LA TUNISIE MEDICALE

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Long working hours and the risk of ischemic cardiac death: A systematic review and a meta-analysis

Heures de travail prolongées et risque de décès cardiaque ischémique: Revue systématique et méta-analyse

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Abstract

Introduction: The relationship between occupational stress, particularly long working hours, and health outcomes such as ischemic cardiac death has garnered increasing attention. Myocardial infarction, a primary cause of sudden cardiac death, is significantly influenced by workplace stress. This systematic review and meta-analysis aim to explore the association between long working hours and the risk of ischemic cardiac death, building upon the foundation of previous studies indicating a potential link between prolonged occupational stress and cardiovascular health issues.

Methods: We systematically searched several databases up to 30 November 2022 without language restrictions, using a comprehensive set of keywords related to occupational stress and ischemic heart disease. The selection criteria focused on clinical trials assessing the risk of occupational stress and cardiovascular disease in individuals of working age from diverse industrial settings. Quality assessment was performed using the STROBE scale, and statistical analysis was conducted using RevMan web software, considering hazard ratios and odds ratios as relative risk estimates.

Results: Our search yielded 20 trials, with 18 meeting the inclusion criteria. These studies encompassed a wide range of years (1992-2019) and involved a total of 288,278 individuals. Our meta-analysis revealed no significant risk increase for ischemic heart disease mortality for those working 41 to 49 hours per week compared to 35 to 40 hours. However, working more than 55 hours per week was associated with a 17% increased risk of ischemic heart disease mortality (RR=1.17, 95% CI [1.05 to 1.31]).

Conclusions: Extended working hours are associated with an increased risk of ischemic heart disease mortality, emphasizing the importance of addressing occupational health and safety standards. This study contributes to the growing body of evidence on the health implications of long working hours and underscores the necessity for preventive strategies to protect worker health in the modern work environment.

Keywords: sudden cardiac death; coronary; myocardial infarction; death; myocardial; occupational stress

Résumé

Introduction : Le lien entre le stress professionnel, notamment les longues heures de travail, et les maladies cardiovasculaires attire une attention croissante. L'infarctus du myocarde, cause majeure de décès cardiaque subit, est fortement influencé par le stress au travail. Cette revue systématique et méta-analyse visent à évaluer l'association entre les longues heures de travail et le risque de décès cardiaque ischémique.

Méthodes : Une recherche systématique a été effectuée dans plusieurs bases de données jusqu'au 30 novembre 2022, sans restriction linguistique, à l'aide de mots-clés liés au stress professionnel et aux maladies cardiaques ischémiques. Les études incluses concernaient des adultes en âge de travailler. L'évaluation de la qualité a été réalisée à l'aide de l'échelle STROBE et l'analyse statistique par le logiciel RevMan Web, en utilisant les rapports de risque relatifs (RR) et les intervalles de confiance à 95 %.

Résultats : Sur 20 études identifiées, 18 ont été retenues, totalisant 288 278 participants. Aucun risque significatif n'a été observé pour les travailleurs effectuant 41 à 49 heures par semaine (RR = 0,99 ; IC 95 % [0,88–1,12]). En revanche, travailler plus de 55 heures par semaine était associé à une augmentation de 17 % du risque de mortalité par maladie cardiaque ischémique (RR = 1,17 ; IC 95 % [1,05–1,31]).

Conclusion : Les heures de travail prolongées augmentent le risque de décès par maladie cardiaque ischémique. Ces résultats soulignent la nécessité d'intégrer la prévention des risques cardiovasculaires dans les politiques de santé au travail et d'adopter des stratégies visant à limiter la surcharge professionnelle.

Mots-clés : stress professionnel, décès cardiaque subit, infarctus du myocarde, maladie coronarienne, surcharge de travail.

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Introduction

Occupational stress and its potential impact on health have been subjects of increasing concern. In a world characterized by dynamic work environments and evolving job demands, understanding the potential health consequences of prolonged work hours is of paramount importance. Among the various health outcomes associated with workplace stress, sudden cardiac death stands out as a critical and potentially life-threatening condition. Myocardial infarction (heart attack) is considered one of the primary causes of sudden cardiac death. It can lead to fatal arrhythmias like ventricular fibrillation, which is a significant contributor to sudden cardiac death. Ischemic heart disease remains a leading global cause of mortality, making it crucial to explore its potential link with the modern work environment.
Previous studies, such as those conducted by De Bacquer D et al (1), Kivimaki M et al (2) and Hayashi R et al (3), have also explored the relationship between workplace stress and cardiovascular health issues, providing important contextual background for our research. Hayashi R et al (3) suggested that there may be a significant association between long working hours and the risk of acute myocardial infarction among middle-aged Japanese men. Specifically, individuals working overtime for 11 hours or more per day had a 63% higher risk of acute myocardial infarction compared to those working 7 to less than 9 hours per day. These facts motivated us to analyze the relationship between the long working hours and the ischemic cardiac death.

Methods

We conducted this systematic review with meta-analysis according to the PRISMA guidelines 2020 (Preferred Reporting Items for Systematic Review and Meta-analysis) (4) and the AMSTAR 2 guidelines (Assessing the methodological quality of systematic reviews) (5) of the available evidence on the effect long working hours exposure and risk of ischemic cardiac death.

Electronics searches

The last electronic search of the relevant literature was conducted on 30 November 2023, with no language restriction. Trials were sought in the following databases "Cochrane Library", "United States National Library of Medicine", "PubMed/MEDLINE", "Excerpta Medica Database", "Embase", “Scopus”, and "Google Scholar". Keywords used were: ‘’sudden cardiac death’’, ‘’coronary’’,’’ myocardial infarction’’, ‘’death’’, “myocardial”, and “occupational stress”. We used the Boolean markers "and" and "or". The reference lists of obtained articles were checked for eligible clinical trials.

Study selection: Clinical trials assessing the risk of the effect of occupational stress and cardiovascular disease. Only articles published in peer-reviewed journals were considered. Whereas data from descriptive studies, reviews, editorial letters, case series (fewer than ten cases), abstracts only, and comments were excluded.

Participants/population: We considered research involving individuals of working age (≥15 years). Our study encompassed participants residing in any nation that is a member of the WHO and/or ILO, as well as individuals from diverse industrial settings and occupational groups. It's important to note that the effects of prolonged working hours could potentially extend to a wider population, such as workers of reproductive age across multiple generations. However, we acknowledge that the scope of our systematic review did not encompass these specific populations and their associated impacts.

Outcomes: The main outcome of our study was to assess the risk of ischemic cardiac death according to three different categories of exposure to working hours: 40 to 49 hours, 50 to 54 hours, and more than 55 hours per week.

Study Selection: The references were managed using Zotero software. Firstly, and after the exclusion of duplicates, all titles and abstracts of publications identified through the initial primary search were single reviewed for relevance. In the second stage, two authors independently reviewed all abstracts of studies that met the inclusion criteria. Disagreements were resolved by discussion after consulting a third member of the review team. We incorporated studies that defined extended work hours in different intervals. Our primary focus was on quantifying the total hours worked, encompassing both primary and secondary job commitments. Our inclusion criteria encompassed studies that employed objective methods (such as time-recording technology) or subjective assessments to measure extended work hours.

Assessment of study quality

All studies that met the selection criteria were appraised by two authors. For CCTs, we used The Strengthening the Reporting of Observational Studies in Epidemiology Scale (STROBE) (6). Studies with a score <13/22 were excluded.

Data Extraction: Two authors extracted data. Disparities were settled with a senior author.

Evaluation of the effect size:
All the statistical analyses were performed using RevMan web software version 5.3. For this study, hazard ratios and odds ratios were treated as estimates of relative risk. The threshold of significance was fixed at 0.05. We tested for the interaction between relevant factors and effect size estimates.

Assessment of heterogeneity: To assess heterogeneity, three strategies were used:
1. The Cochrane Chi² test (Q-test), the Tau² which is the variance of true effects, and 95% predictive interval (index of dispersion) to estimate the degree of

heterogeneity (7.8). We calculated the predictive interval using a Comprehensive Meta-analysis prediction interval software.
2. Graphical exploration with funnel plots (9).
3. Sensitivity analysis with a subgroup analysis when applicable.

Results

Literature research

The bibliographic research yielded 20 trials (Figure 1). Two studies were excluded for reasons. Then, we retained 18 research. The demographic data of the retained studies are summarized in Table 1. These studies included patients. They were published between 1992 and 2019.

Comparison of 35 to 40 hours per week versus 41 to 49 hours per week in terms of cardiac death

Thirteen cohort studies, involving a cumulative participant pool of 288,278 individuals, were incorporated into our analysis.

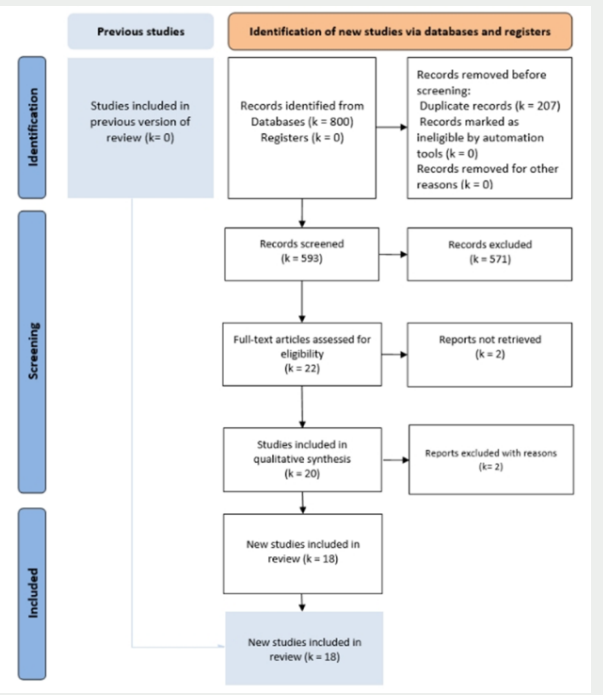

Figure 1. Flow diagram of the bibliographic research

Table 1. Demographic data of the retained studies

Nbre of study	Study	Country	Type of Study	Year of publication	Number of participants	Mean age (years)	STROBE scale
1	Belstress study (1)	Belgium	PNR	1994	11685	45.8	17
2	COPSOQ-I (10)	Denmark	PNR	1997	1803	40.6	16
3	COPSOQ-II (11)	Denmark	PNR	2004	3389	42.7	16
4	DWECS (12)	Denmark	PNR	2000	5535	41.8	18
5	FPS (4)	Finland	PNR	2000	44565	44.6	16
6	Hannerz et al. (13)	Denmark	PNR	2018	68583	48.9	16
7	Hayashi et al. (5)	Japan	PNR	2019	15277	48.1	15
8	HeSSup (14)	Finland	PNR	1998	15150	39.6	18
9	HNR (15)	Germany	PNR	2000	1774	53.3	16
10	Holtermann et al. (16)	Denmark	PNR	2010	4943	48.6	16
11	IPAW (17)	Denmark	PNR	1996	2021	41.2	17
12	Netterstrom et al. (18)	Denmark	PNR	2010	1146	47	18
13	NWCS (19)	Netherlands	PNR	2005	43510	40.1	17
14	O'Reilly et al. (20)	United Kingdom	PNR	2013	414949	39	16
15	PUMA (21)	Denmark	PNR	1999	1783	42.7	16
16	Virtanen et al. (22)	United Kingdom	PNR	2010	6014	48.7	17
17	WOLF-N (23)	Sweden	PNR	1996	4648	44	15
18	WOLF-S (24)	Sweden	PNR	1992	5554	41	15

These studies were integrated into a quantitative meta-analysis. Our findings revealed that in contrast to working 35 to 40 hours weekly, working 41 to 49 hours weekly was linked to a nearly identical (1) risk of mortality related to ischemic heart disease (RR=0.99, 95% CI [0.88 to 1.12]) (Figure 2).

Comparison of 35 to 40 hours per week versus 50 to 54 hours per week in terms of cardiac death

Incorporating a total of 11 cohort studies, with an aggregate participant count of 284,474, we examined the impact of extended working hours on the risk of ischemic heart disease mortality in individuals working 50 to 54 hours per week, relative to those working 35 to 40 hours weekly. These studies were deemed sufficiently clinically like warrant inclusion in a meta-analysis. Our findings indicate that compared to a 35 to 40-hour workweek, working 50 to 54 hours per week showed a heightened risk, albeit with the lower confidence bound dipping below 1, for death due to ischemic heart disease (RR = 1.01, 95% CI [0.82 to 1.25])(Figure 3).

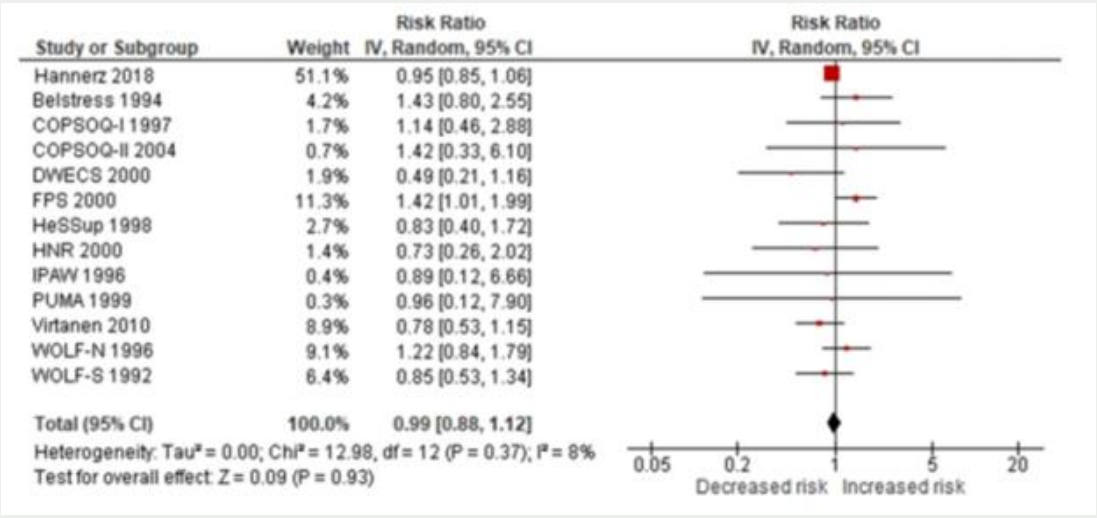

Figure 2. Forest plot of the comparison of 35 to 40 hours per week versus 41 to 49 hours per week in terms of cardiac death

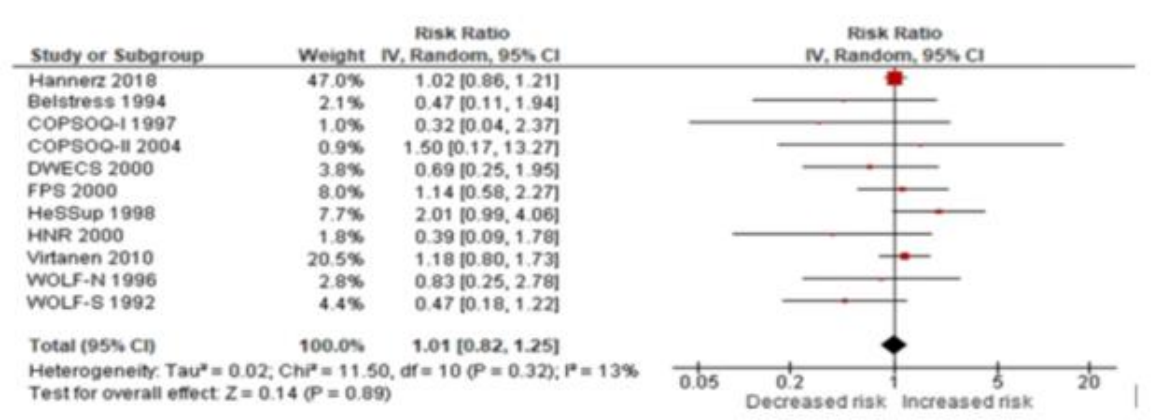

Figure 3. Forest plot of the comparison of 35 to 40 hours per week versus 50 to 54 hours per week in terms of cardiac death

Comparison of 35 to 40 hours per week versus more than 55 hours per week in terms of cardiac death

A total of 16 cohort studies, encompassing 726,803 participants, assessed the impact of extended working hours on the risk of ischemic heart disease mortality among those working more than 55 hours per week in comparison to a 35 to 40-hour workweek. Notably, there was no discernible heterogeneity among the retained studies, allowing for their inclusion in a quantitative meta-analysis. Our analysis revealed that in contrast to a 35 to 40-hour workweek, working more than 55 hours per week was associated with an elevated risk of death due to ischemic heart disease (RR=1.17, 95% CI [1.05 to 1.31]) (Figure 4).

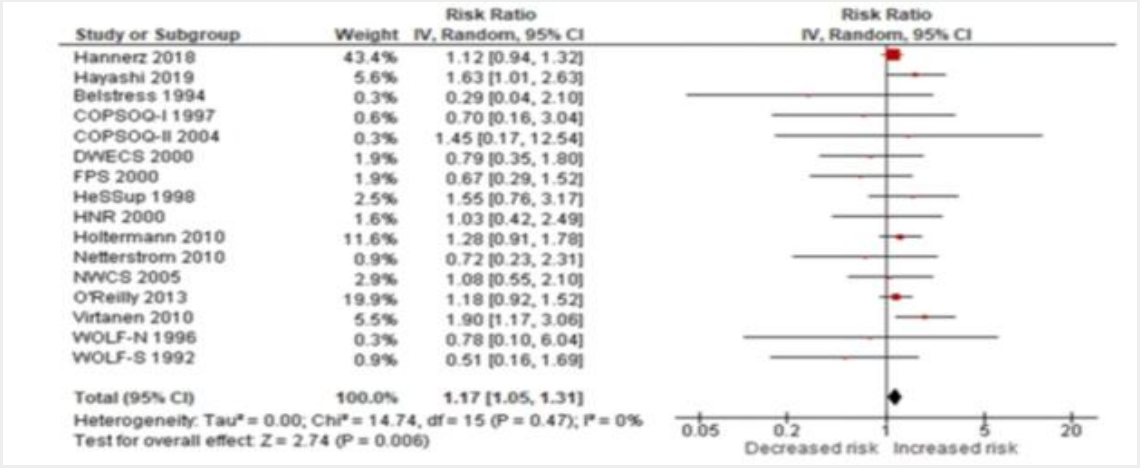

Figure 4. Forest plot of the comparison of 35 to 40 hours per week versus more than 55 hours per week in terms of cardiac death

Discussion

This systematic review and meta-analysis revealed no significant risk increase for ischemic heart disease mortality for those working 41 to 49 hours per week compared to 35 to 40 hours. However, working more than 55 hours per week was associated with a 17% increased risk of ischemic heart disease mortality.

The modern workplace is a dynamic and demanding environment where individuals spend a substantial portion of their lives. In this context, the impact of occupational stress has emerged as a significant concern, given its potential repercussions on health. Among the various health outcomes associated with workplace stress, ischemic cardiac death stands out as a critical and potentially life-threatening condition. This systematic review is undertaken with the primary aim of analyzing the causal relationship between long working hours and the risk of ischemic cardiac death.

The principal findings of our study, which synthesized data from a substantial number of cohort studies encompassing a wide participant pool, provide valuable insights into the relationship between working hours and the risk of ischemic heart disease mortality. When comparing different working hour categories to a reference group adhering to a standard 35 to 40-hour workweek, our analysis revealed distinct patterns. For individuals working 41 to 49 hours per week, we found no statistically significant difference in the risk of ischemic heart disease mortality. However, as working hours increased beyond this range, a notable trend emerged. Those working more than 55 hours per week faced a significantly elevated risk, with a 17% higher likelihood of ischemic heart disease mortality. Importantly, this increase in risk was observed with a high level of confidence (95% CI [1.05 to 1.31]) and was consistent across the studies included, as reflected by negligible heterogeneity (I^2=0%). These results emphasize the potential health risks associated with extended work hours and highlight the importance of addressing occupational health measures and working hour regulations to protect the well-being of the workforce.

In recent years, the relationship between occupational stress and the incidence of cardiac events has emerged as a topic of growing concern in the field of medical research, especially ischemic cardiac death. With the modern lifestyle characterized by longer working hours, increased work-related stress, and irregular schedules, there is a heightened interest in understanding how these factors may contribute to the risk of ischemic cardiac death.

Occupational stress, as defined in medical and psychological literature, refers to the physical, emotional, and psychological strain experienced by individuals due to their work or job-related factors. It is the result of a perceived imbalance between the demands of the job and an individual's ability to cope with those demands (25). Occupational stress can manifest in various ways and may lead to adverse health effects if not managed effectively. Multiple factors can contribute to occupational stress in working situations. Long working hours are the leading cause. Multiple authors have studied the effect of long working hours on health. They found that long working hours can be linked to coronary heart disease events (26). A meta-analysis conducted in 2012 by Virtanen et al (22) describes a research study that examined the relationship between long working hours and the risk of coronary heart disease. Based on the results from prospective observational studies, the researchers concluded that employees working long hours faced an approximately 40% higher risk of developing coronary heart disease (CHD). Several potential mechanisms may underline the association between long working hours and CHD. One candidate is prolonged exposure to psychological stress and related dysregulation of the hypothalamic-pituitary-adrenal and sympatho-adrenomedullary axes, which are the primary biological systems activated during the stress response (27). Such dysregulation, which is often marked by cortisol and catecholamine hypersecretion, may contribute to a variety of endocrine, metabolic, autoimmune, and psychiatric disorders, which in turn are risk factors for CHD. Additional factors that may play a role in the development of coronary heart disease (CHD) could be linked to inadequate relaxation and insufficient unwinding (28). Furthermore, sleep deprivation, which has been demonstrated to be correlated with both extended working hours (22) and CHD, could also contribute to the development of the condition.

However, some studies were against this hypothesis such as a Danish study which was conducted by Hannerz et al (13). They did not find statistically significant associations between weekly working hours (WWH) and the incidence of ischaemic heart disease (IHD) or the usage of antihypertensive drugs among full-time employees. These findings suggest that, in this sample, there was no clear evidence to support a direct link between the number of hours worked per week and the risk of IHD or the need for antihypertensive medications.

Concerning the risk between long working hours and cardio-vascular mortality like our study, multiple researchers analyzed this relationship.

Both our study and O'Reilly D's study (20) indicated an increased risk of mortality associated with long working hours, but they differ in terms of the specific working hour categories, the populations studied, and the outcomes examined. Additionally, the article discusses the moderation of these effects by employment relations or conditions of occupation, which is not addressed in your study.

Nevertheless, Holtermann's study (16) aimed to investigate whether workers with low physical fitness face a higher risk of cardiovascular mortality when exposed to long working hours. The study's findings suggest that men with low physical fitness are at an elevated risk of IHD mortality when exposed to long working hours. In contrast, the risk did not appear to increase significantly for men with intermediate or high levels of physical fitness when working long hours. Therefore, the study suggests that individuals working long hours should aim to maintain good physical fitness to mitigate the risk of cardiovascular mortality.

Concerning medico-legal implications of sudden cardiac death in the workplace, it poses a medico-legal problem of imputability. Therefore, it is important to prove the causal relationship between sudden death and work. Occupational stress can be considered as a risk of sudden death particularly sudden cardiac death. Short-term stress increases the risk of death from myocardial infarction, while long-term stress increases the risk of death from heart failure. Japan was the first country to give the right to compensation to the families of victims of sudden deaths at work attributed to Karoshi overwork. This social medicine term first appeared in Japan in late 1970 (29). In 1969, the first case of karoshi was reported. It was about a 29-year-old male worker in the shipping department of Japan's largest newspaper company. The death was attributed to a stroke (30). The main causes of karoshi were heart attack and stroke secondary to stress (30).

In Tunisian legislation, Article 3 of Law No. 94-28 dated February 21, 1994, as amended and supplemented by Law No. 95-103 dated November 27, 1995, defines an occupational accident as "any accident that occurs as a result of or in the course of work, to any worker while they are in the service of one or more employers, regardless of the cause or location of the occurrence."

Tunisian legislation has covered sudden cardiac deaths at the workplace through the legal presumption of causality in the form of a legal presumption of origin, thereby protecting the beneficiaries through legal compensation. However, It is the responsibility of the employer to prove that the cause of death is not related to the work.

While our study provides valuable insights into the relationship between working hours and ischemic heart disease mortality, several limitations merit consideration. Firstly, the cohort studies included in our analysis varied in terms of study design, population characteristics, and adjustment for confounding factors, which may introduce some heterogeneity. Secondly, our findings are based on observational data, and although we adjusted for relevant covariates, residual confounding cannot be entirely ruled out. Additionally, our study primarily focused on male populations, and the generalizability of our results to diverse demographic groups may require further investigation. Furthermore, we relied on self-reported working hours in some studies, which may be subject to recall bias. As for future perspectives, continued research is warranted to explore the underlying mechanisms linking long working hours to ischemic heart disease, including the role of specific job-related stressors and individual susceptibility factors. Additionally, interventions and policies aimed at reducing excessive work hours and promoting work-life balance should be explored to mitigate the potential health risks associated with extended working hours. Further prospective studies and clinical trials are needed to provide a more comprehensive understanding of this complex relationship and guide preventive measures in the workplace.

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Author contributions:
All the authors participate in the treatment of the patients, writing, and approved the manuscript.

Conflict of interest
No conflict of interest to disclose.

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