first hospitalization for HF among patients in the workforce before hospitalization (n=11880).

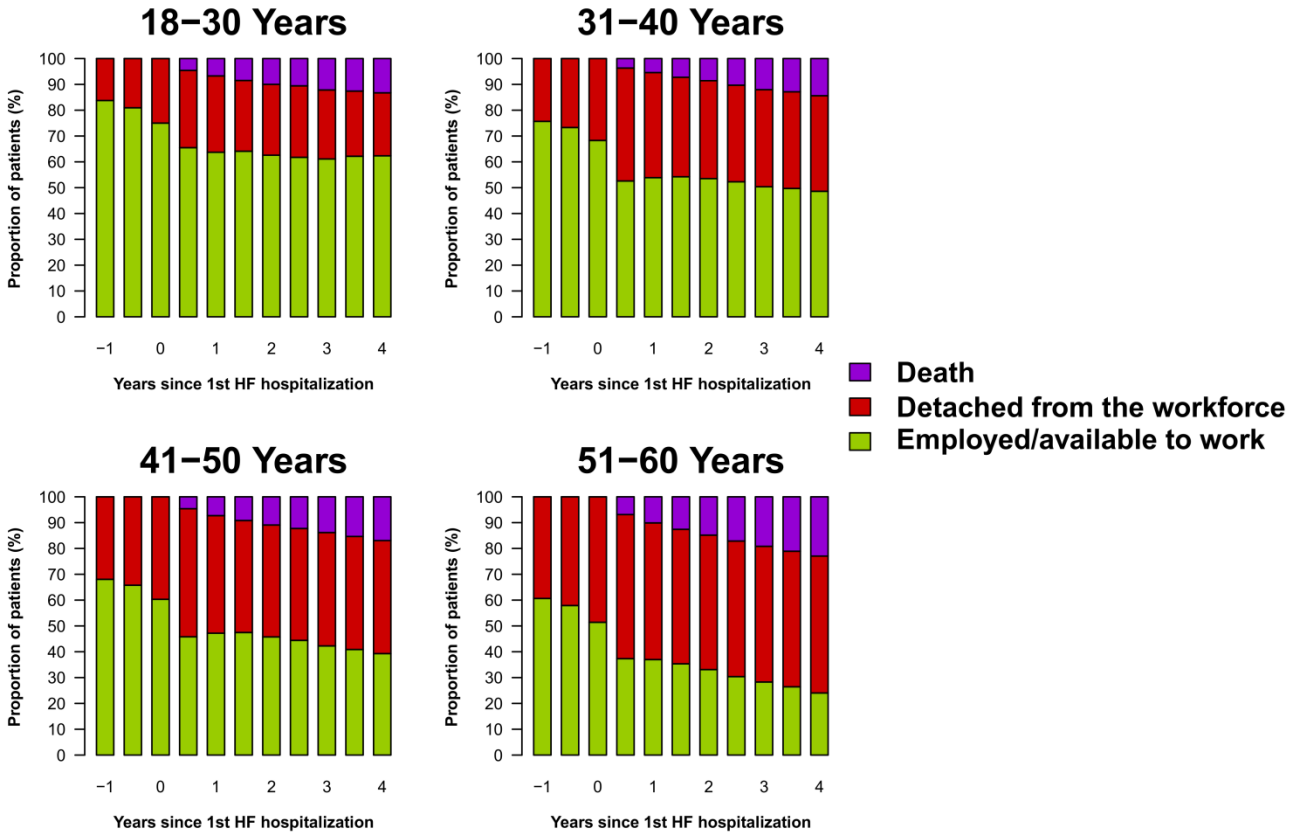


Supplementary material

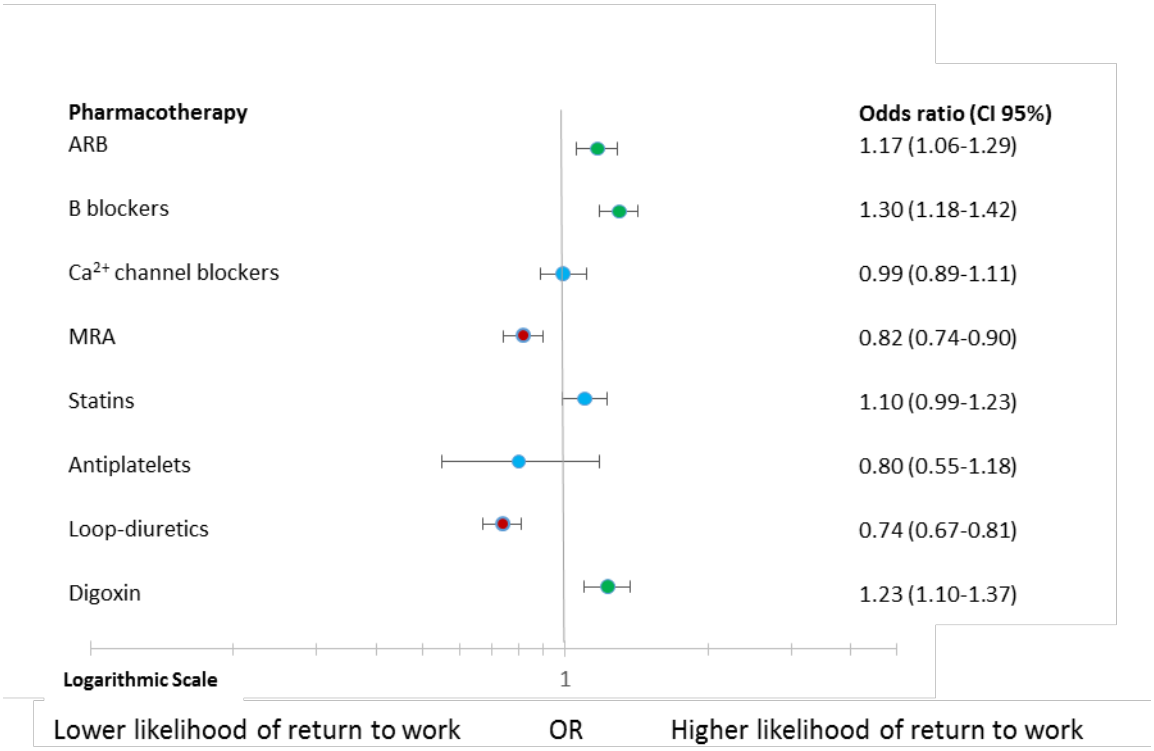
Appendix ICD-10 codes for heart failure and comorbidities

Heart failure	I11.0, I13.0, I13.2, I42, I50
Renal disease	N03, N04, N17-N19, R34, I12, I13
Hypertension	I10-I15
Stroke	I60-I61, I63-I64
Diabetes mellitus	E10-E14
Ischemic heart disease	I20-I25
Atrial fibrillation	I48
Myocardial infarction	I21, I22
Cancer	C00-C99
COPD	J42, J44

Supplementary figure I Distribution of patient outcome following first HF hospitalization in all patients (n=21455). The estimates account for early end of follow-up and are updated every 6 months. The bars at -0.5 and -1 show distributions 6 months and 1 year before the first HF hospitalization, respectively.



Supplementary figure II Multiple logistic regression model of predictors including HF medication of return to the workforce 1 year after first hospitalization for HF among patients in the workforce before hospitalization (n=11880).



ARB- Angiotensin-converting enzyme inhibitors and angiotensin-II receptor blockers;
MRA - mineralocorticoid receptor antagonists; OR- odds ratio;