Original Article

Syncope and Its Impact on Occupational Accidents and Employment
A Danish Nationwide Retrospective Cohort Study

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Background—First-time syncopal episodes usually occur in adults of working age, but their impact on occupational safety and employment remains unknown. We examined the associations of syncope with occupational accidents and termination of employment.

Methods and Results—Through linkage of Danish population-based registers, we included all residents 18 to 64 years from 2008 to 2012. Among 3 410 148 eligible individuals, 21 729 with a first-time diagnosis of syncope were identified, with a median age 48.4 years (first to third quartiles, 33.0–59.5), and 10 757 (49.5%) employed at time of the syncope event. Over a median follow-up of 3.2 years (first to third quartiles, 2.0–4.5), 622 people with syncope had an occupational accident requiring hospitalization (2.1/100 person-years). In multiple Poisson regression analysis, the incidence rate ratio in the employed syncope population was higher than in the employed general population (1.44; 95% confidence interval [CI], 1.33–1.55) and more pronounced in people with recurrences (2.02; 95% CI, 1.47–2.78). The 2-year risk of termination of employment was 31.3% (95% CI, 30.4%–32.3%), which was twice the risk of the reference population (15.2%; 95% CI, 14.7%–15.7%), using the Aalen–Johansen estimator. Factors associated with termination of employment were age <40 years (incidence rate ratio, 1.48; 95% CI, 1.37–1.59), cardiovascular disease (1.20; 95% CI, 1.06–1.36), depression (1.72; 95% CI, 1.55–1.90), and low educational level (2.61; 95% CI, 2.34–2.91).

Conclusions—In this nationwide cohort, syncope was associated with a 1.4-fold higher risk of occupational accidents and a 2-fold higher risk of termination of employment compared with the employed general population. (*Circ Cardiovasc Qual Outcomes*. 2017;10:e003202. DOI: 10.1161/CIRCOUTCOMES.116.003202.)

Key Words: cardiovascular research ■ epidemiology ■ hospitalization ■ incidence ■ injury ■ TLoC ■ work

The incidence of syncope peaks in early working age,[1,2] yet there are few data on its impact on occupational safety and employment. The consequences of syncope in the workplace are important to establish because the lifetime prevalence of syncope is 35%, and one third of patients experience recurrent syncope within few years.[3,4]

Approximately 3.4 million workers are treated in emergency departments for occupational injuries in the United States each year, and globally 3.5 healthy life-years per 1000 workers are lost because of occupational injuries.[5,6] About one third of occupational injuries are because of either falls or traffic accidents, which may be preventable.[5,7] Syncope, characterized by a sudden loss of consciousness with subsequent spontaneous and complete recovery,[3] could lead to an occupational accident if it occurs during working hours.

A recent study showed that patients with previous syncope had almost twice the risk of motor vehicle crashes compared with the general population[8]; however, the potential association of syncope with occupational accidents remains unknown.[9,10] Besides the direct consequences of a syncope, several studies have suggested that syncope is associated with impaired quality of life comparable to that of patients with chronic disorders.[11,12] Plausibly, one of the main reasons for poor quality of life after syncope could be interference with employment and work life. In 1 study, half of the patients with syncope reported that it influenced their ability to work.[11]

The impact of syncope on employment merits further research. Consequently, we analyzed data from a nationwide cohort to examine the association between syncope and risks of subsequent occupational accidents and termination of employment.

WHAT IS KNOWN

- First-time syncopal episodes occur frequently in adults of working age but their impact on occupational safety and employment remains unknown.

WHAT THE STUDY ADDS

- In this nationwide cohort study, syncope is associated with higher risks of subsequent workplace accidents and loss of employment.
- Patients with syncope recurrence, young age, poor socioeconomic status, and comorbidity, such as cardiovascular disease and depression, are at particularly high risk of adverse workplace outcomes.

Methods

Setting

Data in this study cover the period from January 1, 2008, to December 31, 2013. In Denmark, health care is based on a tax-financed system that provides with equal access to all residents free of personal charge.[13] Similarly, financial support may be provided through different types of social benefits among individuals who are unable to maintain a livelihood.

Registers

In this nationwide study, we used a register-based follow-up design. At time of birth or on immigration, all Danish residents are assigned a unique and permanent civil registration number that enables individual-level linkage between nationwide administrative registers holding information on labor market associations and healthcare use.[13]

The Civil Registration System holds information on date of birth, migration, and death.[13] Medical history was retrieved from the Danish National Patient Register, which holds information about all hospitalizations since 1977.[14] Each hospital contact is recorded with one primary and, if appropriate, secondary diagnoses, coded according to the International Classification of Diseases (ICD). From 2008, the registry also holds information about hospitalizations due to occupational accidents, which are coded according to Nordic Medico-Statistical Committee classification of External Causes of Injuries.[14] Medical history was supplemented with information about redeemed prescriptions, which is coded according to the Anatomical Therapeutic Chemical classification in the Danish Register of Medicinal Product Statistics.[15]

We retrieved information about employment status from a registry administered by the Danish National Labor Market Authority, which is updated on a weekly basis.[16] The register includes all Danish residents since 1991 who have received social benefits, including state education fund grants and paid parental leave; social security, unemployment benefits, or other labor market–related benefits; sickness benefits, disability pension, or other health-related benefits; and retirement pension. Data in the register on changes in employment status have been validated with a 98% positive predictive value.[16] In Denmark, the employer is committed to finance sick leave with duration of ≤3 weeks; consequently, data on sick leaves ≤3 weeks are not reported to the register. Registered sick leave >3 weeks is, however, recorded with retrospective correction of the duration and has been validated excellently in the register.[17] From the register, we were also able to retrieve monthly information about the individual's occupational type, which was registered according to a national version of the European Statistical Classification of Economic Activities.

Highest completed level of education was used as a proxy for socioeconomic status. We obtained information from the Population Education Register that includes educational information for 96.4%

of the Danish population according to International Standard Classification of Education.[18]

Study Population and Employment Status

The study population comprised all Danish residents of working age, 18 to 64 years, in the period from 2008 to 2012. We identified a cohort comprising all patients discharged with a first-time primary diagnosis of syncope from hospital or emergency department in this period, using the ICD diagnosis code (10th revision R55.9), which has been validated with a positive predictive value of 95%.[19]

Individuals not receiving any social benefits were classified as employed.[16] Employment was assessed in 2 ways: first, we assessed baseline employment ≤14 days before syncope (before inclusion for the general population). Second, we assessed active employment by creating a time-varying variable, updated weekly throughout follow-up. During the study period, regular retirement with public pension was usually possible from age 65.

Comorbidity

We considered the following medical variables as potential confounders: cardiovascular disease (including ischemic heart disease or previous myocardial infarction, heart failure, arrhythmias, atrioventricular block or left bundle branch block, cerebral vascular disease, or peripheral vascular disease), pacemaker or implantable cardioverter–defibrillator, diabetes mellitus, and depression. Information was retrieved from discharge or surgical procedure codes ≤10 years before inclusion (Table I in the Data Supplement). The definition of diabetes mellitus and depression was augmented by claimed prescriptions of antidiabetic drugs and antidepressants, respectively. Recurrent syncope was defined as a second hospitalization for syncope.

Outcome Measures

The first outcome was occupational accidents, defined as any hospital encounter (emergency department visit or inpatient admission) during the study period registered as an occupational accident (Table I in the Data Supplement); the approach has been validated previously with a sensitivity of 87% and a positive predictive value of 96%.[20] The study population in active employment was followed up until the first of the following events: occupational accident, death, emigration, or end of study through December 31, 2013.

The second outcome was termination of employment following syncope evaluated using baseline employment as reference. Among the people who maintained or returned to employment within 1 month after syncope hospitalization, we evaluated termination of employment counting from the day of syncope discharge or the day of return to employment in case of registered work absence. Termination of employment was defined as initiation of labor market–related or health-related social benefits (Table I in the Data Supplement). Besides death, emigration, and end of study, individuals were also censored on registration of paid parental leave, state education fund grants, or regular retirement pension.

Statistics

We identified patients with syncope using a time-dependent approach so that subjects contributed to at-risk time in the general population until the date of syncope. Basic characteristics are therefore presented at time of study start for the general population and, correspondingly, at time of syncope hospitalization for the syncope population. Crude incidence rates were calculated as number of events per 100 person-years (PY) at risk.

We used multiple Poisson regression analyses to examine incidence rate ratios (IRRs) of subsequent occupational accidents with 95% confidence intervals (CIs) among employed people with syncope compared with the employed general population. Follow-up time was split according to the Lexis diagram so that individuals contributed PY to both unexposed and exposed groups, which enabled continuous update of time-dependent variables (ie, age, comorbidity, employment status, occupational sector, and calendar year).[21] The

Poisson regression models were adjusted for age, sex, calendar year, educational level, comorbidities, and pacemaker or implantable cardioverter–defibrillator. We evaluated effect modification between relevant covariates (including age, sex, educational level, cardiovascular disease, and occupational sector) by inclusion of interaction terms in the model using likelihood ratio tests. A 2-sided P value <0.05 was considered as significance level in all analyses.

Cumulative incidence proportion curves were calculated to illustrate cumulative risk of termination of employment after syncope. Cumulative incidence was assessed using the Aalen–Johansen estimator to account for competing risks in the syncope population.[22] To provide context, patients with syncope were matched with 2 controls from the employed general population by year of birth and sex.

We performed several sensitivity analyses. First, because of a large number (18.7%) of missing data on occupational sector in the employed population, occupational sector was not included in our main analysis. However, we performed the following sensitivity analyses on occupational sector: (1) the main model was redone with adjustment for occupational sector as complete case analysis and (2) the main model was redone with worst and best case approach analyses, where missing values were handled as occupational sector with highest and lowest risk of accidents, respectively. Second, we considered alternative definitions of continuous employment, with analysis of durations of termination of employment of ≤4 and ≤12 consecutive weeks of social benefits, followed by subsequent employment, as ongoing employment. Third, we examined baseline factors associated with termination of employment within 2 years in the syncope population using multiple Poisson regression analysis. Finally, we examined what type of social benefits that were related to termination of employment among people with syncope.
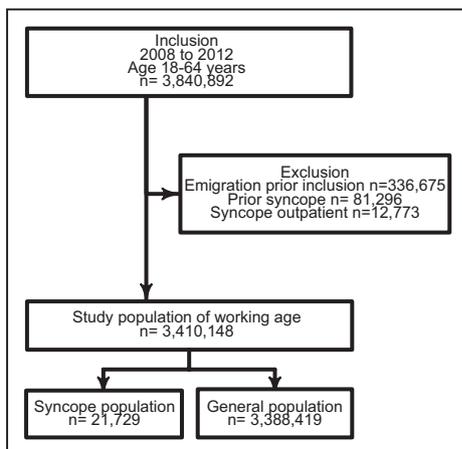
Statistical analyses were performed using SAS version 9.4 (SAS Institute Inc, Gary, NC) and R version 3.3 (R Foundation for Statistical Computing, Vienna, Austria).

Ethics

This study was approved by the Danish Data Protection Agency (reference number: 2007-58-0015/GEH-2014-014 I-Suite number: 02732). In Denmark, ethical approval is not required for retrospective register-based studies by law. All analyses were executed on servers placed at Statistics Denmark, which also has the administrative rights to the data and ensures encryption encoding of the personal identification numbers.

Results

In the period 2008 to 2012, a total of 3 410 148 Danish residents between 18 and 64 years were identified; of these, 21 729 had a first-time hospital encounter for syncope (Figure 1). The median age for patients with syncope was 48.4 years (first to third quartiles, 33.0–59.5), 10 807 (49.7%) were men, and median follow-up was 3.2 years (first to third quartiles, 2.0–4.5; Table 1). At the time of syncope, 10 757 (49.5%) were employed, whereas nonemployed people were predominantly receiving health-related social benefits (21.7%, n=4707).

Occupational Accidents

Throughout follow-up, people with syncope were employed for a total of 29 835 PY, during which 622 had an occupational accident (incidence rate, 2.1/100 PY): 498 (80.1%) had a documented injury in relation to their accident, and accidents were most frequent in manual occupational sectors (Table 2). Correspondingly, in the employed general population, 175 769 had an occupational accident (incidence rate, 1.6/100 PY), with an age- and sex-adjusted IRR, 1.55 (CI, 1.43–1.67; P<0.001) and fully adjusted IRR, 1.44 (CI, 1.33–1.55; P<0.001). Figure 2 provides a summary of results from the main and subgroup analyses. Recurrent syncope was associated with an additional 1.4-fold increased risk of occupational accidents compared with patients with 1 hospitalization for syncope (IRR, 1.44; CI, 1.03–1.99; P=0.03). In subgroup analyses, IRRs were particularly increased among people with syncope who had low educational level (P for interaction=0.005) and age <40 years (P for interaction=0.03). There was no difference in risk of occupational accidents between people with syncope who had cardiovascular disease and people who did not (P for interaction=0.35). However, we found a tendency toward higher IRRs among people with syncope and either preexisting ventricular arrhythmia, heart failure, or pacemaker and ICD (Figure I in the Data Supplement), but the associations were based on a limited number of events, thus not significant (P for interaction=0.11, 0.68, and 0.16, respectively). The relatively higher IRR of occupational accidents among women with syncope compared with men with syncope was associated with differences in occupational sector (P<0.001 for interaction; Figure II in the Data Supplement). In all sensitivity analyses on occupational sector and risk of occupational accidents, we found risk estimates similar to those in the main analysis (Table II in the Data Supplement).

Termination of Employment

Among the 10 757 individuals who were employed at the time of syncope, a total of 9854 (91.6%) maintained or returned to employment within 1 month after discharge; the proportion was >90% regardless of age, sex, educational level, and occupational sector. Yet, among these individuals, the overall 2-year risk of termination of employment was 31.3% (CI, 30.4%–32.3%), which was twice the risk compared with age- and sex-matched controls (15.2%; CI, 14.7%–15.7%; Figure 3). The risk of termination of employment was reduced when periods of ≤4 weeks (26.7%; CI, 25.9%–27.6%) and ≤12 weeks (19.5%; CI, 18.7%–20.3%) of social benefits followed by subsequent employment were considered as ongoing employment. Factors associated with termination of employment in the syncope population were age <40 years (IRR, 1.48; CI, 1.37–1.59; P<0.001), cardiovascular disease (IRR, 1.20; CI, 1.06–1.36; P=0.005), depression (IRR, 1.72; CI, 1.55–1.90; P<0.001), and low educational level (IRR, 2.61; CI, 2.34–2.91; P<0.001; Figure 4). Figure III in the Data Supplement further includes occupational sector and

Figure 1. Flowchart. Inclusion of the study population.

Inclusion
2008 to 2012
Age 18-64 years
n= 3,840,892

Exclusion
Emigration prior inclusion n=336,675
Prior syncope n= 81,296
Syncope outpatient n=12,773

Study population of working age
n= 3,410,148

Syncope population
n= 21,729

General population
n= 3,388,419

Table 1. Basic Characteristics of the Syncope and General Population*†

Characteristics	Syncope (n=21 729)	General Population (n=3 388 419)
Age, median (Q1–Q3), y	48.4 (33.0–59.5)	39.2 (26.2–51.1)
Age groups, y		
18–39	7654 (35.2)	1 750 212 (51.7)
≥40	14 075 (64.8)	1 638 207 (48.3)
Sex		
Women	10 922 (50.3)	1 664 081 (49.1)
Men	10 807 (49.7)	1 724 338 (50.9)
Employment status		
Employed (no social benefits)	10 757 (49.5)	2 302 672 (67.9)
Labor market–related social benefits	1884 (8.7)	177 954 (5.2)
Health-related social benefits	4707 (21.7)	337 060 (10.0)
Regular retirement pension	2640 (12.1)	104 467 (3.1)
Other social benefits‡	1741 (8.0)	466 266 (13.8)
Education (ISCED level)		
Basic school (0–2)	8433 (38.8)	1 140 845 (33.7)
High school education (3)	1450 (6.7)	253 760 (7.5)
Vocational education (3)	7007 (32.3)	1 014 858 (29.9)
Higher education (5–6)	2979 (13.7)	520 379 (15.4)
Long higher education (7–8)	941 (4.3)	164 083 (4.8)
Unknown education	919 (4.2)	294 494 (8.7)
Comorbidity		
Cardiovascular disease§	3602 (16.6)	114 040 (3.4)
Ischemic heart disease	1532 (7.1)	48 295 (1.4)
Cardiac arrhythmias	1261 (5.8)	35 412 (1.1)
Supraventricular arrhythmia	937 (4.3)	25 686 (0.8)
Ventricular arrhythmia	161 (0.7)	2825 (0.1)
Heart failure	696 (3.2)	12 054 (0.4)
Atrioventricular block and LBBB	134 (0.6)	1857 (0.05)
Cerebral vascular disease	1053 (4.9)	26 052 (0.8)
Depression	4461 (20.5)	196 297 (5.8)
Diabetes mellitus	1576 (7.3)	79 214 (2.3)
ICD	121 (0.6)	1089 (0.03)
Pacemaker	164 (0.8)	2023 (0.06)
Hospital contact type for syncope		
Inpatient	11 914 (54.8)	NA
Emergency department	9815 (45.2)	NA

ICD indicates implantable cardioverter–defibrillator; ISCED, international standardized classification of educational degree; LBBB, left bundle branch block; NA, not applicable; and Q1–Q3, 1st to 3rd quartile.

*Basic characteristics at time of study start for the general population and at time of syncope for the syncope population.

†Data are expressed as n (%) unless otherwise indicated.

‡Economic self-supported, but receiving some social benefits, for example, state education fund grants, paid parental leave.

§Defined as ischemic heart disease, myocardial infarction, heart failure, cardiac arrhythmias, cerebral vascular disease, atrioventricular block and LBBB, or peripheral vascular disease.

specific cardiac disorders, but yielded similar results. Among people with syncope who terminated their employment, most (61.0%) obtained health-related social benefits; Figure IV in the Data Supplement depicts health-related and labor market–related causes related to termination of employment.

Discussion

This nationwide cohort study of patients with syncope is the first to demonstrate a significant association between syncope and work-related outcomes, including occupational accidents and termination of employment. Our main findings were (1) that employed people with syncope had a 1.4-fold increased risk of occupational accidents compared with the employed general population, a risk that increased a further 1.4-fold among people with recurrent syncope; (2) 91.6% of people with syncope maintained or returned to employment after hospitalization; (3) yet, the 2-year risk of termination of employment after syncope was 31.3%, which was twice the risk compared with the reference population; and (4) the risk of each outcome was higher among patients with young age, comorbidity, or poor socioeconomic status.

Risk of Occupational Accidents After Syncope

Our findings are in contrast to those of Gaggioli et al[23] who suggested that the incidence of syncope during work is low and its impact benign. Specifically, we found that syncope was associated with a significantly increased risk of occupational accidents requiring contact to hospital or emergency department, and although mortality was low, 4 of 5 accidents resulted in documented injuries. Differences in study design and populations might explain our conflicting findings. Although the study by Gaggioli et al[23] was a cross-sectional survey among 452 reportedly healthy hospital employees, we prospectively evaluated a nationwide cohort of people with syncope from a clinical setting and within various types of occupational sectors.

Accident rates were highest in the male population, as seen elsewhere,[24] whereas women with syncope had a higher relative risk than men. A possible explanation for this difference in risk could be different thresholds for hospital contacts for men and women.[25,26] Supporting this notion was the variation in risk by occupational sector between men and women and the lower proportion of accident-related injury in women. In line with current knowledge, we found a reverse relationship between socioeconomic status and risk of occupational accidents. Additional adjustments for occupational sector did not influence this observation. As expected, work-related accidents requiring hospital contact were more common in manual occupational sectors. Still, our study supports previous findings, suggesting that socioeconomic inequality influences the risk of occupational injury beyond mere differences in work conditions, and that other factors, such as care seeking and injury susceptibility, could play important roles.[24–26]

Notably, our findings indicated a markedly increased risk of occupational accidents among people with recurrent syncope. This observation strengthens the indication of a direct association between syncope and accident risk and the clinical relevance.

Table 2. Summary of Occupational Accidents by Occupational Sector and Severity*

OA Characteristics	OA in Syncope Population			OA in General Population		
	Overall (n=622)	Men (n=375)	Women (n=247)	Overall (n=175 769)	Men (n=124 888)	Women (n=50 881)
Occupational sector						
Manual	187 (30.1)	160 (42.7)	27 (10.9)	63 255 (36.0)	57 303 (45.9)	5952 (11.7)
Trade and transportation	126 (20.3)	84 (22.4)	42 (17.0)	37 506 (21.3)	28 484 (22.8)	9022 (17.7)
Financial, administrative, and clerical	71 (11.4)	42 (11.2)	29 (11.7)	16 415 (9.3)	11 320 (9.1)	5095 (10.0)
Health and education	151 (24.3)	41 (10.9)	110 (44.5)	32 461 (18.5)	11 429 (9.1)	21 032 (41.3)
Other	47 (7.6)	15 (4.0)	32 (13.0)	14 571 (8.3)	6361 (5.1)	8210 (16.1)
Unknown	40 (6.4)	33 (8.8)	7 (2.8)	11 561 (6.6)	9991 (8.0)	1570 (3.1)
Accident-related injury						
Any injury	498 (80.1)	309 (82.4)	189 (76.5)	142 655 (81.1)	102 560 (82.1)	40 095 (78.8)
Superficial†	462 (74.3)	284 (75.7)	178 (72.1)	129 984 (74.0)	93 299 (74.7)	36 685 (72.1)
Severe‡	36 (5.8)	25 (6.7)	11 (4.4)	12 671 (7.2)	9261 (7.4)	3410 (6.7)
Death within 30 d from OA	0 (0)	0 (0)	0 (0)	36 (<0.1)	34 (<0.1)	<3 (<0.1)§

OA indicates occupational accident.
*Data are expressed as n (%) unless otherwise indicated.
†Superficial injury defined as superficial lesion, wound, or sprain.
‡Severe injury defined as fracture, traumatic amputation, crush lesion, internal lesion, or internal bleeding.
§According to the Danish Data Protection Agency, numbers of <3 must not be reported.

Termination of Employment in the Syncope Population

Most patients maintained employment immediately after syncope hospitalization, yet 1 in 3 people with syncope terminated their employment within the following 2 years, twice the rate in the general population. By comparison, 81% of patients undergoing coronary artery bypass grafting and heart valve surgery returned to work within 1 year,[27] as did 78% of patients with bacteremia.[28] Among people who survived out-of-hospital cardiac arrests and returned to work, 50% terminated their employment within 3 years.[29] Also, the estimate of termination of employment among people with
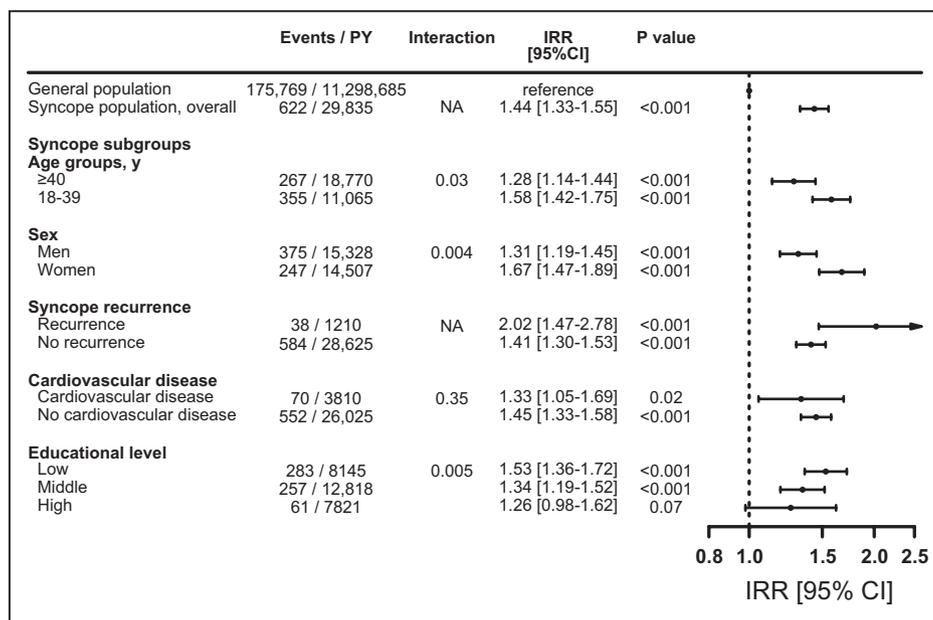
Figure 2. Main and subgroup analyses on the association between syncope and risk of subsequent occupational accidents. The employed general population served as reference in all analyses. Multiple Poisson regression analyses with adjustment for age, sex, calendar year, educational level, ischemic heart disease, heart failure, arrhythmia, atrioventricular block or left bundle branch block, pacemaker or implantable cardioverter–defibrillator, cerebral vascular disease, diabetes mellitus, and depression. The effects associated with syncope were comparable when stratifying by subgroup where P for interaction >0.05. CI indicates confidence interval; IRR, incidence rate ratio; NA, not applicable; and PY, person-years with employment.
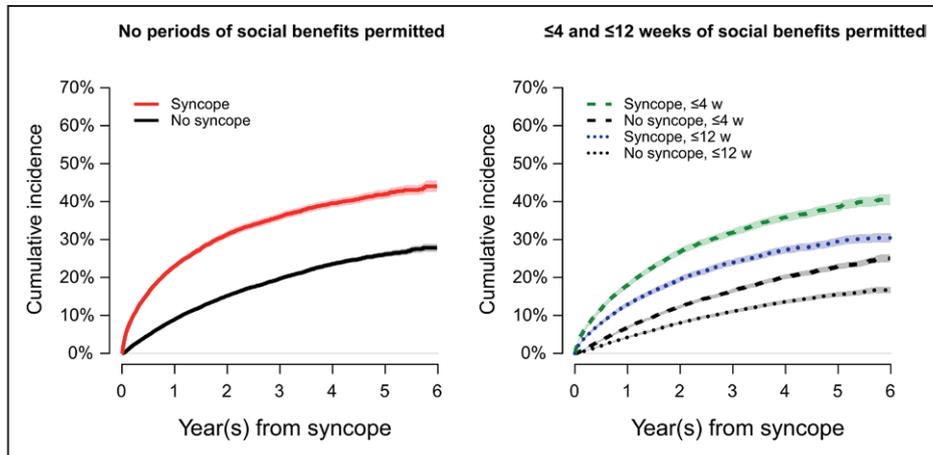
Figure 3. Termination of employment among people with syncope. Termination of employment among people with syncope who maintained or returned to employment within 1 mo after hospitalization (n=9854, 91.6%). The 2-y risk of termination of employment was 31.3% (red), 26.7% (green), and 19.5% (blue), respectively, when 0, ≤4, and ≤12 weeks of social benefits followed by subsequent employment were considered as ongoing employment. Correspondingly, it was 14.9%, 12.3%, and 8.0% in the age- and sex-matched control population (black). Aalen–Johansen estimator accounting for the competing risks of death, state education fund grants, paid parental leave, and regular retirement.

syncope was primarily driven by periods of >3 months off employment.

We found that younger age, somatic and psychiatric comorbidity, and poor socioeconomic status were factors associated with termination of employment. Socioeconomic status is strongly related to work absence and exclusion from labor markets in population studies,[30,31] although the association between socioeconomic status and syncope is poorly described in previous studies.[32]

Among comorbidities, presence of depression showed the strongest association with termination of employment among people with syncope. The relationship between psychiatric disorders and syncope is multifaceted.[3,33] Our definition of depression is likely to refer to a wider spectrum of psychiatric disorders because antidepressants, particularly selective serotonin reuptake inhibitors, are also used to treat anxiety disorders, including panic disorder that may be associated with syncope and work impairments.[33,34]

Patients with syncope are characterized by greater burden of comorbidity and increased exposure to a greater number of medications.[2,32] In keeping with this, we noted that 1 in 5 of the working age individuals with syncope was on health-related
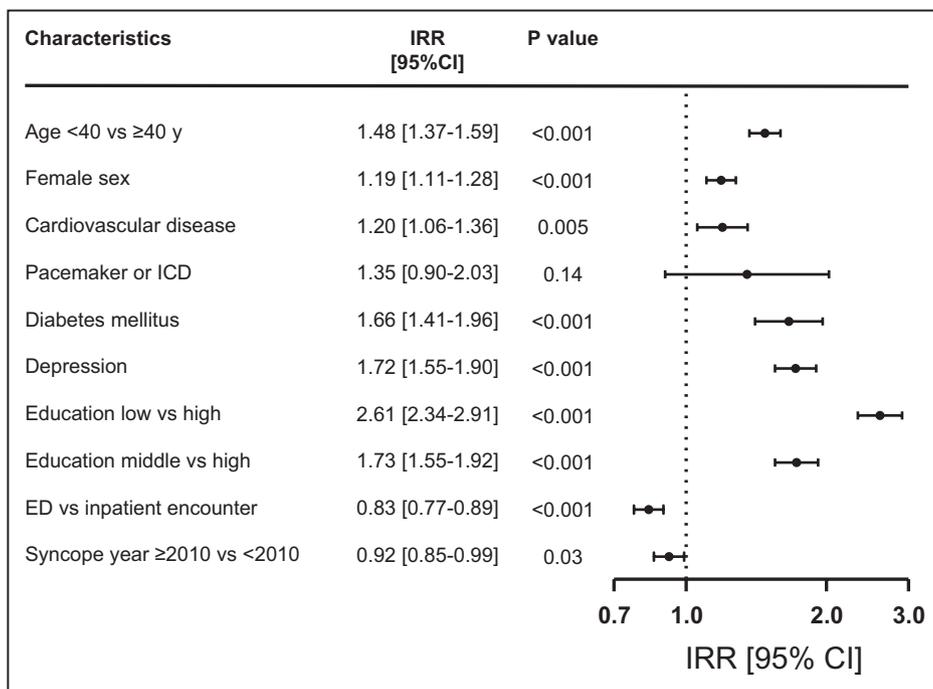
Figure 4. Characteristics associated with termination of employment in the syncope population. Baseline characteristics associated with termination of employment within 2 y among people with syncope. Multiple Poisson regression analysis with adjustment for the listed parameters. CI indicates confidence interval; ED, emergency department; ICD, implantable cardioverter–defibrillator; and IRR, incidence rate ratio.

benefits at time of syncope hospitalization (compared with 1 in 10 in the general population). Furthermore, health-related benefits were the predominant benefits after termination of employment. Multimorbidity may possibly explain some of the excess risk of termination of employment among people with syncope. Nevertheless, most people with syncope did not have any substantial comorbidity and still failed to maintain their employment.

Clinical Implications

Our study suggests that working-age patients with syncope could benefit from further attention to work-related implications. In particular, the association of excess risk of termination of employment among patients with syncope of young age supports the need for intervention because it might have broader implications for individual physical and mental health, and significant public health and socioeconomic consequences. We urge for more focused and appropriate assessment of patients with syncope in clinical practice.[3] Emerging evidence on nonpharmacological treatments in terms of education about underlying mechanisms, reassurance of the benign nature of the episodes, avoidance of triggers, recognition of prodromal symptoms, and counter pressure maneuvers show promising effects on both syncope recurrence and quality of life in patients with reflex syncope.[35,36] Plausibly, increased awareness may also improve aspects related to occupational safety and employment, especially in patients of younger age and without substantial comorbidity. Our findings further identified poor socioeconomic status and comorbidity as potential areas of intervention. More focused and multidisciplinary approaches may be required among these individuals,[37] which might include psychiatric evaluation and intervention.[3,38] However, further research is warranted to examine in detail why this association between syncope and detrimental effects on occupational safety and employment occurs and to facilitate better understanding of the content and organization of preventive strategies.

Strengths and Limitations

The main strength of this study was the use of nationwide registers that enabled identification and follow-up of a large cohort of patients with syncope in occupational settings irrespective of age, socioeconomic status, and health insurance schemes. In addition, the completeness and diversity of data enabled evaluation of several work-related aspects while controlling for a wide range of potential confounding factors.

However, the study has several limitations. First, because of its observational design, causal interpretations are precluded. Because the syncope and general population has not been randomly allocated, inherent differences in risk because of imbalances in the distribution of other potentially influential factors will always be present that is residual bias. Particularly, information about clinical parameters, such as a detailed medical history, blood pressure, electrocardiographic, and echocardiographic measures, is unavailable in the registers. Other factors, such as information about habits, behaviors, work ethic, or socioeconomic status, are more difficult to measure. Consequently, we used surrogate markers in terms of, for example, highest attained level of education to, at least

partially, control for these lifestyle-related factors, or use of antidepressant drugs as a marker for depression and related psychiatric disorders. Furthermore, we evaluated the potential confounding influence of occupational sector in a subgroup of patients, who did not have missing data, using a worst case/best case scenario. Still, data on circumstances of the occupational accidents, physical and psychosocial work environment factors, and employer characteristics were unavailable; hence effect measures should be interpreted as indications of associations. Second, clinical information on the cause and management of the syncope episode was unavailable. Our study was based on ICD diagnosis codes, which do not specify the cause of the syncope. However, previous studies in the Danish population show that the primary discharge diagnosis code used in this study (ICD-10 code R55.9) has 95% positive predictive value and is representative of the most common clinical presentations of syncope.[19] Many cases of syncope remain unexplained despite thorough investigation.[3] Third, individuals with syncope who contact the emergency department or hospital may not be representative of all patients with syncope,[39] in particular younger individuals with clearly defined vasovagal syncope are likely to be evaluated by a general practitioner rather than at a hospital. Consequently, our findings apply primarily to individuals evaluated in emergency departments and hospitals.

This study is representative for the Danish population, and results may plausibly apply to similar Western countries. Extrapolation of these results to other countries should, however, be done with care because of differences in health, social security, and other policies.

Conclusions

This nationwide cohort study suggests that syncope is associated with detrimental effects on occupational safety and employment: the risk of occupational accidents was 1.4-fold higher than the employed general population, and 1 in 3 terminated employment within 2 years. These adverse outcomes might be reduced by specific attention to the occupational implications of syncope in clinical practice and future guideline recommendations.

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