Return to the Workforce After First Hospitalization for Heart Failure

A Danish Nationwide Cohort Study

Editorial, see p 1010

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 21 455 patients of working age (18–60 years) with a first HF hospitalization in the period from 1997 to 2012. Of these patients, 11 880 (55%) were in the workforce before HF hospitalization and comprised the study population. We applied logistic regression to estimate odds ratios 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 versus 51–60 years; odds ratio [OR], 3.12; 95% confidence interval [CI], 2.42–4.03), male sex (OR, 1.22; 95% CI, 1.12–1.34), and level of education (long-higher versus basic school; OR, 2.06; 95% CI, 1.63–2.60). Conversely, hospital stay >7 days (OR, 0.56; 95% CI, 0.51–0.62) and comorbidity including history of stroke (OR, 0.55; 95% CI, 0.45–0.69), chronic kidney disease (OR, 0.46; 95% CI, 0.36–0.59), chronic obstructive pulmonary disease (OR, 0.62; 95% CI, 0.52–0.75), diabetes mellitus (OR 0.76; 95% CI, 0.68–0.85), and cancer (OR, 0.49; 95% CI, 0.40–0.61) were all significantly associated with lower chance of return to work.

CONCLUSIONS: Patients in the workforce before HF hospitalization had low mortality but high risk of detachment from the workforce 1 year later. Young age, male sex, and a higher level of education were predictors of return to work.

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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, and financially for society as a whole, as well.

What Are the Clinical Implications?

- One of three patients, who were employed/able to work before their first heart failure hospitalization, were not in the workforce 1 year later, despite a relatively low 1-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 nonreturn to work of younger patients, we hope to stimulate more research into why this happens and whether it can be avoided.
- Interventions that maintain employment in these patients could have beneficial effects on both their physical and mental health.

Heart failure (HF) is associated with considerable morbidity, reduced quality of life, and a 5-year mortality of >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 past 30 years.[5] The improved prognosis combined with better treatment and survival for patients with congenital and acute cardiovascular diseases has resulted in the 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 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, the 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. In addition 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, therefore, should shed light on an unstudied consequence of HF and provide a novel perspective on the impact of HF on the lives of those who, perhaps, have the 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 that contains weekly follow-up of all public welfare payments since 1991, including sickness pension and disability benefits. (It has previously been validated for the study of the social and economic consequences of disease.[13]); (2) Danish nationwide administrative registries that hold information on sociodemographic characteristics, income, and education level; (3) the Danish National Patient Registry that holds information of all admissions to hospitals since 1978, and outpatient visits since 1995, coded according to the *International Classification of Diseases, Eighth Revision*, and the *International Classification of Diseases, Tenth Revision*[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 that holds information on vital status; and (6) The Danish Cause of Death Registry that holds information about the primary and underlying cause of death.

Study Population and Baseline Variables

The study population comprised patients who were 18 to 60 years of age at the time of first hospitalization for HF in the period 1997 to 2012, and who were members of the workforce (employed or available to work) before hospitalization (Figure 1). Because of 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 (online-only Data Supplement Table I) in the study period, and those with a prior HF hospitalization (1978–1996) were excluded. Each contact is coded by 1 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 4 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

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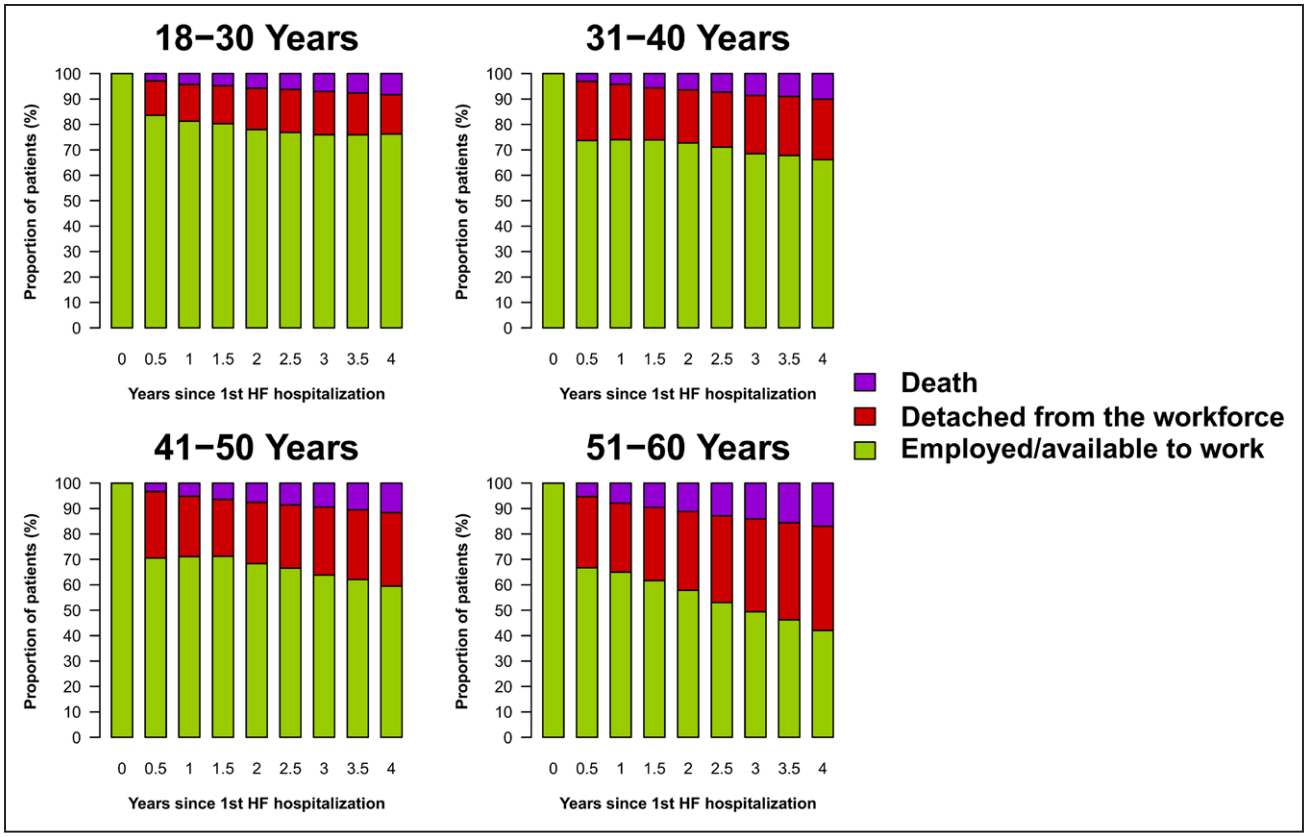

Figure 1. Distribution of patient outcome following first HF hospitalization in patients employed/available to the workforce before hospitalization (18–30 years, n=429; 31–40 years, n=1064; 41–50 years, n=3059; and 51–60 years, n=7328).

The estimates account for early end of follow-up and are updated every 6 months. HF indicates heart failure.

receive a full state pension. Comorbidities, ie, ischemic heart disease, cancer, atrial fibrillation, chronic kidney disease, chronic obstructive pulmonary disease (COPD), diabetes mellitus, hypertension, and stroke, were identified by at least 1 hospitalization in a 10-year period before and including index HF hospitalization (online-only Data Supplement Appendix I). History of diabetes mellitus was additionally identified by at least 1 filled prescription for glucose-lowering drugs 6 months before first HF hospitalization. Medical therapy before first HF hospitalization was defined by at least 1 filled prescription of the drug in the preceding 6 months. We assessed the use of the following drugs: angiotensin-converting enzyme inhibitors and angiotensin-II receptor blockers, aspirin, calcium channel blockers, digoxin, clopidogrel, mineralocorticoid receptor antagonists, statins, β-blockers, and loop diuretics. Average 5-year family income before first HF hospitalization was calculated and summarized in quartiles.

Outcome Measures

Work status at the time of HF hospitalization was determined based on the 5 weeks leading up to the first HF hospitalization. We subsequently evaluated work status in 5-week periods, 6 months after discharge, and repeated this evaluation at fixed time points every 6 months up to a total of 4 years of follow-up. The primary outcome was return to the workforce estimated in the 5-week period 1 year after the first HF hospitalization. Patients who were not on paid sick leave, had not taken early retirement, or had not received any support because of reduced working capability were classified as able to work, as were patients receiving state educational grants, paid maternity leave, or some other leave of absence, because these social benefits are for persons who are capable of working. We used 5-week evaluation periods to reduce misclassification, ie, 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 3 or more of the 5 evaluated weeks were classified as detached from the workforce. It is important to note that 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 of 5 and 4 of 5 weeks, respectively. We subsequently 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 1 year before first HF hospitalization.

Statistics

Baseline age was grouped (18–30, 31–40, 41–50, and 51–60 years). 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 analyzed by multiple logistic regression, adjusting for age, sex, income, education level, and comorbidities (ischemic heart disease, cancer, atrial fibrillation, chronic kidney disease, COPD, diabetes mellitus, 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 31, 2013. Patients who were not followed for 1 year because of 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-month intervals in the first 4 years after the initial hospitalization. Early end of follow-up because emigration and administrative censoring on December 31, 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, by 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) 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 21 455 patients aged 18 to 60 years with first HF hospitalization between 1997 and 2012. Of these, 11 880 (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 the youngest age group 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=21 455) stratified by workforce availability and age group are shown in Table 3. At baseline, 9575 (45%) patients were not in the workforce. In comparison with those in the workforce, these patients had higher frequency of ischemic heart disease, cancer, chronic kidney disease, COPD, diabetes mellitus, and stroke. Postdischarge 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 before first HF admission, a decrease in the workforce fraction was seen in all age groups: 15% in the oldest group, 11% in patients aged 41 to 50 years, and 9% in the 2 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, 1-year mortality was low, ranging from 4% to 8%, and was highest in the oldest age group (Figure 1). We assessed return to work among patients with (n=9385) and without (n=2495) significant comor-

Table 1. Occupational Status at Time of First Heart Failure Hospitalization According to Age Group

	Age Group, n (%)				
	All (n=21 455)	18–30 y (n=572)	31–40 y (n=1558)	41–50 y (n=5073)	51–60 y (n=14 252)
In the workforce	11 880 (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)

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Table 2. Baseline Characteristics of Patients in the Workforce Before First Hospitalization for Heart Failure (n=11 880).

	Age Group, mean±SD or n (%)				
	18–30 y (n=429)	31–40 y (n=1064)	41–50 y (n=3059)	51–60 y (n=7328)	*P* Value
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)	
Highest education level					<0.0001
Basic school <10 y	201 (47)	341 (32)	1006 (33)	2367 (32)	
High school, +3 y	59 (14)	58 (5)	140 (5)	217 (3)	
Vocational education	91 (21)	386 (36)	1209 (40)	3043 (42)	
Short/medium higher, +2–4 y	35 (8)	144 (14)	396 (13)	1049 (14)	
Long higher, +≥5 y	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, days					<0.0001
0–2	161 (38)	348 (33)	1057 (35)	2343 (32)	
3–7	124 (29)	350 (33)	1106 (36)	2849 (39)	
>7	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
Chronic obstructive pulmonary disease	0 (0)	11 (1)	87 (3)	401 (5)	<0.0001
Diabetes mellitus	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
β-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
Mineralocorticoid receptor antagonists	49 (11)	191 (18)	618 (20)	1585 (22)	<0.0001

Values displayed are mean±SD or number (%). ACE-I indicates angiotensin-converting enzyme inhibitors; and ARB- angiotensin-II receptor blockers.
*Average 5-year family income before event, in quartiles.
†Filled prescriptions 180 days before admission.

bidity, ie, no history of stroke, diabetes mellitus, chronic kidney disease, COPD, and cancer. During 4 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 is depicted in online-only Data Supplement Figure I. Among patients

Table 3. Baseline Characteristics of All Patients With a First Hospitalization for Heart Failure From 1997 to 2012 (n=21 455)

	Workforce Availability			
	Yes		No	
Age group, y	18–40	41–60	18–40	41–60
Patients, n	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 y	542 (36)	3373 (32)	351 (55)	4434 (50)
High school, +3 y	117 (8)	357 (3)	37 (6)	209 (2)
Vocational education	477 (32)	4252 (41)	169 (27)	3050 (34)
Short/medium higher, +2–4 y	179 (12)	1445 (14)	29 (5)	777 (9)
Long higher, +≥5 y	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, days				
0–2	509 (34)	3400 (33)	253 (40)	3174 (36)
3–7	474 (32)	3955 (38)	188 (30)	2988 (33)
>7	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)
Chronic obstructive pulmonary disease	11 (1)	488 (5)	16 (3)	942 (11)
Diabetes mellitus	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)

Values displayed are mean±SD or number (%).
*Average 5-year family income before event, in quartiles.

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 with 95% confidence intervals 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 sex, higher educational attainment, and higher income were associated with a higher likelihood of returning to the workforce. Conversely, several comorbidities such as stroke, diabetes mellitus, 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 were 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 sick leave from the workforce was

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Table 4. Pharmacotherapy 90 Days After Discharge Among Those Who Are Still Alive (n=11 501) Defined by Filled Prescriptions

	Age Group, y			
	18–30	31–40	41–50	51–60
Patients, n	421	1042	2991	7047
Pharmacotherapy, n (%)				
Loop diuretics	138 (33)	503 (48)	1604 (54)	4234 (60)
Antiplatelets, any	32 (8)	263 (25)	1193 (40)	3221 (46)
β-Blockers	193 (46)	647 (62)	2020 (68)	4603 (65)
Statins	15 (4)	172 (18)	961 (32)	2626 (37)
ACE-I/ARB	212 (50)	697 (67)	2288 (77)	5308 (75)
Thiazides	26 (6)	86 (8)	281 (9)	686 (10)
Ca^{2+} channel blockers	25 (6)	108 (10)	338 (11)	989 (14)
Digoxin	47 (11)	185 (18)	590 (20)	1712 (24)
Mineralocorticoid receptor antagonists	70 (17)	264 (25)	805 (27)	1898 (27)

Ejection fraction is not known. ACE-I indicates angiotensin-converting enzyme inhibitors; and ARB, angiotensin-II receptor blockers. P <0.0001.

accepted. When sick 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 sick leave from the workforce was accepted. When sick 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 the primary diagnosis and found no significant difference in 1 year return to workforce in comparison with 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 were seen when we required 2 or 4 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 angiotensin-converting enzyme inhibitors/angiotensin II receptor blockers, β-blockers, and digoxin were significantly associated with increased likelihood of return to work. Conversely, loop diuretics and mineralocorticoid receptor antagonists were significantly associated with lower likelihood of return to work (online-only Data Supplement 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 one-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 comorbidities (stroke, diabetes mellitus, cancer, COPD, and chronic kidney disease) were associated with detachment from the workforce.

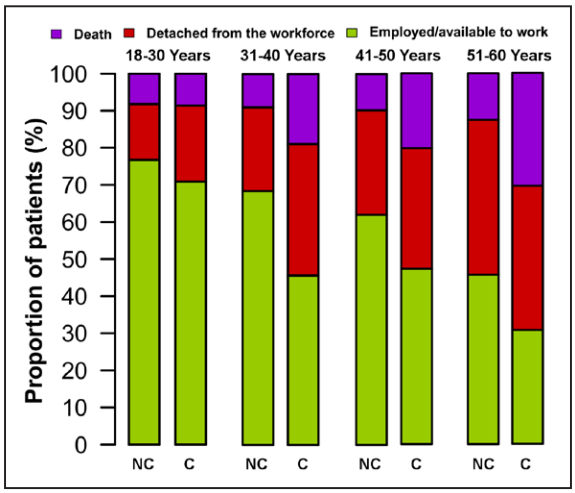

Figure 2. Outcome after 4 years.
Distribution of 4 years of outcomes following first HF hospitalization in patients employed/available to the workforce with (n=2495) and without (n=9385) history of chronic kidney disease, COPD, diabetes mellitus, stroke, or cancer. The estimates account for the early end of follow-up. C indicates comorbidity; and NC, no comorbidity.

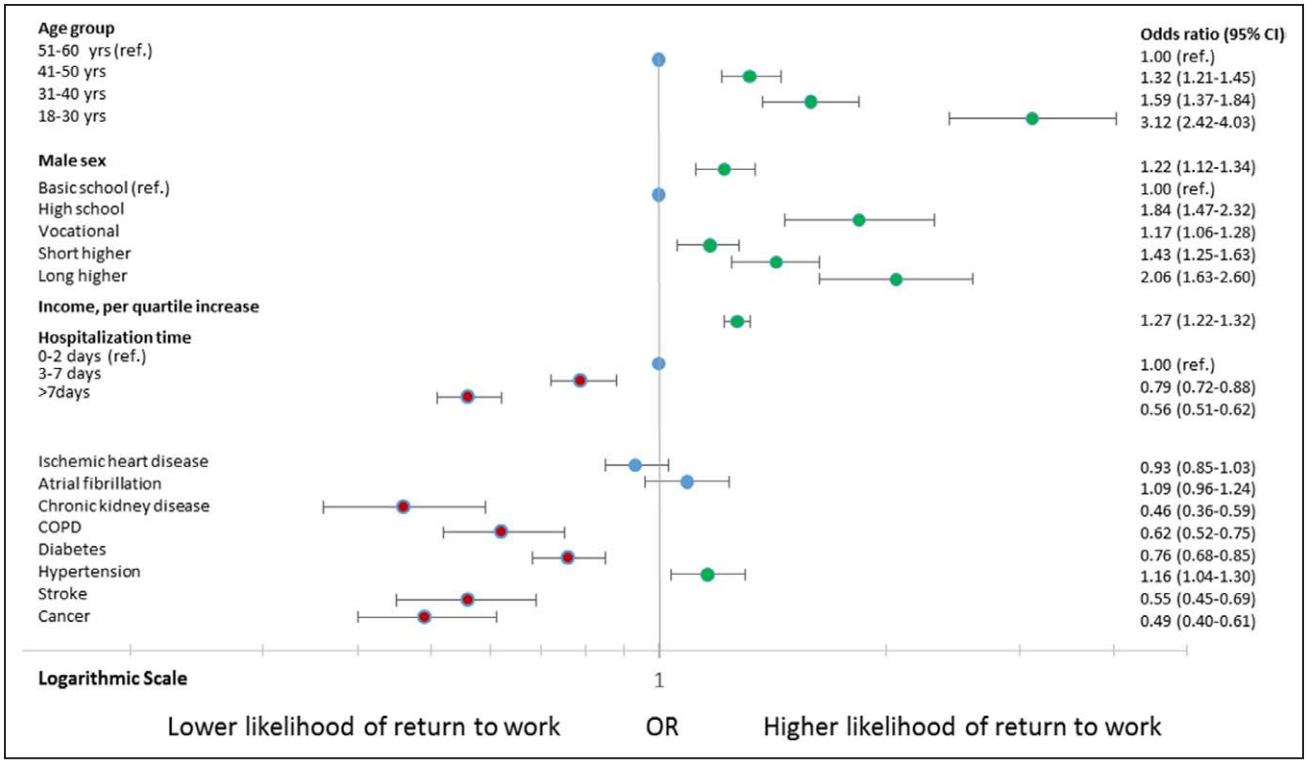

Figure 3. Multiple logistic regression model of predictors of return to the workforce 1 year after first hospitalization for HF among patients in the workforce before hospitalization (n=11 880).
CI indicates confidence interval; COPD, chronic obstructive pulmonary disease; and OR, odds ratio.

Work capability among HF patients has, to our knowledge, not been assessed before. HF has been shown to reduce quality of life, based on standardized 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 the 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 2-way, because changes in employment have 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 the time of first hospitalization for HF, nearly half of the patients had been detached from the workforce. Evidently, some of the patients had 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. Our primary end point was return to the workforce, but mortality is of great importance. In comparison 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 and 60 years of age, ie, young patients with a better prognosis. The MAGGIC (Meta-analysis Global Group in Chronic Heart Failure) meta-analysis reported a similar 1-year mortality of between 6.5% and 7.5% in patients aged <60 years.[21,22] Another explanation might be that our patients were part of the workforce before admission and thus were 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 before hospitalization.

Among patients in the workforce before hospitalization, we found that a significant fraction was detached from the workforce when evaluated 1 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 by using the same Danish data.[15,23] It is striking that 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] Returns

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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 1 year after their cardiac arrest.[15] It is clearly important, therefore, to try to better understand why this detachment from the workforce occurs. For example, is it solely attributable to reduced functional capacity or might it reflect the psychological or other consequences of a diagnosis of HF? 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 caregivers? 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 labor market and dependence on public benefits has great economic consequences that go beyond the already significant economic burden these patients place on the healthcare system, and potentially many other social, psychological, and medical implications, as well. It is perhaps not surprising that the youngest age group had the highest proportion returning to and maintaining capability of working, which could be because of a lower prevalence of comorbidities and a 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 1 year after HF hospitalization. Cancer, chronic kidney disease, COPD, and stroke showed the strongest associations, but diabetes mellitus also had a significant association with a reduced chance of return to work. These findings emphasize the importance of a multidisciplinary approach to the management of HF patients.[24,25] For example, in a young person with cancer and HF as a result of chemotherapy, it may be the cancer rather than HF that prevents full functional and psychological recovery and return to work. In keeping with this, we saw a strong correlation between comorbidity and a lower chance of return to work. Nevertheless, we still found that a large proportion of those with HF and no comorbidity also failed to return to the workforce (Figure 2).

Contribution of National Policies Regarding Healthcare 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 a low percentage of unemployment in comparison with other Western countries. No one is forced to retire, but people can receive a full state-funded pension at the age of 65 years if they were born before January 1, 1959, otherwise at the age of 67 years.

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 functional class. Also, we chose to look at first hospitalization and disregarded prior outpatient contacts attributable to HF. This means some patients have diagnosed and treated HF, but we chose this approach to ensure the inclusion of patients with similar severity of disease, ie, 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. Because of 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. Last, 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 because of the lack of necessity and not because of poor performance status. Because of emigration, the 1-year outcome was not available for 54 patients (0.5%). In our logistic regression analyses, these patients were set to be detached from the workforce. This potentially incurred a small bias.

CONCLUSIONS

Among individuals in the workforce before first HF hospitalization, we found that, despite a low mortality, 30% were not in the workforce 1 year later. Younger age, male sex, and a higher level of education and income were associated with return to work, whereas comorbidities and longer hospital stays reduced the chance of returning to work. The 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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FOOTNOTES

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