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Original article

## Informal caregiving as a risk factor for type 2 diabetes in individuals with favourable and unfavourable psychosocial work environments: A longitudinal multi-cohort study

J. Mortensen<sup>a,\*</sup>, A.J. Clark<sup>a</sup>, T. Lange<sup>b,c</sup>, G.S. Andersen<sup>d</sup>, M. Goldberg<sup>e,j</sup>,  
C.H. Ramlau-Hansen<sup>f</sup>, J. Head<sup>g</sup>, M. Kivimäki<sup>g</sup>, I.E.H. Madsen<sup>h</sup>, C. Leineweber<sup>i</sup>,  
R. Lund<sup>a,l</sup>, R. Rugulies<sup>h</sup>, M. Zins<sup>j,k</sup>, H. Westerlund<sup>i</sup>, N.H. Rod<sup>a</sup>

<sup>a</sup> Department of Public Health, University of Copenhagen, Copenhagen, Denmark

<sup>b</sup> Department of Biostatistics, University of Copenhagen, Copenhagen, Denmark

<sup>c</sup> Center for Statistical Science, Peking University, Peking, China

<sup>d</sup> Clinical Epidemiology, Steno Diabetes Center, Gentofte, Denmark

<sup>e</sup> Paris Descartes University, Paris, France

<sup>f</sup> Department of Public Health, Section for Epidemiology, Aarhus University, Aarhus, Denmark

<sup>g</sup> Department of Epidemiology and Public Health, University College London, London, UK

<sup>h</sup> National Research Centre for the Working Environment, Copenhagen, Denmark

<sup>i</sup> Division of Epidemiology, Stress Research Institute, Stockholm University, Stockholm, Sweden

<sup>j</sup> INSERM, Population-based Epidemiological Cohorts Unit-UMS 11, Paris, France

<sup>k</sup> INSERM, UMR 1168, VIMA, Villejuif, France

<sup>l</sup> Center for Healthy Aging, University of Copenhagen, Copenhagen, Denmark

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### ABSTRACT

**Aim.** – To examine whether informal caregiving is associated with increased risk of type 2 diabetes (T2D), and whether job strain and social support at work modify the association.

**Methods.** – Individual participant's data were pooled from three cohort studies—the French GAZEL study, the Swedish Longitudinal Occupational Survey of Health (SLOSH) and the British Whitehall II study—a total of 21,243 study subjects. Informal caregiving was defined as unpaid care for a closely related person. Job strain was assessed using the demand-control model, and questions on co-worker and supervisor support were combined in a measure of social support at work. Incident T2D was ascertained using registry-based, clinically assessed and self-reported data.

**Results.** – A total of 1058 participants developed T2D during the up to 10 years of follow-up. Neither informal caregiving (OR: 1.09, 95% CI: 0.92–1.30) nor high job strain (OR: 1.04, 95% CI: 0.86–1.26) were associated with T2D risk, whereas low social support at work was a risk factor for T2D (OR: 1.18, 95% CI: 1.02–1.37). Also, informal caregivers who were also exposed to low social support at work were at higher risk of T2D (OR: 1.40, 95% CI: 1.08–1.82) compared with those who were not informal caregivers and had high social support at work (multiplicative test for interaction,  $P = 0.04$ ; additive test for interaction, synergy index = 10).

**Conclusion.** – Informal caregiving was not independently associated with T2D risk. However, low social support at work was a risk factor, and informal caregivers with low social support at work had even higher risks of T2D.

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### Introduction

People who provide informal caregiving for disabled and elderly relatives make a large contribution to the lives of these people, and save the healthcare system considerable expenses

[1]. Informal caregiving, defined as unpaid care for a sick, disabled or elderly family member or other closely related person [2], may be associated with positive aspects, such as companionship and feelings of reward [3]. However, informal caregivers may also be more vulnerable to negative health consequences due to the potential emotional and physical strain that can accompany the commensurate responsibilities [4,5]. It has previously been shown that informal caregiving is associated with high levels of

\* Corresponding author.

E-mail address: jemo@sund.ku.dk (J. Mortensen).

allostatic load, which is a cumulative biological marker of ill health [6], and our team has recently shown that informal caregiving predisposes to long-term sickness absence among women [7].

Type 2 diabetes (T2D) is a major global health problem, leading to serious complications such as retinopathy, neuropathy, nephropathy and atherosclerosis [8]. Stress-induced secretion of cortisol stimulates glucose production in the liver and antagonizes insulin production [9], which means that stress is hypothesized to play a causal role in the aetiology of T2D. In support of this hypothesis, a meta-analysis found that depression and emotional stressors, such as anxiety, sleep problems, anger and hostility, were associated with greater risk of T2D [10]. Furthermore, an unhealthy lifestyle encompassing strong risk factors for T2D [11] may be a consequence of caregiving stress [12]. However, the relationship between informal caregiving stress and risk of T2D has never been investigated in population-based studies.

Among gainfully employed individuals, workplace characteristics may modify the association between informal caregiving and risk of T2D. A recent large-scale meta-analysis by the Individual Participant Data in Working Populations (IPD-Work) consortium found that job strain, defined as the combination of high psychological demands at work and low job control, is a risk factor for T2D [11]. In addition, a longitudinal study found that job strain was a risk factor for T2D in women, and the association was stronger for women who also had low perceived social support at work [13]. Thus, social support at work may mitigate the effect of psychosocial stressors on T2D risk.

The overall objective of the present study was to assess the association between informal caregiving and incident T2D in gainfully employed individuals. A further aim was to determine whether there is any interaction between informal caregiving and psychosocial work factors on T2D risk based on two alternative hypotheses (Fig. 1). First, based on the role-strain model [14], it was hypothesized that the accumulation of stress from caregiving and work may be particularly harmful. Therefore, the present study aimed to assess whether the combined effect of informal caregiving and job strain was greater than the sum of their individual effects on T2D risk. Second, according to the stress-buffer hypothesis [15], it is to be expected that a supportive work environment may function as a positive resource for informal caregivers. Thus, our study also aimed to determine whether social support at work can reduce the risk of T2D associated with informal caregiving.

## Methods

### Study population

The present study used longitudinal data from the GAZEL study in France [16], the Swedish Longitudinal Occupational Survey of

Health (SLOSH) [17] and the Whitehall II study from the UK [18]. These cohort studies were chosen because they offer information on informal caregiving, psychosocial work factors and diabetes, and represent a wide range of employees from different social-care systems. The GAZEL study was established in 1989 and included 20,625 employees of the French national gas and electricity company. SLOSH is an open cohort established in 2006 and comprises 40,877 individuals representative of the Swedish workforce. Whitehall II was established in 1985 and included 10,308 British civil servants from 20 London-based departments. Data from the year 2000 were used as baseline in the GAZEL (response rate: 71%), while year 2008 data were used from SLOSH (response rate: 61%) and the years 1991–1994 from Whitehall II (response rate: 87%).

A total of 24,636 men and women  $\geq 30$  years were gainfully employed at baseline. We excluded 805 subjects with diabetes at baseline (self-reported or diagnosed), and 2588 subjects with missing information on diabetes, informal caregiving and/or  $\geq 1$  covariate(s), leaving a total study population of 21,243 subjects (Appendix A; see supplementary materials associated with this article online).

Participants gave their informed consent to participate in the cohort studies, and all three studies had been approved by their respective ethics committees.

### Informal caregiving

To assess informal caregiving, individuals were asked whether they provided regular care for an aged person ( $> 65$  years) in GAZEL, and for an aged or disabled relative in Whitehall II and SLOSH. Further information on the number of weekly hours of caregiving was available for Whitehall II and SLOSH.

### Psychosocial work factors

Job demands were assessed by five items in GAZEL and SLOSH, and by four items in Whitehall II, and comprised statements such as: “My job requires working very fast”. High job demands were defined as a score above the median within the specific study population [19]. Job control (decision latitude) comprised two subscales: skill discretion and decision authority. Skill discretion was assessed by four items in all cohorts, and encompassed statements such as: “My job requires a high level of skill”. Decision authority was assessed by two items in all cohorts, and included statements such as “I have a lot of say about what happens on my job”. The two items of decision authority were assigned the same weight as the four items of skill discretion in calculating the job control scores. Low job control was defined as a score below the median within the specific cohort study [19]. In accordance with the job strain model [20] and using the harmonized version

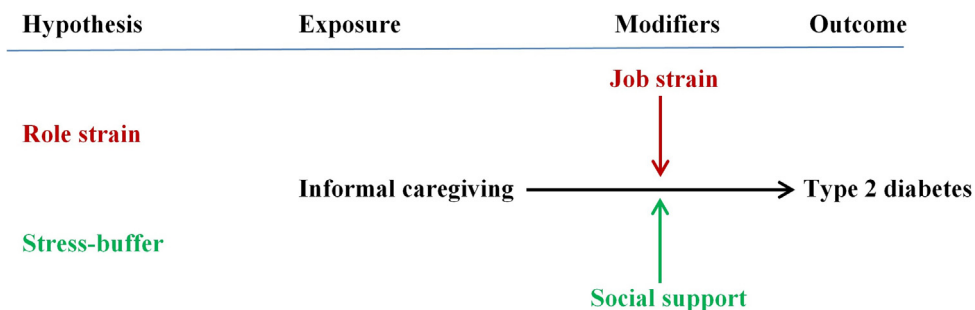


Fig. 1. Chart of the study aim to determine whether there is any interaction between informal caregiving and psychosocial work factors on type 2 diabetes risk, based on two alternative hypotheses, in gainfully employed workers.

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