Association Between Reported Long Working Hours and History of Stroke in the CONSTANCES Cohort

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Background and Purpose—Long working hours (LWHs) are a potential risk factor for stroke. The aim of this study was to investigate this association in a large general population cohort.

Methods—We used the French population-based cohort, CONSTANCES (Cohorte des Consultants des Centres d'Examens de Santé), to retrieve information on age, sex, smoking, and working hours from the baseline, self-administered questionnaire. Other cardiovascular risk factors and previous occurrence of stroke were taken from a parallel medical interview. We defined LWH as working time >10 hours daily for at least 50 days per year. Participants with primarily part-time jobs were excluded as were those with stroke before LWH exposure. We used logistic models to estimate the association between LWH and stroke, stratified by age, sex, and occupation. In additional modeling, we excluded subjects whose stroke occurred within 5 years of the first reported work exposure.

Results—Among the 143 592 participants in the analyses, there were 1224 (0.9%) strokes, 42 542 (29.6%) reported LWH, and 14 481 (10.1%) reported LWH for 10 years or more. LWH was associated with an increased risk of stroke: adjusted odds ratio of 1.29 (95% CI, 1.11–1.49). Being exposed to LWH for 10 years or more was more strongly associated with stroke, adjusted odds ratio of 1.45 (95% CI, 1.21–1.74). The association showed no differences between men and women but was stronger in white-collar workers under 50 years of age.

Conclusions—This large analysis reveals a significant association between stroke and exposure to LWH for 10 years or more. The findings are relevant for individual and global prevention. (***Stroke***. 2019;50:00-00. DOI: 10.1161/STROKEAHA.119.025454.)

Key Words: epidemiology ■ logistic models ■ odds ratio ■ risk factors ■ work

Stroke is a devastating though largely preventable health condition.[1] Long working hours (LWH) may be a risk factor for cardiovascular diseases and stroke.[2] In Japan, 60% of compensated Karoshi (death from over-work) cases died of stroke.[3] A meta-analysis observed a dose-response relationship between LWH and stroke but did not adjust for other modifiable risk factors of stroke.[4] A Danish study found association with LWH only for hemorrhagic stroke.[5]

Our study investigated the association between LWH and stroke in a large general population study.

Methods

The article adheres to the American Heart Association Journals' implementation of the Transparency and Openness Promotion Guidelines. The data of the CONSTANCES cohort (Cohorte des Consultants des Centres d'Examens de Santé) are protected by our national regulatory agency (Commission nationale de l'informatique et des libertés, number 910486). However, the CONSTANCES cohort is an open epidemiological laboratory and access to study protocols and data is available on request (http://www.constances.fr/index_EN.php#propose).

The French CONSTANCES study is a population-based cohort started in 2012.[6] Participants are randomly selected adults aged 18 to 69 years. Data are compiled from self-administered questionnaires and health examinations conducted at affiliated health-screening centers. All study participants gave informed consent before enrolling in the study, which obtained human studies approval.

Using baseline questionnaire data, we restricted our selection to subjects who had ever worked for >6 months and had worked predominantly in full-time jobs. Age, sex, smoking, occupation, and LWH were retrieved from the baseline questionnaires. Participants reported if they were exposed to LWH (≥10 hours daily for at least 50 days, yes/no variable), and the number of years of exposure (<1

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Table 1.   Multivariable Analyses Describing Associations Between Relevant Risk Factors and History of Stroke

	Total	Stroke Cases, N (%)	Crude Odds Ratios (95% CI)	Adjusted Odds Ratios (95% CI)*	Adjusted Odds Ratios (95% CI)*	Adjusted Odds Ratios (95% CI)*
Age, y			1.07 (1.07–1.08)	1.04 (1.04–1.05)	1.04 (1.03–1.05)	1.04 (1.03–1.05)
Body mass index, kg/m^2			1.07 (1.05–1.08)	0.99 (0.97–1.01)	0.99 (0.97–1.00)	0.99 (0.97–1.01)
Sex						
Men	72 551	691 (0.95)	1	1	1	1
Women	71 041	533 (0.75)	0.79 (0.70–0.88)	1.01 (0.87–1.18)	1.02 (0.88–1.19)	1.02 (0.88–1.19)
Occupation						
Self-owner/manager/chief executive officer/professional jobs/farmer	45 903	329 (0.72)	0.85 (0.73–0.99)	0.92 (0.78–1.10)	0.93 (0.78–1.10)	0.93 (0.78–1.10)
High-skilled white-collar jobs	38 549	326 (0.85)	1	1	1	1
Low-skilled white-collar jobs	30 569	238 (0.78)	0.92 (0.78–1.09)	1.13 (0.94–1.37)	1.13 (0.94–1.37)	1.13 (0.94–1.37)
Blue-collar jobs	14 051	156 (1.11)	1.32 (1.09–1.59)	1.18 (0.94–1.49)	1.19 (0.95–1.49)	1.19 (0.95–1.49)
Long working hours						
No	95 391	763 (0.80)	1	1		
Yes	42 542	394 (0.93)	1.16 (1.03–1.31)	1.29 (1.11–1.49)		
Long working hours						
No (or 1 y)	107 602	844 (0.78)	1		1	
Yes (1–5 y)	8844	40 (0.45)	0.57 (0.42–0.79)		0.98 (0.69–1.40)	
Yes (5–10 y)	6937	52 (0.75)	0.96 (0.72–1.27)		1.05 (0.75–1.48)	
Yes (10–15 y)	4634	54 (1.17)	1.49 (1.13–1.97)		1.39 (1.00–1.93)	
Yes (15–20 y)	3185	39 (1.22)	1.57 (1.14–2.17)		1.55 (1.09–2.20)	
Yes ≥20 y	6662	128 (1.92)	2.48 (2.05–2.99)		1.45 (1.16–1.81)	
Long working hours						
No (or 1 y)	107 602	844 (0.78)	1			1
Yes (1–10 y)	15 781	92 (0.58)	0.74 (0.60–0.92)			1.02 (0.79–1.31)
Yes ≥10 y	14 481	221 (1.53)	1.96 (1.69–2.28)			1.45 (1.21–1.74)
High blood pressure diagnosed						
No	126 281	677 (0.54)	1	1	1	1
Yes	17 311	547 (3.16)	6.05 (5.40–6.78)	2.60 (2.22–3.05)	2.60 (2.22–3.05)	2.60 (2.22–3.05)
Diabetes mellitus diagnosed						
No	139 717	1130 (0.81)	1	1	1	1
Yes	3875	94 (2.43)	3.05 (2.47–3.77)	0.95 (0.73–1.25)	0.95 (0.72–1.24)	0.95 (0.72–1.24)
Dyslipidemia diagnosed						
No	130 690	722 (0.55)	1	1	1	1
Yes	12 902	502 (3.89)	7.29 (6.49–8.18)	3.09 (2.63–3.62)	3.08 (2.63–3.61)	3.08 (2.63–3.61)
Familial history of cardiovascular diseases						
No	129 106	1067 (0.83)	1	1	1	1
Yes	14 486	157 (1.08)	1.32 (1.11–1.56)	0.96 (0.79–1.18)	0.96 (0.79–1.18)	0.96 (0.79–1.18)
Smoking						
No smoker	63 218	468 (0.74)	1	1	1	1
Current/former smoker <30 pack/y	58 881	461 (0.78)	1.06 (0.93–1.20)	1.13 (0.98–1.31)	1.13 (0.98–1.31)	1.13 (0.98–1.31)
Current/former smoker ≥30 pack/y	5897	136 (2.31)	3.17 (2.61–3.84)	1.58 (1.26–1.98)	1.57 (1.25–1.97)	1.57 (1.25–1.97)

*Adjusted on age, body mass index, sex, occupations, high blood pressure, diabetes mellitus, dyslipidemia, familial history of cardiovascular diseases, and smoking habits (in addition of long working hours).

year, short [1–<10 years], and long duration of LWH [≥10 years]). Cumulative exposure in 5-year increments was also calculated. Subjects reporting LWH but missing data on exposure duration were included in the <1-year category.

Each participant had a medical interview completed by a physician, including history of stroke (all subtypes together) and age of occurrence, diabetes mellitus, history of high blood pressure, dyslipidemia (hypercholesterolemia or hypertriglyceridemia), family history of cardiovascular events, and body mass index.

The main outcome was having a stroke reported by a physician. Subjects missing data were considered as not having a stroke. Subjects who had a stroke before being exposed to LWH were excluded from analysis. Logistic models were used, adjusted by cardiovascular risk factors. Additional models were stratified by occupation, age, and sex. See the online-only Data Supplement for additional analyses.

All study participants gave informed consent before enrolling in the study. CONSTANCES has obtained authorization from the French National Data Protection Authority and was approved by the National Council for Statistical Information, the National Medical Council, and the Institutional Review Board of the National Institute for Medical Research (INSERM).

Results

From the 162 115 subjects with at least 6 months work experience, 18 508 (11.4%) had a history of predominantly part-time jobs, and 15 (0.01%) reported a stroke before the onset of exposure to LWH. In the final sample (n=143 592), 1224 strokes were included (0.9%), 42 542 (29.6%) participants reported LWH, and 14 481 (10.1%) reported exposure to LWH for 10 years or more.

LWH were associated with stroke (Table 1), especially among those exposed to LWH for 10 years or more (adjusted odds ratio, 1.45; [95% CI, 1.21–1.74]). Younger people had a higher risk of stroke when exposed to LWH for >10 years (Table 2). Stratification by occupation revealed a lower effect for owners, managers, chief executive officers, professionals, and farmers, though no interaction between LWH/occupation was found (P>0.05).

Discussion

An association between LWH and stroke was found with modest increases in adjusted odds ratio for LWH exposures of 10 years or more. Results are consistent with studies elsewhere: a meta-analysis, where the meta-risk was 1.31 for work of >55 hours per week[4] and 2 Korean case-control studies on all types of stroke and hemorrhagic stroke only.[7,8] Our results support the temporal sequence and a dose-response relationship with exposure duration.

Various studies have postulated direct and indirect causal pathways for effects of working conditions on stroke, including those mediated by modifiable behaviors that also increase the risk of cardiac arrhythmias/hypercoagulability among patients with LWH.[9] Irregular shifts, night work, and job strain are suspected of being responsible for unhealthy working conditions.[10–12] Owners, executives, managers, professionals, and farmers generally have greater decision latitude than other workers, perhaps accounting for the smaller effects in these groups. The Danish studies that showed no effect did not document years of exposure; in addition, working conditions in Denmark are among the best worldwide, which might explain their difference with other studies.[5]

Table 2.   Stratified Analyses by Sex, Age, and Occupation for Association Between Long Working Hours and History of Stroke

	Long Working Hours	Adjusted Odds Ratios (95% CI)*
Sex		
Men	No (or 1 y)	1
	Yes (1–10 y)	0.83 (0.58–1.19)
	Yes ≥10 y	1.39 (1.13–1.73)
Women	No (or 1 y)	1
	Yes (1–10 y)	1.27 (0.89–1.82)
	Yes ≥10 y	1.52 (1.10–2.11)
Age		
<50 y	No (or 1 y)	1
	Yes (1–10 y)	0.96 (0.61–1.50)
	Yes ≥10 y	2.28 (1.46–3.58)
≥50 y	No (or 1 y)	1
	Yes (1–10 y)	1.00 (0.74–1.36)
	Yes ≥10 y	1.36 (1.12–1.65)
Occupation		
Self-owner/manager/chief executive officer/professional jobs/farmer	No (or 1 y)	1
	Yes (1–10 y)	1.07 (0.71–1.63)
	Yes ≥10 y	1.21 (0.91–1.59)
High-skilled white-collar jobs	No (or 1 y)	1
	Yes (1–10 y)	1.25 (0.80–1.97)
	Yes ≥10 y	1.77 (1.28–2.43)
Low-skilled white-collar jobs	No (or 1 y)	1
	Yes (1–10 y)	0.77 (0.43–1.40)
	Yes ≥10 y	1.70 (1.09–2.67)
Blue-collar jobs	No (or 1 y)	1
	Yes (1–10 y)	0.79 (0.38–1.64)
	Yes ≥10 y	1.59 (0.97–2.61)

*Adjusted for body mass index, high blood pressure, diabetes mellitus, dyslipidemia, familial history of cardiovascular diseases, and smoking (plus age and occupation for sex, sex and occupation for age, and sex and age for occupation).

The main limitation is the stroke diagnosis. Positive predictive values for self-reported stroke were around 60% in a UK study.[13] In our study, stroke was defined by a doctor who examined each participant following protocol guidelines to improve diagnosis accuracy. Though the clinician cannot check medical/imaging records, misclassification probably had a low impact on the association found. In this same cohort, diabetes mellitus recorded from the same examination protocol had high agreement with health claims data.[14] In addition to exclusion of prior stroke, we further controlled the temporal sequence by using a 5-year lag to ensure that exposure would precede the event. Moreover, in this study, known independent risk factors for stroke (and not other types

of brain events) were found to be associated with stroke, giving additional reassurance of the diagnosis. Our study did not distinguish ischemic from hemorrhagic stroke, where effects of LWH might be different: job demand was previously related to ischemic but not hemorrhagic stroke,[11] whereas other analyses observed an association with LWH only for hemorrhagic stroke.[5] Although recall and selection bias are related to death or major cognitive sequelae, it is unlikely that these would have modified the LWH association observed. Finally, subjects reporting mainly part-time work were excluded from the sample. Future studies may include job exposure matrices to better control recall bias, diagnoses separating ischemic and hemorrhagic stroke, and focus on incident stroke.

Conclusions

This large-scale analysis reveals a significant association between exposure to LWH for a period of 10 years or more and history of stroke. Future study may confirm this link with prevention strategies for reducing LWH in patients with high-risk profiles for stroke and reducing the global burden of disease.[15]

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Disclosures

None.

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