EFFETS DE LA DOUBLE EXPOSITION À DES CONTRAINTES PSYCHOSOCIALES AU TRAVAIL ET À DES RESPONSABILITÉS FAMILIALES ÉLEVÉES SUR LA PRESSION ARTÉRIELLE ET LA DÉTRESSE PSYCHOLOGIQUE DES FEMMES : UNE ÉTUDE PROSPECTIVE DE 5 ANS RÉALISÉE AUPRÈS DE COLS BLANCS DE LA RÉGION DE QUÉBEC

Thèse

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Thèse

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Sous la direction de :

Chantal Brisson, directrice de recherche

RÉSUMÉ

Objectifs généraux :

1. Réaliser une revue systématique de l'effet des contraintes psychosociales au travail des modèles demande-latitude (DL) et déséquilibre efforts-reconnaissance (DER) sur la pression artérielle (PA).
2. Évaluer, sur une période de cinq ans, l'effet de la double exposition aux contraintes psychosociales au travail des modèles DL (*job strain*) et DER et à des responsabilités familiales élevées sur la PA (moyenne) et la détresse psychologique (prévalence) auprès de femmes cols blancs.

Méthodes :

1. Les études incluses dans la revue systématique devaient : i) évaluer ≥1 contrainte psychosociale au travail, ii) mesurer la PA moyenne ou l'hypertension, iii) inclure ≥100 travailleurs et iv) être publiée en français ou en anglais dans v) un journal arbitré.
2. La population étudiée à l'objectif 2 était constituée de plus de 1000 femmes de la région de Québec, vues à trois reprises sur une période de 5 ans. Les contraintes psychosociales, les responsabilités familiales et la détresse psychologique ont été mesurées par questionnaire. La PA ambulatoire a été mesurée aux 15 minutes, durant une journée de travail.

Résultats :

1. Environ une étude sur deux présentait un effet délétère des contraintes psychosociales au travail sur la PA (74 études). Un effet plus consistant a été observé : i) chez les hommes et ii) parmi les études de qualité méthodologique supérieure.
2. Comparées aux femmes non-exposées, les femmes ayant une double exposition au DER et à des responsabilités familiales élevées avaient : i) une moyenne de PA plus élevée au recrutement (diastolique: +2,75 mm Hg), trois ans plus tard (systolique: +2,22 mm Hg, diastolique: +2.55 mm Hg) et cinq ans plus tard (systolique: +2,94 mm Hg, diastolique: +3,10 mm Hg) et ii) un rapport de prévalences de détresse psychologique plus élevé au

recrutement (2,04 (intervalles de confiance (IC) à 95% : 1,68-2,49), 3 ans plus tard (1,90 (IC à 95% : 1,52-2,38) et cinq ans plus tard (1,56 (IC à 95% 1,16-2,10). De plus, les femmes ayant une double exposition au *job strain* et à des responsabilités familiales élevées avaient un rapport de prévalence de détresse psychologique plus élevé au recrutement (1,53 (IC à 95% 1,22-1,93) et cinq ans plus tard (1,43 (IC à 95% 1,07-1,91).

Conclusions :

1. L'effet délétère des contraintes psychosociales au travail sur la PA a été plus fréquemment observé chez les hommes que chez les femmes et au sein des études de qualité méthodologique supérieure.

2. Notre étude, réalisée chez les femmes, a montré un effet délétère de la double exposition à des contraintes psychosociales au travail et à des responsabilités familiales élevées sur la PA et la détresse psychologique.

La présente thèse de doctorat contribue ainsi aux efforts de prévention primaire des maladies cardiovasculaires et des problèmes de santé mentale, deux fardeaux de santé publique majeurs.

ABSTRACT

General objectives:

1. To realize a systematic review of the adverse effects of psychosocial work factors of both the demand–control (DC) and effort–reward imbalance (ERI) models on blood pressure (BP).
2. To evaluate, over the 5-year follow-up, the effect of the double exposure to the psychosocial work factors of the DC or ERI models and high family responsibilities on BP (mean) and psychological distress (prevalence) among white-collar working women.

Methods:

1. To be included in the systematic review, studies had to: i) evaluate at least one psychosocial work factor, ii) evaluate BP or hypertension, iii) comprise ≥100 workers, iv) be written in English or French, and v) be published in a peer reviewed journal.
2. The study population was composed of over 1,000 women from Quebec City. They were assessed three times during a 5-year period (year 1, 3 and 5). At each time, psychosocial work factors, family responsibilities and psychological distress were measured using questionnaires. Ambulatory BP was measured every 15 minutes during a working day.

Results:

1. About half of the 74 studies included in the systematic review, reported a significant adverse effect of psychosocial work factors on BP. A more consistent effect was observed among: i) men and ii) studies of higher methodological quality.
2. Compared to unexposed women, women having a double exposure to ERI at work and high family responsibilities had: i) a higher BP level at baseline (diastolic: +2.75 mmHg), after 3-year (systolic: +2.22 mmHg and diastolic: +2.55 mmHg), and after 5-year (systolic: +2.94 mmHg and diastolic: +3.10 mmHg) and ii) a higher prevalence ratio of psychological distress at baseline (2.04 (95% confidence intervals (CI): 1.68-2.49), after 3-year (1.90 (95% CI: 1.52-2.38), and after 5-year follow-up (1.56 (95% CI:1.16-2.10). Women having a double exposure to job strain and high family responsibilities had also a significantly

higher prevalence of psychological distress at baseline (1.53 (95% CI: 1.22-1.93) and at the 5-year follow-up (1.43 (95% CI: 1.07-1.91).

Conclusion:

1. In this systematic review, a more consistent adverse effect of psychosocial work factors was observed among men than women and in studies of higher methodological quality.
2. This thesis showed an adverse effect of the double exposure to psychosocial work factors and high family responsibilities on women BP and psychological distress.

These findings contribute to the current effort of primary prevention of cardiovascular disease and mental health problems, by documenting the psychosocial etiology of elevated BP and psychological distress.

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ABRÉVIATIONS

DL : demande-latitude, DER : déséquilibre efforts-reconnaissance, MCV : maladies cardiovasculaires, PA : pression artérielle.

BP: blood pressure, CVD: cardiovascular diseases, DC: demand-control, DCS: demand-control-support, ERI: effort-reward imbalance.

REMERCIEMENTS

Gabriel Harvey-Ouimet, je te dédie cette thèse de doctorat. Il n'existe pas de mot assez fort pour décrire la chance que j'ai de t'accompagner à travers tes apprentissages et tes si nombreuses folies. Tu as un immense talent pour illuminer une pièce, me faire éclater de rire et m'impressionner avec tes inépuisables prouesses. Je te remercie de me faire découvrir la magie de ton imaginaire et la richesse de ta simplicité. Grâce à toi, j'ai acquis la conviction que la famille est ce que nous avons de plus beau, de plus pur et de plus solide. Tu as parsemé la fin de mon doctorat du bonheur de classer méthodiquement des petites voitures, d'essayer des nouveaux mouvements de danse farfelus et de la satisfaction d'entendre ton hocquet après une séance de chatouilles réussie. Tu es le cadeau le plus précieux que la vie m'ait offert. J'espère que cette thèse de doctorat t'inspirera à aller au bout de tes rêves. Tout est possible. L'avenir t'appartient.

Merci à mes parents, Brigitte Gilbert et Yvan Ouimet, d'être toujours là pour moi. Vous m'avez appris ce que signifie l'amour inconditionnel. Maman, tu es ma confidente, mon amie, mon soleil et tellement plus. Pendant mon doctorat, tu m'as aidée à 'arrêter le hamster' quand il courait un peu trop vite, à croire en moi et à prendre le temps d'apprendre à devenir une maman à mon tour. Papa, tu es mon phare, mon inspiration à persévérer et à travailler avec rigueur et organisation. C'est tellement sécurisant de savoir que je peux compter sur toi quand j'ai besoin d'être rassurée ou aidée, sans même avoir à demander. Te rends-tu compte? 'Ta' thèse est terminée! Merci aussi à mes beaux-parents; merci Pâquerette Dufour pour ton soutien continu envers moi et 'ti-prout', ta bonne humeur et ta compréhension et merci Robert Rouleau pour tes conseils avisés, tes nombreux coups de main et la petite coupe de vin parfois bien méritée.

Un merci tout particulier à ma sœur Sophie Tremblay de ne jamais avoir lâché ma main. Tes petits mots, tes attentions et ta présence m'ont aidé plus que je ne saurais l'exprimer. Merci aussi de me rappeler de suivre mon instinct quand je m'égare.

Merci à tous les autres membres de ma famille et à mes amis de m'encourager dans mes projets et de partager avec moi petits et grands moments.

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Merci aux Instituts de recherche en santé du Canada (IRSC), au Fond de recherche en santé du Québec (FRQS), à l'Institut Robert-Sauvé en santé et en sécurité au travail (IRSST) et à mes parents pour leur soutien financier.

Enfin, merci à mon amoureux, Mathias Poret. Tu es une magnifique surprise et le plus beau des nouveaux chapitres. Merci de rendre ma vie à la fois douce, simple, pimentée et remplie d'aventures. Je t'aime.

AVANT-PROPOS

Je suis auteure principale des trois articles scientifiques intégrés à cette thèse. Ma contribution est donc majeure à chacune des étapes de la réalisation de ces articles (revue de la littérature, définition des objectifs, stratégie d'analyse, analyses statistiques, rédaction, révision, soumission, réponses aux réviseurs). Les trois articles répondent à des objectifs de recherche originaux, développés dans le cadre de l'élaboration de mon projet de thèse.

Gilbert-Ouimet M, Trudel X, Brisson C, Vézina M, Milot A, Adverse effect of psychosocial work factors on blood pressure: a systematic review of studies on demand-control-support and effort-reward imbalance models (2013), Scandinavian journal of work, environment and health, 1;40(2):109-32. (Impact factor: 3.10)

Gilbert-Ouimet M, Brisson C, Milot A, Vézina M, Do women exposed to both adverse psychosocial work factors and high family responsibilities tend to have a higher blood pressure level? A 5-year prospective study among white-collar working women (accepté à Psychosomatic medicine le 14 janvier 2016, impact factor: 4.08).

Gilbert-Ouimet M, Brisson C, Vézina M, Adverse effect of psychosocial work factors and family responsibilities on psychological distress: a 5-year prospective study among white-collar working women (à soumettre à American journal of public health en mai 2016, impact factor: 4.5).

Autres contributions pertinentes:

Ces contributions sont complémentaires et portent sur des sujets connexes à ma thèse, soit i) l'étiologie psychosociale des maladies cardiovasculaires (principalement la pression artérielle) et des problèmes de santé mentale ou ii) l'évaluation d'une intervention organisationnelle visant à réduire les contraintes psychosociales au travail et à observer les effets sur la pression artérielle et la détresse psychologique.

Articles et chapitres de livres connexes pertinents

Articles publiés :

Hasson H, **Gilbert-Ouimet M**, Brisson C, Baril-Gingras G, Vézina M, Bourbonnais R, Montreuil S (2012), Implementation of an occupational intervention – do employees perceive changes that managers implement ?, Journal of occupational and environmental medicine; 54 (1), 85-91.

Hasson H, Brisson C, **Gilbert-Ouimet M**, Guérin S, Baril-Gingras G, Vézina M, Bourbonnais R, An organizational-level occupational health intervention: Employee perceptions of exposure to changes, and psychosocial outcomes (2014); 22(2): 179-97 Work and stress.

Gilbert-Ouimet M, Baril-Gingras G, Brisson C, Cantin V, Leroux I, Vézina M, Vinet A, Trudel L, Bourbonnais R, Changes implemented during a workplace psychosocial intervention and their consistency with intervention priorities, (2015); 57(3): 251-61, Journal of occupational and Environmental Medicine.

Article acceptés:

Boucher P, **Gilbert-Ouimet M**, Trudel X, Milot A, Brisson C, Masked hypertension and effort-reward imbalance among 2369 white-collar workers, Journal of human hypertension.

Trudel X, Brisson C, **Gilbert-Ouimet M**, Duchaine C, Guénette L, Milot A, Effort-reward imbalance and the prevalence of uncontrolled hypertension among treated workers.

Articles soumis :

Brisson C, Trudel X, **Gilbert-Ouimet M**, Vézina M, Trudel L, Masse B, Milot A. Effects on blood pressure and hypertension of a workplace intervention targeting adverse psychosocial work factors.

Brisson C, Leroux I, Bourbonnais R, **Gilbert-Ouimet M,** Ndjaboue Ruth, Larocque B, Masse B, Vézina M, Prospective effects of psychosocial stressors at work on medically certified sickness absence for mental health problems among 7000 white collar workers.

Duchaine C, Brisson C, Vézina M, Ndjaboué R, Levesque M, Trudel X, **Gilbert-Ouimet M**, Dionne C, Contribution of psychosocial work factors to socioeconomic inequalities in mental health among workers from Quebec City.

Chapitres de livres :

Theorell T, Brisson C, Vézina M, Milot A, **Gilbert-Ouimet M**, *Psychosocial factors in primary cardiology prevention*, European Association for Cardiovascular Prevention and Rehabilitation textbook of preventive cardiology, Oxford University Press, 2015.

Brisson C, **Gilbert-Ouimet M**, Duchaine C, Milot A, Trudel X, Vézina M, Workplace interventions aiming to reduce effort-reward imbalance and improve related health problems, Chapter 16 of the book entitled Work Stress and Health in a Globalized Economy, Edited by Johannes Siegrist and Morten Wahrendorf, Springer publisher. In press.

Rapports de recherche :

Biron C, St-Hilaire F, Baril-Gingras G, Paradis M-E, Chabot S, Lefebvre R, Ivers H, Vézina M, Fournier P-S, **Gilbert-Ouimet M**, Brisson C, *Projet Brocoli:* Comprendre les facteurs influençant les démarches en santé psychologique et l'adoption de pratiques de gestion des risques psychosociaux par les gestionnaires, Institut de recherche Robert-Sauvé en santé et en sécurité au travail, 2015, 91 pages.

Les résultats de cette thèse ont par ailleurs fait l'objet de plusieurs **présentations dans des conférences nationales et internationales :**

Gilbert-Ouimet M, Trudel X, Brisson C, Vézina M, Milot A, Effets des stresseurs psychosociaux au travail sur la pression artérielle: une revue systématique, ACFAS, Québec, mai 2013 (présentation orale).

Gilbert-Ouimet M, Trudel X, Brisson C, Vézina M, Milot A, Effets des stresseurs psychosociaux au travail sur la pression artérielle: une revue systématique, Canadian society of epidemiology and biostatistics, St. John's, Newfoundland, 24-27 juin 2013 (présentation orale).

Gilbert-Ouimet M, Trudel X, Brisson C, Vézina M, Milot A, Effets des stresseurs psychosociaux au travail sur la pression artérielle: une revue systématique, Canadian hypertension congress, 17 octobre 2013 (présentation par affiche).

Gilbert-Ouimet M, Trudel X, Brisson C, Vézina M, Milot A, Adverse effects of psychosocial work factors on blood pressure: a systematic review and critical synthesis of the literature, Internation cardiology conference, Rome, Italy, 4-5 December 2013 SUR INVITATION (présentation orale).

Gilbert-Ouimet M, Brisson C, Milot A, Vézina M, Effet de la double exposition à des stresseurs psychosociaux au travail et à des responsabilités familiales élevées sur la pression artérielle des femmes : résultats préliminaires d'une étude de 5 ans, 22ième reunion scientifique annuelle de la Société québécoise d'hypertension artérielle, Québec, Québec, 16-18 janvier 2014 (présentation par affiche).

Gilbert-Ouimet M, Brisson C, Milot A, Vézina M, Effet de la double exposition à des stresseurs psychosociaux au travail et à des responsabilités familiales élevées sur la pression artérielle des femmes : une étude prospective de 5 ans, 1ère journée de la recherche des étudiants de l'axe santé des populations et pratiques optimales en santé, Québec, 5 mai 2014 (présentation orale).

Gilbert-Ouimet M, Brisson C, Milot A, Vézina M, Effet de la double exposition à des stresseurs psychosociaux au travail et à des responsabilités familiales élevées sur la pression artérielle des femmes : une étude prospective de 5 ans, Journée de la recherche de la Faculté de medicine de l'Université Laval, Québec, juin 2014 (présentation orale).

Gilbert-Ouimet M, Brisson C, Milot A, Vézina M, Effect of the double exposure to adverse psychosocial work factors and high family responsibilities on blood pressure among white-collar working women: a 5-year prospective study, ICOH-WOPS International Conference on Psychosocial Factors at Work, Australie, septembre 2014 (présentation orale).

Gilbert-Ouimet M, Brisson C, Milot A, Vézina M, Effect of the double exposure to adverse psychosocial work factors and high family responsibilities on blood pressure among white-collar working women: a 5-year prospective study, Canadian hypertension congress, Toronto, octobre 2015 (présentation orale).

Cinq de ces présentations ont reçu des **distinctions** :

2016 Prix de la meilleure présentation orale de niveau doctorat pour la présentation intitulée : « Effet de la double exposition à des stresseurs psychosociaux au travail et à des responsabilités familiales élevées sur la détresse psychologique des femmes : une étude prospective de 5 ans », 3e journée de la recherche des étudiants de l'axe santé des populations etpratiques optimales en santé, Québec, 2 mai 2016 (prix : 150$ en argent).

2016 Prix de la meilleure affiche de niveau doctorat pour la présentation intitulée : « Effet de la double exposition à des stresseurs psychosociaux au travail et à des responsabilités familiales élevées sur la détresse psychologique des femmes : une étude prospective de 5 ans », 1ère édition des journées de la recherche en santé de la Faculté de médecine de l'Université Laval, Québec, 25 mai 2016 (prix : 250$ en argent).

2014 Prix de la meilleure présentation orale de niveau doctorat pour la présentation intitulée : « Effet de la double exposition à des stresseurs psychosociaux au travail et à des responsabilités familiales élevées sur la pression artérielle des femmes : une étude prospective de 5 ans », 1ère journée de la recherche des étudiants de l'axe santé des populations etpratiques optimales en santé, Québec, 5 mai 2014 (prix : 150$ en argent).

2014 « Coups de coeur 2014 » (parmi les trois meilleurs résumés présentés), retenu par les membres du Comité scientifique de la Société québécoise d'hypertension artérielle, pour une présentation orale du résumé intitulé : Effet de la double exposition à des stresseurs psychosociaux au travail et à des responsabilités familiales élevées sur la pression artérielle des femmes : résultats préliminaires d'une étude de 5 ans.

2013 Prix de la meilleure présentation par affiche au niveau doctorat de la Société québécoise d'hypertension artérielle lors de la 21ième reunion scientifique annuelle de la Société québécoise d'hypertension artérielle à Montréal du 16 au 18 janvier 2013. Montant du prix : 500$ en argent).

Présentations à venir:

Gilbert-Ouimet M, Brisson C, Milot A, Vézina M, Effect of the double exposure to adverse psychosocial work factors and high family responsibilities on blood pressure among white-collar working women: a 5-year prospective study, 25th Epidemiology in occupational health congress, Barcelona septembre 2016.

Gilbert-Ouimet M, Brisson C, Milot A, Vézina M, Effect of the double exposure to adverse psychosocial work factors and high family responsibilities on blood pressure among white-collar working women: a 5-year prospective study, INCOSE, Belgique, septembre 2016.

Boucher P, **Gilbert-Ouimet M**, Trudel X, Milot A, Brisson C, Masked hypertension and effort-reward imbalance among 2369 white-collar workers, INCOSE, Bruxelles, septembre 2016.

Gilbert-Ouimet M, Brisson C, Milot A, Vézina M, Effect of the double exposure to adverse psychosocial work factors and high family responsibilities on blood pressure among white-collar working women: a 5-year prospective study, CARHW, Toronto, octobre 2016.

Boucher P, **Gilbert-Ouimet M**, Trudel X, Milot A, Brisson C, Masked hypertension and effort-reward imbalance among 2369 white-collar workers, CARHW, Toronto, octobre 2016.

Trudel X, Brisson C, **Gilbert-Ouimet M**, Duchaine C, Guénette L, Milot A, Effort-reward imbalance and the prevalence of uncontrolled hypertension among treated workers, CARHW, Toronto, octobre 2016.

Duchaine C, Brisson C, Vézina M, Ndjaboué R, Levesque M, Trudel X, **Gilbert-Ouimet M**, Dionne C, Contribution of psychosocial work factors to socioeconomic inequalities in mental health among workers from Quebec City, CARHW, Toronto, octobre 2016.

Bourses d'excellence pour ma formation doctorale :

Années	**Organisme**	**Titre du projet**	**Montant**
2011-2014	IRSC	Bourse de formation au niveau doctorat pour le projet de recherche ayant pour titre : Effets des contraintes psychosociales au travail et des responsabilités familiales sur la pression artérielle ambulatoire et la santé mentale des femmes	105 000$
2011-2014	FRQS	Bourse de formation au doctorat pour le projet de recherche ayant pour titre "Effets des contraintes psychosociales au travail et des responsabilités familiales sur la pression artérielle ambulatoire et la santé mentale des femmes" (déclinée car non cumulable avec la bourse des IRSC)	60 000$
2011-2014	IRSST	Supplément de bourse de formation de doctorat pour le projet de recherche ayant pour titre "Effets des contraintes psychosociales au travail et des responsabilités familiales sur la pression artérielle ambulatoire et la santé mentale des femmes	14 400$
2014-2016	FRQS	Bourse de formation au doctorat pour le projet de recherche ayant pour titre "Effets des contraintes psychosociales au travail et des responsabilités familiales sur la pression artérielle ambulatoire et la santé mentale des femmes"	40 000$

Subventions:

Au cours de mon doctorat, mon expertise en épidémiologie psychosociale, particulièrement en ce qui a trait aux aspects liés au genre, m'a amenée à être co-chercheure de 5 projets de recherche subventionnés par les IRSC (Instituts de recherche en santé du Canada) ou en attente d'une réponse de la part du CERSSPL-UL (Centre de recherche sur les soins et les services de première ligne de l'Université Laval) :

Années	Niveau d'implication et organisme		Titre du projet	Montant
2012-2013	**CC**	IRSC	Inégalités sociales, environnement psychosocial au travail et santé mentale: une étude auprès de 5000 hommes et femmes (avec Brisson C, Vézina M, Bourbonnais R, Dionne C, Levesque M, Ndjaboué R, Trudel X, Mâsse B, Pearce N)	48 798$
2012-2017	**CC**	IRSC	Inégalités sociales, environnement psychosocial au travail, vie active, retraite et santé cardiovasculaire: une étude prospective de 20 ans chez 9000 hommes et femmes (avec Brisson C, Milot A, Vézina M, Dionne C, Bourbonnais R, Mâsse B, Pearce N, Trudel X, Dagenais GR)	617 000$
2015-2016	**CC**	IRSC	Effet des contraintes psychosociales au travail sur les problèmes de santé mentale : Une revue systématique et méta-analyse. (avec Brisson C, Richer N, Jauvin N, Lafond M-J, Lesage A, Moore L, Vézina M)	100 000$
2015-2019	**CC**	IRSC	Inégalités sociales, environnement psychosocial au travail, vie active, retraite et santé mentale: une étude prospective de 20 ans chez 9000 hommes et femmes (avec Brisson C, Milot A, Vézina M, Laurin D, Dionne C, Bourbonnais R, Mâsse B, Lesage A, Pearce N, Trudel X, Ndjaboué R, Lauzier S)	649 104$

Années	Niveau d'implication et organisme		Titre du projet	Montant
Soumis avril 2016	**CC**	CERSSPL-UL	Effet des contraintes psychosociales au travail sur le diabète de type 2: élaboration d'un protocole de recherche pour réaliser une revue systématique de la littérature (avec Brisson C, Milot A, Tourigny A, Vézina M, Légaré F, Guénette L)	15 000$

*CC : co-chercheure.

CHAPITRE 1. Introduction et pertinence

1.1 Problématique

Dans les pays industrialisés, les maladies cardiovasculaires (MCV) et les problèmes de santé mentale figurent parmi les groupes de problèmes de santé les plus fréquents et invalidants de la population en âge de travailler (1). Une pression artérielle (PA) élevée est l'un des principaux facteurs de risque de MCV. Plus d'une Canadienne sur trois a une PA élevée (15,1% sont *pré-hypertendues* [1] et 19% sont hypertendues) (2). Au niveau populationnel, une diminution de seulement 2 mm Hg de la PA systolique peut entraîner une diminution de la mortalité attribuable aux maladies coronariennes et aux accidents vasculaires cérébraux de respectivement 7% et 10% (3). Les problèmes de santé mentale constituent un second enjeu populationnel majeur. Selon des données canadiennes récentes, 28% des femmes qui occupent un emploi rémunéré présentent des symptômes de détresse psychologique élevée (une atteinte précoce à la santé mentale) par rapport à 22,4% des hommes (4). Une détresse psychologique élevée a été associée à un risque accru de développer une dépression majeure (5, 6), de l'hypertension (7) et une maladie coronarienne (8).

De plus en plus d'évidences montrent que les contraintes psychosociales au travail des modèles demande-latitude (9) et déséquilibre efforts-reconnaissance (10) peuvent contribuer à l'élévation de la pression artérielle (11) ainsi qu'au développement des problèmes de santé mentale (12). Les femmes des pays industrialiés sont davantage exposées à ces contraintes psychosociales que les hommes (4, 13). De plus, au Canada et aux États-Unis, les femmes qui occupent un emploi rémunéré consacrent en moyenne deux fois plus d'heures par semaine aux responsabilités familiales que leurs homologues masculins (environ 30 comparées à 17 heures pour les deux pays) (14, 15). Endosser des rôles multiples, comme ceux de mère et de travailleuse peut entraîner un stress physiologique et psychologique pouvant nuire à la santé (16-20). Selon deux revues narratives de la littérature, ce seraient les conditions d'exercices de ces rôles qui seraient nocives (14, 21). Il est ainsi possible d'envisager que le fait d'occuper un travail comportant

[1] PA systolique entre 125-139 mm Hg et/ou PA diastolique entre 80 et 89 mm Hg.

des contraintes psychosociales et d'assumer des responsabilités familiales élevées puisse être délétère pour la santé.

Dans les études antérieures, la double exposition à des contraintes psychosociales au travail et à des responsabilités familiales élevées a été associée au développement de la maladie coronarienne (22), à une PA moyenne plus élevée (23-25), à une détresse psychologique élevée (26), aux affections psychosomatiques (27) et à la perception d'un mauvais état de santé général (28-30). Quatre études antérieures ont porté sur cette double exposition et la PA (23-25, 31). Ces études sont limitées par des devis transversaux et par une évaluation des contraintes psychosociales au travail restreinte à un seul modèle théorique (DL ou DER) (23-25, 31). De plus, une seule étude antérieure a porté sur la double exposition à des contraintes psychosociales au travail et à des responsabilités familiales élevées et la santé mentale (26). La présente étude évaluera pour la première fois les effets de cette double exposition sur la PA ambulatoire et la détresse psychologique sur la base d'un devis longitudinal comprenant une mesure valide des contraintes psychosociales au travail des deux modèles validés les plus reconnus.

1.2 Objectifs

Objectif préalable à la réalisation de l'étude :

1. Réaliser une **revue systématique** de l'effet des contraintes psychosociales au travail des modèles demande-latitude et déséquilibre efforts-reconnaissance sur la pression artérielle, en tenant particulièrement compte du genre et de la qualité méthodologique des études.

Objectif général de l'étude :

- ❖ Évaluer, sur une période de cinq ans, l'effet de la double exposition à certaines contraintes psychosociales au travail et à des responsabilités familiales élevées sur: a) la pression artérielle et b) la détresse psychologique dans une population de femmes occupant un emploi de col blanc dans la région de Québec.

Objectifs spécifiques de l'étude:

2. Évaluer l'effet de la double exposition aux contraintes psychosociales du **modèle demande-latitude** et à des responsabilités familiales élevées sur la **pression artérielle** (moyenne).
3. Évaluer l'effet de la double exposition aux contraintes psychosociales du **modèle déséquilibre efforts-reconnaissance** et à des responsabilités familiales élevées sur la **pression artérielle** (moyenne).
4. Évaluer l'effet de la double exposition aux contraintes psychosociales du **modèle demande-latitude** et à des responsabilités familiales élevées sur la **détresse psychologique** (prévalence).
5. Évaluer l'effet de la double exposition aux contraintes psychosociales du **modèle déséquilibre efforts-reconnaissance** et à des responsabilités familiales élevées sur la **détresse psychologique** (prévalence).

La **période de latence** pour observer les effets délétères de cette double exposition et la **persistance des effets dans le temps** seront explorées en évaluant l'effet des expositions mesurées lors du recrutement sur les issues de santé mesurées au même moment (recrutement) ainsi que trois et cinq ans plus tard.

De plus, les **effets modifiants potentiels** des facteurs suivants seront explorés : a) l'âge (objectifs 2-5), b) le soutien social au travail (objectifs 2 et 4) et c) le surinvestissement (objectifs 3 et 5).

1.3 État des connaissances

Des données récentes montrent que les femmes des pays industrialisés sont davantage exposées à certaines contraintes psychosociales au travail (*stress au travail*) que les hommes (4, 13). Une explication potentielle est qu'elles tendent à occuper dans des secteurs d'activités pouvant comporter plus de contraintes psychosociales (32). En 2010, près de 80% des femmes des pays industrialisés travaillaient dans le domaine des services comparativement à moins de 60% des hommes (33). Plus spécifiquement, une majorité d'entre elles (63%) occupait des emplois concentrés en trois secteurs d'activités : la vente (28%), la santé ainsi que les services communautaires (20%) et l'éducation (15%) (33). Le fait que les femmes soient davantage exposées aux contraintes psychosociales au travail peut également s'expliquer par leur tendance à occuper des emplois plus précaires (à temps partiel et contractuels) (33) ou se situant davantage au bas de l'échelle hiérarchique (33) que les hommes. Enfin, il est aussi envisageable que, pour un même titre d'emploi, les femmes soient davantage exposées à certaines de ces contraintes (34). Les résultats de trois études antérieures montrent par exemple que les femmes peuvent disposer de moins de latitude décisionnelle que les hommes pour un même titre emploi (34-36).

1.3.1 Les modèles théoriques des contraintes psychosociales au travail

Les deux modèles théoriques les plus reconnus pour évaluer les effets des contraintes psychosociales au travail sur la santé sont le modèle demande-latitude (DL) de Karasek (9) et le modèle déséquilibre efforts-reconnaissance (DER) de Siegrist (10).

Selon le modèle DL (figure 1), une demande psychologique élevée combinée à une latitude décisionnelle faible au travail (*job strain*) entraîne des effets délétères sur la santé. La demande psychologique réfère à la quantité de travail à faire, à la complexité des tâches et aux contraintes de temps. La latitude décisionnelle réfère à la possibilité de prendre des décisions concernant son travail, de faire preuve de créativité ainsi que d'utiliser et de développer ses compétences. Le soutien social au travail, qui a été ajouté à ce modèle par Johnson *et al.* (37), amplifierait (c.-à-d. modifierait) l'effet délétère d'une exposition au *job strain* sur la santé (37).

Selon le modèle DER (figure 2), un déséquilibre entre les efforts investis dans le travail et la reconnaissance obtenue en échange peut aussi entraîner des problèmes de santé (10). La reconnaissance peut être économique (rémunération), sociale (estime et respect) et organisationnelle (statut professionnel et perspectives de carrière) (10). Ce construit comporte une troisième dimension, le surinvestissement (10). Celui-ci se traduit par un besoin d'approbation, une compétitivité et une hostilité latente, une impatience et une irritabilité disproportionnée ainsi qu'une incapacité à s'éloigner du travail. Le surinvestissement amplifierait l'effet délétère du DER sur la santé (10).

1.3.2 Pression artérielle et contraintes psychosociales au travail

La pression artérielle est caractérisée par sa grande variabilité. Pour cette raison, les mesures cliniques de PA (collectées au moyen d'un sphygmomanomètre à mercure durant une visite) ne reflètent que partiellement la PA journalière d'un individu. De plus, en clinique, la présence d'un observateur peut entraîner une surestimation et parfois même une sous-estimation de la PA dû à un *effet de la blouse blanche* (38) ou à une hypertension masquée (39). L'utilisation d'appareils de monitoring ambulatoires permet d'éviter ces problèmes et d'obtenir des mesures fiables et valides de la PA toutes les 15 à 30 minutes durant la journée. Les moyennes quotidiennes diurnes de PA ambulatoire sont également plus reproductibles que les mesures cliniques. Les résultats d'études prospectives montrent d'ailleurs que les mesures ambulatoires de PA s'avèrent un meilleur prédicateur du risque de MCV (38, 40, 41) et d'événements cardiovasculaires (42-45) que les mesures cliniques.

Plusieurs études ont porté sur l'effet des contraintes psychosociales au travail des modèles DL et DER sur la pression artérielle (46-47). Landsbergis *et al.* (2013) ont réalisé une méta-analyse des études transversales ayant porté sur le *job strain* et la PA ambulatoire. Les mesures d'effet globales présentées dans cette méta-analyse sont des moyennes de PA plus élevées, soit +3,43 mm Hg (systolique) et +2,07 mm Hg (diastolique), chez les travailleurs exposés au *job strain* comparés aux travailleurs non-exposés à ces contraintes (46). Cependant, 13 des 22 études ayant servi à calculer ces différences n'ont observé aucun résultat statistiquement significatif. Pour leur part, Rosenthal *et al.* (2011) ont réalisé une revue narrative visant à amorcer la réflexion quant aux inconsistances observées dans la littérature. Cette revue de la littérature incluait 54 études ayant des caractéristiques méthodologiques particulières (liées au devis, aux variables d'exposition, aux covariables ou aux issues étudiées) ou incluant des populations de travailleurs spécifiques (chauffeurs d'autobus, infirmières, cols blancs) (47). Les auteurs de ces revues de la littérature ont proposé deux principales pistes d'explication aux inconsistances observées: i) le genre et ii) la qualité méthodologique des études. Leurs hypothèses étant que l'effet serait plus consistant chez les hommes que chez les femmes (46) et parmi les études utilisant un devis prospectif et des mesures ambulatoires de PA (47). Cependant, ces hypothèses n'ont été que partiellement vérifiées dans ces revues de la littérature compte tenu: i) de l'approche narrative utilisée (non systématique) (47), ii) de l'absence d'évaluation systématique des contraintes du modèle DER (46, 47) et iii) de l'absence d'évaluation systématique des effets des contraintes psychosociales sur l'hypertension (46, 47).

La présente thèse de doctorat inclue la première revue systématique des études portant sur l'effet des contraintes psychosociales au travail des modèles DL et DER sur la PA moyenne et l'hypertension. En contournant les limites des revues de la littérature antérieures, cette revue systématique permet de mieux comprendre les inconsistances observées dans la littérature, notamment celles liées au genre et à la qualité méthodologique des études.

Préalablement à la réalisation de la revue systématique, une synthèse des résultats des études prospectives sur le *job strain* (48-58) et le DER (59) a été réalisée. Globalement, un effet délétère significatif a été observé dans 8/12 études (tableau synthèse des études prospectives en annexe 1). Plus spécifiquement, un effet délétère a été observé dans 6/7 études prospectives ayant eu recours à des mesures ambulatoires de PA (annexe 1). Les différences de moyennes de PA systoliques et diastoliques observées variaient respectivement entre +1,2 et +7,7 mm Hg (48, 50, 52, 54, 55, 59) et entre +0,8 et +7 mm Hg (52, 55, 59) et les rapports de cotes ou risques relatifs d'hypertension variaient entre 1,27 et 2,78 (49, 50, 59) (annexe 1). Ces résultats supportent l'hypothèse selon laquelle un devis prospectif et l'utilisation de mesures de PA ambulatoires mènent à un effet délétère consistant. De plus, pour le *job strain*, ces résultats tendent à supporter l'hypothèse selon laquelle un effet délétère plus consistant est observé chez les hommes que chez les femmes (effet délétère significatif: 5/5 études chez les hommes et 2/4 études chez les femmes) (annexe 1).

1.3.3 Détresse psychologique et contraintes psychosociales au travail

Une détresse psychologique élevée constitue une atteinte précoce à la santé mentale. Elle a été associée au risque d'atteintes cliniques plus sévères, telles la dépression majeure (5, 6), l'hypertension (7) et la maladie coronarienne (8). La détresse psychologique est le résultat d'un ensemble d'émotions négatives ressenties par un individu qui, *lorsqu'elles se présentent avec persistance*, peuvent donner lieu à des symptômes dépressifs et anxieux (60), à de la somatisation (61) ainsi qu'à des symptômes cognitifs et de colère (62). La personne en détresse peut néanmoins continuer de travailler et d'interagir de façon acceptable avec son environnement (63). Il s'agit ainsi d'« un indicateur de première importance pour estimer le risque d'atteintes cliniques » de façon précoce chez les travailleurs (64-66).

Le caractère précoce de cette atteinte à la santé mentale la rend par ailleurs difficile à répertorier dans un système de classification de maladies psychiatriques (comme le DSM-IV (67)). En effet, seule une minorité des personnes ayant des problèmes psychologiques sont diagnostiquées pour une maladie psychiatrique (68, 69). De plus, les diagnostics médicaux peuvent sous-estimer la prévalence de la détresse psychologique élevée puisque les personnes ne consultent pas nécessairement un médecin pour cette atteinte précoce à la santé mentale (70). Pour ces différentes raisons, la détresse psychologique est généralement mesurée de manière auto-rapportée. Cette approche est cohérente avec la vision de l'OMS qui soutient que la santé mentale ne doit pas être restreinte à l'absence de troubles mentaux (71).

Les résultats des études prospectives ayant porté sur les contraintes psychosociales au travail et les problèmes de santé mentale ont été synthétisés dans trois revues systématiques de la littérature (12, 72, 73). Les auteurs de ces revues systématiques ont mis en évidence un effet délétère des contraintes psychosociales des modèles DL et DER sur la détresse psychologique et la dépression (72, 73) ainsi que sur les *troubles mentaux communs*[2] (12). Pour la détresse psychologique et la dépression, un effet délétère consistant

[2] Selon cette étude, les troubles mentaux communs incluent la détresse psychologique, les symptômes dépressifs et anxieux, la dépression majeure, la somatisation, la consommation de médicaments psychotropes et la fatigue chronique.

a été observé à la fois chez les femmes et les hommes (72, 73). Pour les troubles mentaux communs, un effet plus faible mais plus consistant a été observé chez les femmes que chez les hommes (12). Comme ces revues de la littérature n'incluent pas les études réalisées au cours des sept dernières années et comme leurs conclusions ne sont pas spécifiques à la détresse psychologique, voici un bref état des connaissances à jour pour cette atteinte.

Les études prospectives ayant porté sur l'effet des contraintes psychosociales des modèles DL ou DER sur la détresse psychologique sont synthétisées à l'annexe 2. Une majorité (11/17) de ces études portait sur les symptômes dépressifs (74-84) et les symptômes anxieux (77, 78, 81-84), qui constituent deux dimensions de la détresse psychologique (65, 85, 86). Globalement, les rapports de cotes et de prévalences variaient de 1,33 à 4,6 (annexe 2). Dans les 15 études portant sur le modèle DL, un effet délétère a été observé pour au moins une des contraintes psychosociales de ce modèle (annexe 2). Par ailleurs, seules quatre études ont évalué l'effet de la combinaison des deux contraintes du modèle DL, soit le *job strain* (76, 79, 87, 88). Un effet délétère significatif (76, 88) ou marginalement significatif (79) a été observé dans trois de ces études (annexe 2). Un tel effet a également été observé dans les quatre études portant sur le DER (77, 83, 84, 89). L'effet délétère des contraintes psychosociales des modèles DL et DER était aussi consistant chez les femmes et les hommes (effet délétère significatif: 5/6 études chez les femmes et les hommes, annexe 2).

1.3.4 Responsabilités familiales

La présence de plus en plus marquée des femmes sur le marché du travail (90) et la reconnaissance de leur contribution au soutien financier familial a suscité, chez les couples, une remise en question du partage des responsabilités familiales et la nécessité de tenir compte des trajectoires professionnelles des deux conjoints (91). Bien que les hommes participent davantage à l'accomplissement des responsabilités familiales qu'auparavant, les femmes des pays industrialisés continuent d'en assumer la majeure partie (34, 92). En effet, lorsque les deux conjoints travaillent, les femmes consacrent environ deux fois plus d'heures par semaine au travail non-rémunéré que les hommes (92). Au Canada et aux États-Unis, les femmes qui occupent un emploi rémunéré consacrent en moyenne deux fois plus d'heures par semaine aux responsabilités familiales que leurs homologues masculins (environ 30 heures comparées à 17 heures pour les deux pays) (14, 15).

Bien qu'il n'existe pas de définition formelle des responsabilités familiales, elles ont généralement été définies par une combinaison plus ou moins grande d'indicateurs liés au nombre d'enfants d'âge mineur, aux soins qui leur sont proférés et à l'accomplissement des tâches ménagères (incluant le plus souvent le ménage, les courses et la préparation des repas) (23, 24, 28, 30, 93-96). Des définitions plus exhaustives incluent également les soins à une personne à autonomie réduite (95, 97-99), la tenue du budget familial (93), l'entretien extérieur (23, 100), l'entretien des voitures (23, 93) et les périodes de jeu avec les enfants (100).

1.3.5 Responsabilités familiales, pression artérielle et santé mentale

Douze études antérieures ont porté sur l'association entre les responsabilités familiales et la PA (annexe 3) (24, 25, 96, 101-103) ou la détresse psychologique (annexe 4) (94, 104-108). L'ensemble de ces études étaient transversales, ce qui limite l'inférence causale de leurs résultats (109). Une PA plus élevée a été observée dans 4/6 études antérieures en fonction: i) du fait d'être parent (103), ii) du nombre d'enfants mineurs (103) (23), iii) des responsabilités élevées liées aux soins des enfants (23) et iv) du *stress à la maison* (mesuré par les tâches ménagères, la cohésion maritale, la satisfaction quant à la vie sexuelle, les soins aux enfants et le conflit travail-famille) (25, 96) (annexe 3). Dans ces études, les différences de moyennes de PA observées chez les femmes variaient entre +3,4 et 5,7 mm Hg pour la PA systolique (23) (25) et était de +4 mm Hg pour la PA diastolique (23) (annexe 3). Mentionnons par ailleurs que seules des valeurs-*p* (<0,05) ont été présentées dans 2/4 études antérieures (96, 103), ce qui ne permet pas de déterminer la force de l'association.

Une association positive (*délétère*) a été observée dans 4/6 études antérieures ayant porté sur la détresse psychologique et: i) les responsabilités liées aux soins des enfants un mois après le retour au travail suivant un congé de maternité (104), ii) les responsabilités liées aux soins des enfants et aux tâches ménagères (94), iii) être parent (106) ou iv) être parent et s'occuper d'une personne à mobilité réduite (108) (annexe 4). Des coefficients bêta de 0,28 (104) et de 0,32 (94) et des rapports de prévalences de détresse psychologique de 1,54 (106) et 1,4 (108) ont été observés (annexe 4). De plus, une cinquième étude a permis d'observer une association protectrice entre l'aide du conjoint dans la réalisation des tâches ménagères et la détresse psychologique des femmes (coefficient bêta : -0,075) (annexe 4).

1.3.6 Double exposition à des contraintes psychosociales au travail et à des responsabilités familiales élevées, pression artérielle et santé mentale

Selon les auteurs de deux revues de la littérature narratives, assumer de multiples rôles, comme ceux de mère et travailleuse, est généralement favorable à la santé (14, 110). Ces auteurs suggèrent que ce sont plutôt les conditions d'exercice de ces rôles qui peuvent nuire à la santé (14, 110). L'effet délétère proviendrait du fardeau cumulatif que ces rôles comportent (14, 110). Il est ainsi envisageable qu'un effet délétère puisse découler du fait d'occuper un travail comportant des contraintes psychosociales et d'assumer des responsabilités familiales élevées.

Quatre études antérieures ont évalué l'association entre la double exposition à des contraintes psychosociales au travail et à des responsabilités familiales élevées et la pression artérielle (23-25, 31). Ces études sont transversales. Trois études ont porté sur le modèle DL (23, 24, 31) et une étude a porté sur le modèle DER (25). Portela *et al.* (2013) ont observé que les femmes exposées au *job strain* et ayant des tâches domestiques élevées (ménage, lavage, préparation des repas et repassage) avaient une PA ambulatoire systolique plus élevée à la maison (+21.5 mm Hg 'à la maison et éveillée') (31). Ce résultat est toutefois limité par le fait qu'il repose sur uniquement 8 femmes exposées et 13 femmes non-exposées ainsi que sur un outil de mesure du *job strain* non validé. Brisson *et al.* (1999) ont observé que les femmes détenant un diplôme universitaire (n=69) présentaient une PA ambulatoire systolique significativement plus élevée lorsqu'elles étaient simultanément exposées au *job strain* et qu'elles avaient : i) des enfants (+8,1 mm Hg), ii) une charge élevée liée aux soins des enfants (+9,7 mm Hg) et iii) des tâches ménagères élevées (+10,9 mm Hg) (23). Robitaille *et al.* (2008) ont pour leur part observé que, chez les femmes de 45 ans et plus (n=533), celles qui étaient en situation de double exposition au *job strain* et à des responsabilités familiales élevées avaient une PA ambulatoire diastolique significativement plus élevée (+1,8 mm Hg) par rapport aux non exposées (24). Les responsabilités familiales étaient définies par le nombre d'enfants et à leur âge, aux soins des enfants, à la préparation des repas et au ménage à l'intérieur de la maison. Enfin, Xu *et al.* (2004) ont évalué l'association entre la double exposition au DER et à un *stress à la maison* élevé et la PA clinique de 421 femmes chinoises. Le *stress à la maison* a été défini par cinq indicateurs : la cohésion maritale, les responsabilités domestiques, la satisfaction quant à la vie sexuelle, les responsabilités liées aux soins et à l'éducation des enfants et le conflit travail-famille. Xu *et al.* (2004) ont observé une PA systolique significativement plus élevée (+6,5 mm Hg) chez les femmes ayant une double exposition en comparaison aux femmes non-exposées (25).

Une seule étude a porté sur l'association entre la double exposition à des contraintes psychosociales au travail et à des responsabilités familiales élevées et la santé mentale (26). Il s'agit de l'étude transversale d'Ertel *et al.* (2008), menée auprès de 358 femmes et 73 hommes du Massachusetts. Dans cette étude, l'effet délétère du *job strain* sur les symptômes dépressifs était amplifié par le fait d'avoir à la fois un soutien social faible au travail et au moins un enfant de <18 ans (RC=2.9 (IC à 95% : 1.7-4.2)) (26). Cependant, cet effet n'était plus statistiquement significatif après un ajustement pour les variables confondantes potentielles[3]. L'ajustement pour la *douleur physique* a toutefois pu contribuer à annuler une portion de l'effet étudié (sous-estimation) (109) puisque cette variable peut se trouver sur le chemin causal unissant les contraintes psychosociales et les symptômes dépressifs. Il est également à noter qu'aucune analyse séparée en fonction du genre n'a été réalisée dans cette étude.

En bref, les connaissances actuelles au sujet de la double exposition à des contraintes psychosociales au travail et à des responsabilités familiales élevées sont très peu nombreuses, particulièrement en ce qui a trait au DER et à la santé mentale. De plus, ces connaissances ne permettent pas de se prononcer quant à l'effet causal (aucune évaluation prospective) ainsi qu'à la persistance de l'effet dans le temps (section 3.7). La présente thèse contribue à combler ces lacunes.

[3] Ces variables étaient : l'âge, le genre, le statut marital, l'éducation, l'origine ethnique, le revenu du ménage, le taux horaire, le nombre d'heures travaillées par semaine et la douleur physique.

1.3.7 Conflits entre le travail et la vie personnelle : construits complémentaires à celui de la double exposition

Le conflit travail-famille et le conflit famille-travail ("*work-to-family*" et "*family-to-work*" *conflicts*) (111) constituent des construits connexes et complémentaires à celui de la double exposition à des contraintes psychosociales au travail et à des responsabilités familiales élevées. Ils reposent sur *l'hypothèse de rareté* (*scarcity hypothesis*) selon laquelle un individu dispose d'une quantité d'énergie et de ressources fixe et limitée (112). Les différentes sphères de la vie pourraient ainsi entrer en compétition les unes avec les autres (112). Les conflits entre le travail et la famille surviennent lorsque les exigences de la vie professionnelle interfèrent avec les exigences de la vie personnelle (conflit *travail-famille*) et inversement (conflit *famille-travail*) (111). Afin de mesurer ces conflits, les individus doivent par exemple déclarer leur degré d'accord avec des énoncés tels : « mon horaire de travail nuit fréquemment à ma vie familiale (113) » ou « je dois remettre à plus tard certaines tâches de travail pour accomplir des demandes familiales (114) ».

Dans le cadre d'une revue systématique et méta-analyse de la littérature, Allen *et al.* (2000) ont observé que les femmes ayant des conflits travail-famille et famille-travail avaient davantage de problèmes de santé physique et mentale (111). En effet, pour le conflit travail-famille, ces auteurs ont présenté un coefficient de corrélation moyen de 0,29 pour les problèmes de santé physique (le calcul s'appuyait sur les études portant sur la PA, la fatigue, la perte d'appétit, l'état de santé général, le niveau d'énergie et le cholestérol) et de 0,32 pour la dépression (111). Des études plus récentes permettent également d'observer que les femmes exposées aux conflits travail-famille (115-119) ou famille-travail (115, 116) ont une prévalence plus importante de détresse psychologique élevée (116-119) ou de dépression majeure (115). Cependant, une grande majorité des études antérieures étaient transversales (N=52/54) (111). Néanmoins, cette littérature appuie la pertinence d'évaluer l'effet de stresseurs provenant du travail et de la vie personnelle sur la santé des femmes.

1.3.8 Plausibilité biologique et modèle causal

Une exposition prolongée aux contraintes psychosociales au travail ou aux responsabilités familiales élevées peut occasionner un stress physiologique et psychologique pouvant contribuer au développement de problèmes de santé cardiovasculaire et mentale (16-20, 120) (Figure 3). Bien que les connaissances à ce sujet soient peu nombreuses, les mécanismes biologiques seraient liés à l'activation du système nerveux sympathique (catécholamines) et à l'activation de l'axe hypothalamo-hypophyso-surrénalien (glucocorticoïdes). Des études portant sur les interactions entre le système nerveux sympathique et le système rénine-angiotensine ont également révélé le rôle majeur de l'angiotensine II dans la réponse au stress aigu récidivant et chronique (120). L'angiotensine II peut provoquer une vasoconstriction, une dysfonction endothéliale, la prolifération cellulaire et l'inflammation favorisant l'athérosclérose (121, 122). Ainsi, l'activation du système nerveux sympathique et la stimulation de l'axe hypothalamo-hypophyso-surrénalien, jumelées à l'activation du système rénine-angiotensine peuvent conduire à l'élévation de la PA. De plus, un fonctionnement anormal de l'axe hypothalamo–hypophyso-surrénalien peut mener à des anomalies structurelles et fonctionnelles du cerveau pouvant contribuer à la survenue de problèmes de santé mentale (18-20). Les effets délétères des contraintes psychosociales et des responsabilités familiales peuvent également survenir de manière indirecte, par le développement de facteurs de risque d'atteintes à la santé cardiovasculaire ou mentale tels l'obésité, le tabagisme, la sédentarité, la diminution de la socialisation ou la faible satisfaction envers le travail et/ou la vie conjugale (53, 123-125).

Comparées aux expositions séparées, la double exposition à des contraintes psychosociales au travail et à des responsabilités familiales élevées pourrait amplifier les effets délétères sur la santé (figure 3). En effet, des études expérimentales permettent de supposer raisonnablement que les effets délétères seraient plus forts en présence *d'une exposition plus ou moins longue à des stresseurs multiples* qu'en présence d'une exposition à un seul stresseur (16-20). Ces effets plus forts pourraient découler de la survenue de conflits i) de temps, ii) de tension entre les rôles et iii) de comportement (91):

> Le conflit de temps survient lorsque les exigences des différents rôles rendent difficile la gestion du temps. [...] Le conflit de tension entre les rôles explique que le stress ressenti dans un des divers rôles influence la façon de répondre aux demandes dans les autres rôles. La fatigue et le stress vécus au travail, par exemple, peuvent se transposer, lors du retour à la maison, dans la vie familiale et inversement. [...] Le dernier type de conflit décrit par Greenhaus et Beutell (1985), soit celui lié aux comportements, explique le phénomène selon lequel, un comportement spécifique à un rôle est incompatible avec le comportement attendu dans un autre rôle. Certaines caractéristiques valorisées dans le monde du travail, comme le fait d'être objectif et agressif peuvent être incompatibles avec les attentes et besoins des membres de la famille. La difficulté de l'individu à s'adapter à ces demandes divergentes peut engendrer un conflit de comportement (126).

Ces conflits liés aux rôles multiples peuvent donner l'impression de *perdre le contrôle* d'une ou plusieurs sphères de sa vie (104). Diverses théories du stress psychosocial suggèrent que le fait de percevoir les demandes auxquelles nous sommes confrontées comme difficilement surmontables entrave la résistance physique et psychologique au stress (127-131). Une revue de la littérature a par exemple montré que l'incapacité d'exercer un contrôle sur les horaires peut occasionner des effets délétères sur la santé perçue (physique et mentale) (132).

1.3.9 Période de latence et persistance de l'effet

Les auteurs de revues de la littérature portant sur les effets des contraintes psychosociales au travail sur les MCV (11, 133, 134) et la pression artérielle (46, 47) ont tenté de documenter la période de latence requise pour observer les effets délétères de ces expositions. Aucune période minimale n'a été recommandée. Pour les MCV, qui peuvent prendre plusieurs années à se développer, Belkic *et al.* (2004) et Eller *et al.* (2009) ont néanmoins observé que les études ayant une période de suivi de 9 à 15 ans présentaient des risques accrus de MCV, laissant supposer qu'elles comprenaient une période suffisamment longue pour inclure une éventuelle période de latence (11, 134). Pour leur part, les auteurs des deux revues de la littérature portant sur les contraintes psychosociales au travail et la PA font état de la difficulté de se prononcer au sujet d'une période de suivi minimale en fonction des connaissances disponibles (46, 47). Comme l'élévation de la PA est une atteinte précoce à la santé cardiovasculaire, il est toutefois raisonnable de penser que la période de latence minimale soit considérablement plus courte que celle requise pour les MCV.

Deux mises en garde ont été soulevées dans les revues de la littérature portant sur les MCV (11, 134, 135) et la PA (47) quant à une durée de suivi de plusieurs années. Il s'agit de l'introduction potentielle : 1) d'un biais d'information non différentiel lié à des changements d'exposition non pris en compte (pouvant sous-estimer les effets) (11, 47, 135) et 2) d'un biais de sélection de 'bonne santé du travailleur' lié au fait que les sujets les *plus stressés* et les *plus malades* peuvent avoir davantage tendance à quitter le marché du travail (pouvant également sous-estimer les effets) (47, 134, 135).

En ce qui a trait à la santé mentale, les auteurs de deux revues de la littérature ont rapporté qu'il est difficile de se prononcer au sujet de la période de latence sur la base des connaissances disponibles (72, 73) et qu'il s'agit d'une limite majeure de la littérature (72). Ces auteurs mentionnent par ailleurs qu'une durée de suivi de quelques années contribue à minimiser l'éventuel biais de la méthode commune pouvant surestimer les effets (72, 73). Ce biais est introduit lorsqu'une inflation des mesures d'effet découle du fait que l'exposition et l'issue sont mesurées de manière auto-rapportées (109). Un tel biais peut par exemple survenir lorsqu'un sujet ayant une détresse psychologique élevée (auto-rapportée) surestime son exposition aux contraintes psychosociales au travail.

Parmi l'ensemble des études prospectives antérieures ayant porté sur l'effet délétère des contraintes psychosociales au travail sur la PA ou la détresse psychologique, aucune n'a examiné la période de latence (par exemple à l'aide de quelques temps de mesures). Deux questions peuvent ainsi se poser : i) est-ce que les effets prennent de nombreuses années avant de survenir? et ii) est-ce que les effets sont de courte durée, c'est-à-dire qu'ils ne persistent pas dans le temps? Comme l'ensemble des études antérieures ayant porté sur les responsabilités familiales ou sur la double exposition à des contraintes psychosociales au travail et à des responsabilités familiales élevées étaient transversales, elles ne nous renseignent pas quant à la période de latence requise ou quant à la persistance des effets dans le temps. Par ailleurs, compte tenu du caractère précoce des atteintes étudiées (détresse psychologique et élévation du niveau de PA), nous envisageons une période de latence relativement courte, voire des effets présents dès le premier temps de mesure. De plus, comme l'exposition à des stresseurs psychosociaux *multiples* pourrait mener à des effets délétères plus forts que les expositions évaluées séparément (16-20), nous envisageons que les effets de la double exposition persisteront dans le temps.

1.3.10 Effets modifiants potentiels

Âge : Chez les femmes, l'hypertension tend à survenir à un âge plus avancé que chez les hommes (136). Gilbert-Ouimet *et al.* (2011) ont observé deux effets délétères distincts du DER en fonction de l'âge : i) un effet sur la survenue de l'hypertension des femmes de ≥45 ans et ii) un effet sur la moyenne de PA des femmes de <45 ans (59). De plus, une étude antérieure portant sur l'effet de la double exposition aux contraintes psychosociales au travail et aux responsabilités familiales élevées a observé un effet délétère significatif sur la PA diastolique (+1,8 mm Hg) des femmes de <45 ans (alors qu'aucun effet global n'était observé) (24). Ainsi, les contraintes psychosociales pourraient contribuer au développement d'atteintes cardiovasculaires plus sévères chez les femmes plus âgées (hypertension) et d'atteintes précoces chez les « jeunes » adultes (élévations de la PA).

Pour leur part, Marchand *et al.* (2010) ont observé une diminution de la prévalence de la détresse psychologique élevée de 2% par année de naissance au sein d'un échantillon représentatif de la population générale canadienne (68). Cependant, aucune étude n'a évalué l'effet modifiant de l'âge sur l'association entre les contraintes psychosociales ou les responsabilités familiales et la détresse psychologique.

Soutien social : Selon le modèle DL, un soutien social faible au travail pourrait amplifier l'effet délétère du *job strain* sur la santé (37). Cependant, l'effet modifiant du soutien social faible a été évalué dans seulement deux études antérieures portant sur le *job strain* et la PA et aucun effet n'a été observé (137, 138). De plus, cet effet modifiant a été évalué dans une seule étude portant sur l'association entre la double exposition au *job strain* et aux responsabilités familiales élevées et la PA et aucun effet n'a été observé (PA systolique : +0,3 mm Hg et PA diastolique : +0,4 mm Hg) (24). Ces études étaient par ailleurs limitées par un devis transversal (137, 138), des mesures cliniques de la PA (137, 138) et un faible taux de participation (48%) (137). Une étude antérieure a également porté sur l'effet séparé du soutien social sur la PA. Un effet délétère a été observé chez les femmes alors qu'aucun effet n'a été observé chez les hommes (139).

Dans la seule étude portant sur la double exposition et la détresse psychologique, le soutien social faible au travail amplifiait l'association (RC=3,5 (IC à 95% : 1,6-5,4)) (26). De plus, 4/6 études (74, 75, 79, 82, 87, 140) portant sur l'effet séparé du soutien social faible sur la détresse psychologique des femmes ont observé un effet délétère significatif (mesures d'effet relatives: 1,24-1,74, annexe 2).

Surinvestissement : Selon le modèle DER, le surinvestissement pourrait amplifier l'effet délétère du déséquilibre efforts-reconnaissance sur la santé (10). L'effet modifiant potentiel du surinvestissement sur la PA a été évalué dans une seule étude antérieure (59). Cette étude était prospective et utilisait des mesures de PA ambulatoires. Bien qu'aucun effet modifiant du surinvestissement n'ait été observé, un effet délétère séparé de cette contrainte a été observé sur la PA moyenne des hommes et des femmes (59). Cependant, aucun effet n'a été observé dans les six études transversales ayant porté sur l'effet séparé du surinvestissement (59, 141-146). De plus, aucune étude prospective antérieure n'a porté sur l'effet modifiant potentiel ou l'effet séparé du surinvestissement sur la détresse psychologique.

1.3.11 Rationnelle et contribution à l'avancement des connaissances

Cette thèse de doctorat a pour but de faire progresser les connaissances au sujet des effets des contraintes psychosociales au travail et des responsabilités familiales sur la santé cardiovasculaire et mentale des femmes. La rationnelle d'un tel apport s'appuie sur les connaissances antérieures: **i) les contraintes psychosociales au travail** peuvent avoir un effet délétère sur la pression artérielle (46, 47) et sur la détresse psychologique (12, 72, 73). Pour la PA, des inconsistances ont cependant été observées dans la littérature, particulièrement chez les femmes et au sein des études de qualité méthodologique moindre (46, 47). La présente thèse de doctorat permet de mieux comprendre ces inconsistances au moyen de la première revue systématique de la littérature portant sur les effets des contraintes psychosociales au travail des modèles DL et DER sur la PA moyenne et sur l'hypertension des femmes et des hommes. Pour la détresse psychologique, l'ensemble des études prospectives antérieures (N=17) ont observé un effet délétère des composantes des modèles DL et DER. Par ailleurs, seule une minorité de ces études ont évalué l'effet de combinaisons de contraintes, soit le *job strain* (N=4) ou de DER (N=4), dont les effets délétères sont potentiellement plus forts que ceux des contraintes évaluées séparément (9, 10). Globalement, les principales limites des études antérieures sur la PA et la détresse psychologique sont : un faible taux de participation (<75%)[4] au recrutement (53, 57, 58, 77, 79, 82, 84, 87, 140, 148) et au suivi (75, 81, 84, 148), le recours à une seule mesure de l'exposition (pouvant sous-estimer l'effet (133)) (48-52, 54, 58, 70 , 74-77, 79 , 82, 87, 88, 140, 149) et l'absence d'analyses séparées en fonction du genre (49, 51, 53, 56, 58, 76, 77, 79, 80, 84).

ii) Les responsabilités familiales élevées ont également été associées à une pression artérielle et à une détresse psychologique accrues (23-25, 94, 96, 103-108, 150, 151). Toutefois, les 13 études antérieures étaient transversales et certaines d'entre elles ont eu recours à un échantillon de petite taille (96, 104, 150, 151), avaient un faible taux de participation (<75%) (94, 106) et ont mesuré les responsabilités familiales avec uniquement un ou deux items (105-107, 151, 152).

iii) L'intérêt d'évaluer les effets de **la double exposition** à des contraintes psychosociales au travail et à des responsabilités familiales élevées sur la PA et la détresse psychologique des femmes est multiple. D'abord, les femmes sont davantage exposées aux contraintes psychosociales au travail (4, 13) et aux responsabilités familiales élevées (14, 34, 92) que les hommes. Ensuite, l'effet de ces expositions combinées sur la santé cardiovasculaire et mentale pourrait être plus fort que les effets séparés de ces expositions (16-20). Dans les quatre études antérieures, les travailleurs exposés à la double exposition avaient une PA moyenne ou une prévalence de détresse psychologique plus élevées que les non-exposés. Toutefois, ces études sont transversales, une seule a porté sur le DER (25) et une seule a porté sur la santé mentale (26). La présente étude, qui utilise un devis

[4] Dans une revue de la littérature récente, Galea *et al.* (2007) ont rapporté qu'un taux de participation de 75% est généralement considéré satisfaisant dans les études épidémiologiques (147). Un taux de participation <75% peut rendre les études plus vulnérables à l'introduction d'un biais de sélection survenant lorsque les sujets refusant de participer ou perdus au suivi sont à la fois plus exposés à l'exposition et à l'issue à l'étude. Une sous-estimation de l'effet peut par exemple survenir si les non-participants sont proportionnellement plus exposés et plus *malades* que les sujets inclus (109).

longitudinal et qui porte sur les deux modèles (DL et DER), apporte ainsi une contribution majeure.

iv) Aucune **période de latence** n'a été suggérée pour l'effet des contraintes psychosociales au travail et/ou des responsabilités familiales sur la PA (46, 47) et la santé mentale (72, 73). De même, aucune étude n'a évalué la **persistance des effets dans le temps**. Mieux documenter la survenue et la persistance des effets favorisera une évaluation plus valide des effets délétères de la double exposition.

Les **trois contributions majeures** de la présente thèse consistent ainsi à intégrer :

1) La première revue systématique de la littérature sur les effets des contraintes psychosociales au travail des modèles DL et DER sur la PA moyenne et sur l'hypertension des femmes et des hommes.

2) La première évaluation des effets de la double exposition à des contraintes psychosociales au travail et à des responsabilités familiales élevées sur la PA et la détresse psychologique sur la base d'une étude au devis longitudinal comprenant une mesure valide et plus complète des contraintes psychosociales au travail. Cette avancée est appuyée par d'importantes forces, incluant de très bons taux de participation au recrutement (80,9%) et aux suivis à 3 (86%) et à 5 ans (85%), des mesures ambulatoires de PA et un échantillon de grande taille.

3) La première exploration des périodes de latence requises pour observer les effets délétères de cette double exposition et de la persistance des effets dans le temps.

CHAPITRE 2- Méthode

Objectif #1. Revue systématique :

La revue systématique de la littérature figurant dans la présente thèse de doctorat a été réalisée avant l'étude empirique. Cette revue systématique visait à évaluer l'effet des contraintes psychosociales au travail sur la PA en fonction d'une stratégie de recherche préétablie. Les citations pertinentes ont été extraites des bases de données PubMed, Embase, Web of Science et PsycInfo pour la période allant de 1979 à maintenant. Une combinaison de trois types de mots-clés a été utilisée pour générer les listes de citations:

1. Des mots-clés liés au travail : job, work, occupation, occupations, workplace, worker, employee.

2. Des mots-clés liés aux contraintes psychosociales : psychosocial factors, psychosocial work factors, psychosocial work-related factors, job stress, job-related stress, work stress, work-related stress, psychosocial, psychosocial stress, psychological demand, job demand, demand, job control, job control, job strain, iso-strain, social support, reward, effort-reward imbalance, effort reward, Karasek, Siegrist, psychosocial environment.

3. Des mots-clés liés à la PA: blood pressure, hypertension, ambulatory blood pressure, blood pressure monitoring, cardiovascular responses, cardiovascular risk factors, systolic blood pressure, and diastolic blood pressure.

Dans une première étape, un réviseur (MGO) a sélectionné les citations sur la base des titres des articles. Dans une seconde étape, deux réviseurs indépendants (MGO et Xavier Trudel) ont lu les résumés des titres sélectionnés et les ont classés comme "pertinent", "potentiellement pertinent" ou "non-pertinent". Les publications pertinentes et potentiellement pertinentes ont été entièrement lues, synthétisées et approuvées par les deux réviseurs. Cette revue systématique suivait les critères de qualité PRISMA ("preferred reporting items for systematic reviews and meta-analyses") (153).

Les critères de sélection des études étaient les suivants: i) être rédigée en anglais ou en français, ii) être publiée dans un journal avec évaluation par les pairs, iii) inclure ≥100 travailleurs, iv) porter sur au moins une contrainte psychosociales au travail des modèles DL ou DER, v) porter sur le niveau de PA ou l'hypertension (sauf l'hypertension gestationnelle). Les études transversales, prospectives et cas-témoins ont été incluses. Les revues narratives n'étaient pas incluses. Les publications basées sur une même population étaient uniquement retenues si elles portaient sur des expositions ou issues différentes.

Un effet a été défini par une différence statistiquement significative de la pression artérielle chez les travailleurs exposés aux contraintes psychosociales comparés aux travailleurs non-exposés. Les mesures d'effets et leurs valeur-*p* ou intervalles de confiance à 95% ont été présentés pour chaque étude. Les résultats ont été synthétisés en fonction du genre (hommes, femmes), des devis d'études (transversal, cas-témoins, prospectif), des types de mesures de PA (cliniques, ambulatoires), des issues évaluées (niveau de pression artérielle, hypertension) et des taux de participation.

Objectif 2 à 5. Étude sur la pression artérielle et la détresse psychologique :

2.1 Devis et population à l'étude

Cette thèse de doctorat s'inscrit dans le cadre d'une étude prospective de cinq ans. L'étude globale incluait 2200 travailleurs, hommes et femmes, de trois entreprises publiques québécoises du secteur de l'assurance. Les travailleurs étaient employés de bureau (30,2%), techniciens (24,7%), professionnels (40,1%) et cadres (5%).

La présente étude porte sur les femmes de cette étude (n=1362). Pour être éligibles, elles devaient : 1) travailler au moins 21 heures par semaine et 2) travailler au sein de l'entreprise depuis au moins trois mois et 3) ne pas être enceinte. La population spécifique à chacun des objectifs est présentée dans la section décrivant les analyses (section 2.7) et au tableau 1.

2.2 Collecte des données

La collecte des données a été réalisée en milieu de travail à trois reprises : au recrutement (2000-04) et après des suivis moyens de 3 ans (2004-06) et de 5 ans (2006-09) (tableau 2). Les taux de participation étaient de 80,9% au recrutement, de 86% au suivi à 3 ans et de 85% au suivi à 5 ans. Chaque collecte était constituée i) d'un questionnaire auto-administré portant sur l'environnement psychosocial au travail, les responsabilités familiales et la santé (incluant la détresse psychologique), ii) de mesures anthropométriques et iii) de mesures ambulatoires de PA. Les mesures ambulatoires de PA ont été récoltées aux 15 minutes durant une journée de travail régulière dans les jours précédents ou suivants la complétion du questionnaire. Aux trois temps de collecte, près de 95% des participants ayant complété le questionnaire ont également participé à la prise des mesures de PA.

2.3 Variables dépendantes (issues de santé)

Pression artérielle

Les mesures de PA ambulatoires ont été collectées au moyen de l'appareil portatif Spacelabs 90207 (Spacelabs Produits Médicaux Ltée, St-Laurent, Québec, Canada). Cet appareil a été validé par des protocoles établis par des investigateurs indépendants (154-156). Des infirmières et des assistants de recherche spécialement formés étaient en charge d'installer l'appareil sur le bras non dominant du participant si la différence de PA mesurée aux deux bras était inférieure à 10 mmHg. Sinon, l'appareil a été installé sur le bras présentant la mesure de PA la plus élevée. La PA ambulatoire a été mesurée toutes les 15 minutes durant une période continue de sept heures pendant les heures régulières de travail (8h00 à 16h00). Une trentaine de mesures sont ainsi disponibles, pour chaque participant, à chaque temps de collecte.

Les moyennes de PA systoliques et diastoliques ont été calculées pour la journée complète de travail. La PA moyenne a été modélisée comme une variable continue. Des modèles d'analyses séparés ont été réalisés pour la moyenne de PA systolique et diastolique.

Détresse psychologique

La détresse psychologique a été mesurée à l'aide de la version française courte et validée (14 items) du questionnaire auto-administré *Psychiatric Symptom Index* (PSI) (65, 85, 86, 159). Ce questionnaire mesure la fréquence des symptômes : dépressifs, anxieux, d'agressivité et de troubles cognitifs au cours de la semaine précédente. Les échelles de réponse sont de type Likert à 4 niveaux, avec des scores variant de 14 à 56.

Il a été suggéré de catégoriser la détresse psychologique en fonction des quintiles de la population générale (65). Cette recommandation veut ainsi que le quintile le plus élevé soit utilisé pour désigner les *cas*. Le choix de ce point de césure s'appuie sur le fait que des études antérieures ont montré que 15 à 20% de la population générale a des problèmes sévères de détresse psychologique (70, 160, 161). De plus, appartenir au quintile le plus élevé de détresse psychologique a été associé à la consultation d'un professionnel de la santé pour un problème de santé mentale, à l'hospitalisation pour ce type de problèmes, au suicide (pensées ou tentative) et à la consommation de médicaments psychotropes (165). Dans la présente étude, la détresse psychologique a été modélisée de manière dichotomique. Les participantes ayant des scores ≥26.19, soit le 80^{e} percentile de la population générale ont été considérées comme des *cas prévalents* (1).

2.4 Variables indépendantes (expositions)

Modèle demande-latitude

Les deux contraintes psychosociales du modèle demande-latitude ont été mesurées à l'aide des 18 items du questionnaire recommandé par Karasek (Annexe 5). La validité de convergence, la validité discriminante, la consistance interne (162-164), la validité factorielle (163, 164) de même que la stabilité temporelle à un an (163) de la version française ont été démontrées. Les échelles de réponse sont de type Likert à 4 niveaux.

La demande psychologique et la latitude décisionnelle ont été dichotomisées en fonction du score médian observé dans un échantillon représentatif des travailleurs québécois (165). Ainsi, les sujets dont le score de demande psychologique était ≥24 formaient le groupe ayant une demande élevée et les autres sujets formaient le groupe ayant une demande faible. Pour leur part, les sujets dont le score de latitude décisionnelle était ≤72 formaient le groupe ayant une latitude faible tandis que les autres sujets formaient le groupe ayant une latitude élevée. Pour le *job strain*, le groupe de sujets exposés à la fois à une demande psychologique élevée et à une latitude décisionnelle faible était comparé à l'ensemble des autres sujets (groupe de référence).

Modèle déséquilibre efforts-reconnaissance

Les efforts ainsi que la reconnaissance ont été mesurés à l'aide de 4 et 11 items, respectivement (annexe 5). Les qualités psychométriques de la version originale et de la version française de cet instrument ont été démontrées (166). La stabilité temporelle à un an de la version originale a également été démontrée (167). Les échelles de réponse sont de type Likert à 4 niveaux.

Les scores d'efforts et de reconnaissance ont été calculés en additionnant les réponses à chacune des questions. Le ratio du score d'efforts sur celui de la reconnaissance mesure le degré de déséquilibre. Le groupe de sujets soumis à un déséquilibre constitué d'efforts élevés et de reconnaissance faible (ratio >1) constitue le groupe exposé alors que le groupe ayant un ratio (≤ 1) constitue le groupe non exposé.

Responsabilités familiales

La mesure des responsabilités familiales utilisée est adaptée de celle de Brisson *et al.* (1999) (101). L'algorithme appliqué était identique à celui utilisé dans une étude antérieure réalisée auprès de la même population que celle de la présente étude (24). Les responsabilités familiales étaient mesurées à l'aide de deux dimensions: "le nombre d'enfants et leur âge" ainsi que "les tâches ménagères et soins aux enfants". Les items utilisés sont présentés à l'annexe 5.

Nombre d'enfants et leur âge: Cette dimension s'appuie sur l'idée selon laquelle le nombre d'heures de travail à la maison est proportionnel au nombre d'enfants y habitant et est fonction de leur âge [71, 73]. Conséquemment, plus de poids est accordé aux plus jeunes enfants [71, 73]. Les enfants dans les catégories d'âge 0 à 5, 6 à 11, 12 à 17 et 18 à 20 ans avaient respectivement un poids de 3, 2,5, 2 et 1,5 [33, 84]. L'algorithme pour calculer le score lié au nombre d'enfants et à leur âge était le suivant : (3 * nombre d'enfants de 0 à 5 ans) + (2,5 * nombre d'enfants de 6 à 11 ans) + (2 * nombre d'enfants de 12 à 17 ans) + (1,5 * nombre d'enfants de 18 à 20 ans) [33, 84].

Tâches ménagères et soins aux enfants : Deux tâches ménagères ont été évaluées : la planification et la préparation des repas ainsi que le ménage à l'intérieur de la maison. Deux items ont été utilisés afin de mesurer les soins aux enfants : «qui s'occupe des soins aux enfants à la maison» et «qui s'occupe des soins ou des activités en lien avec les enfants en dehors de la maison (médecin, dentiste, école, loisirs, etc.)». Pour ces items, seules les réponses des participantes ayant des enfants ≤20 ans ont été considérées. Les participantes devaient indiquer si elles s'acquittaient de ces tâches par elles-mêmes (score = 1), avec l'aide d'une autre personne (score = 0,5), si quelqu'un d'autre s'en occupait (score = 0) ou si personne ne s'en occupait (score = 0). L'algorithme de calcul était constitué de la somme des scores pour les quatre tâches.

Responsabilités familiales : Cette mesure est composée du total des deux scores obtenus pour "le nombre d'enfants et leur âge" et "les tâches ménagères et soins aux enfants". L'algorithme pour calculer les responsabilités familiales était le suivant : (nombre d'enfants et leur âge + 1) * (tâches ménagères et soins aux enfants). On ajoute 1 à la première mesure pour éviter qu'une femme qui n'a pas d'enfant se retrouve avec un score de zéro [33, 84].

Les expositions liées "au nombre d'enfants et leur âge", "aux tâches ménagères et soins aux enfants" et "aux responsabilités familiales" ont été définies de telle sorte que le groupe de sujets composant le tertile supérieur (groupe exposé) était comparé au groupe de sujets composant les tertiles inférieur et intermédiaire (groupe de référence).

La double exposition à des contraintes psychosociales au travail et à des responsabilités familiales élevées a fait l'objet de l'analyse principale. Des analyses exploratoires ont aussi été réalisées pour la double exposition à des contraintes psychosociales et : i) au fait d'avoir des enfants (oui/non), ii) au nombre d'enfants et à leur âge et iii) aux tâches ménagères et aux soins aux enfants. Ces différents scénarios sont présentés au tableau 3.

2.5 Variables modifiantes potentielles

L'effet modifiant potentiel des variables suivantes a été évalué : l'âge (≤ 45 ans versus >45 ans), le soutien social au travail et le surinvestissement. Le soutien social des collègues et le soutien social des superviseurs ont respectivement été mesurés avec les six et les cinq items recommandés par Johnson et Karasek (1989) (37) (annexe 5). Les échelles de réponse étaient de type Likert à 4 niveaux. Le score a été dichotomisé en fonction de la médiane observée dans un large échantillon de travailleurs québécois (≤33) (125). Les participantes dont le score de soutien social était inférieur à la médiane constituaient le groupe exposé (soutien faible) alors que les autres formaient le groupe non exposé. Pour sa part, le surinvestissement a été mesuré à l'aide de l'échelle courte et validée de 6 items recommandée par Siegrist (annexe 5) (166). Les échelles de réponse étaient de type Likert à 4 niveaux. Les participantes dont le score se retrouvait dans le tertile supérieur étaient considérées *surinvesties* alors que les autres formaient le groupe non exposé. Seule l'exposition au surinvestissement à trois ans a été prise en compte parce que l'échelle validée n'était pas disponible au recrutement.

2.6 Variables de confusion potentielle

Plusieurs variables de confusion potentielle ont été prises en compte : i) des variables socioéconomiques et démographiques: la scolarité, l'occupation, le revenu familial, l'âge, le statut marital, ii) des variables liées au mode de vie : la consommation d'alcool (168), le tabagisme (168), l'indice de masse corporelle et la pratique d'activités physiques durant les loisirs (168), iii) d'autres contraintes psychosociales : les événements stressants récents (168) et le soutien social hors travail (168), iv) des facteurs biologiques : les antécédents familiaux de maladies cardiovasculaires, le diabète, l'hypercholestérolémie, la prise de contraceptifs oraux, la ménopause, l'hormonothérapie post-ménopausique (168) et la prise de médicaments antihypertenseurs et v) la personnalité (169, 170). De plus, le fait que certaines de ces variables soient potentiellement situées dans la chaîne causale (facteurs intermédiaires) a été pris en compte (section 4.9).

2.7 Analyses

Le tableau 1 présente les variables d'exposition, les variables dépendantes (issues de santé), les temps de mesure, la taille d'échantillon disponible ainsi que les principales analyses statistiques réalisées.

La PA et la détresse psychologique ont été mesurées lors des trois temps de collecte. Afin d'explorer la période de latence et la persistance des effets dans le temps, les effets de la double exposition à des contraintes psychosociales au travail et à des responsabilités familiales élevée sur la PA moyenne et la détresse psychologique ont été évaluées : i) de manière transversale, soit au recrutement (effet proximal) et ii) de manière longitudinale, soit à trois ans (effet à moyen terme) et à cinq ans (effet à plus long terme) (figure 4). Pour l'analyse des associations transversales, l'ensemble des participantes éligibles ont été incluses (tableau 1). Pour l'analyse des effets à 3 ans, seules les participantes présentes au recrutement et à ce suivi ont été retenues (tableau 1). De même, pour l'analyse des effets à cinq ans, seules les participantes présentes au recrutement et à ce suivi ont été retenues (tableau 1).

Pour l'ensemble des analyses, les différents groupes d'exposition (figure 4) ont été comparés au groupe non exposé, composé des participantes ayant à la fois des contraintes psychosociales au travail faibles et des responsabilités familiales faibles. Les variables de confusion potentielle ont été incluses dans les différents modèles statistiques.

Moyenne de pression artérielle, objectifs 2 et 3 : Les différences de moyennes brutes et ajustées de PA ont été calculées par analyses de covariance (ANOVA) (171). La signification statistique de ces différences de moyennes a été testée par un test de F partiel (172) et les intervalles de confiance à 95% ont été présentées. Des modèles séparés ont été réalisés pour la PA systolique et pour la PA diastolique. Pour les effets à 3 et à 5 ans, un ajustement pour la mesure initiale de la PA a été réalisé en analyse de sensibilité. Cet ajustement visait à limiter le *confounding* au recrutement (lié à des facteurs non mesurés associés à l'exposition et à l'issue) (109). Toutefois, cet ajustement n'a pas été envisagé pour les analyses principales puisqu'il est possible que les expositions aux contraintes psychosociales au travail et aux responsabilités familiales aient été associées à la mesure initiale de la PA. Ainsi, l'effet délétère de ces expositions aurait pu débuter avant le début de l'étude. L'ajustement pour la mesure initiale aurait donc pu « annuler » une partie de l'effet sur la PA (*horse racing effect*) (173). Les résultats de cette analyse de sensibilité ont été présentés afin de documenter cette hypothèse.

Prévalence de la détresse psychologique, objectifs 4 et 5 : Les rapports de prévalences de la détresse psychologique élevée ont été modélisés par régression log-binomiale (174) et leurs intervalles de confiance à 95% ont été présentés.

Effets modifiants et confondants potentiels : Les effets modifiants potentiels de l'âge (<45 ans / ≥ 45 ans), du soutien social au travail et du surinvestissement ont été explorés au moyen d'analyses stratifiées. Des termes d'interaction multiplicatifs ont également été calculés.

Pour chaque issue de santé, l'ensemble des variables de confusion potentielles ont été incluses dans un modèle statistique dit "complet". Le modèle complet était comparé au modèle brut afin de déterminer si le groupe de covariables était porteur de confusion. Pour être porteur de confusion, le groupe de covariables devait introduire un changement dans la mesure d'effet[5] d'au moins 10% (il est recommandé d'utiliser un seuil se situant entre 0,05 et 0,15 (175)). Le calcul du changement proportionnel est le suivant: $(ME_A - ME_B) / ME_A$ (où le ME_A désigne la mesure d'effet ajustée et le ME_B désigne la mesure d'effet brute). Par validité d'apparence, les facteurs de risque les plus documentés ont été retenus dans les modèles ajustés, qu'il y ait confusion ou non. Ces facteurs de risque sont les suivants : i) pour la PA : l'âge, la scolarité, l'IMC, le tabagisme, consommation d'alcool, l'activité physique, le diabète, le statut ménopausique, l'hormonothérapie et les antécédents familiaux de MCV et ii) pour la détresse psychologique : l'âge, la scolarité, l'IMC, le tabagisme, consommation d'alcool, l'activité physique, statut marital, le statut ménopausique, l'hormonothérapie et la survenue d'événements stressants. Pour les analyses au suivi à 3 ans et au suivi à 5 ans, le changement dans le temps des variables de confusion potentielle a été pris en compte.

[5] Les mesures d'effet sont: les différences de moyennes de PA et les rapports de prévalences de la détresse psychologique élevée.

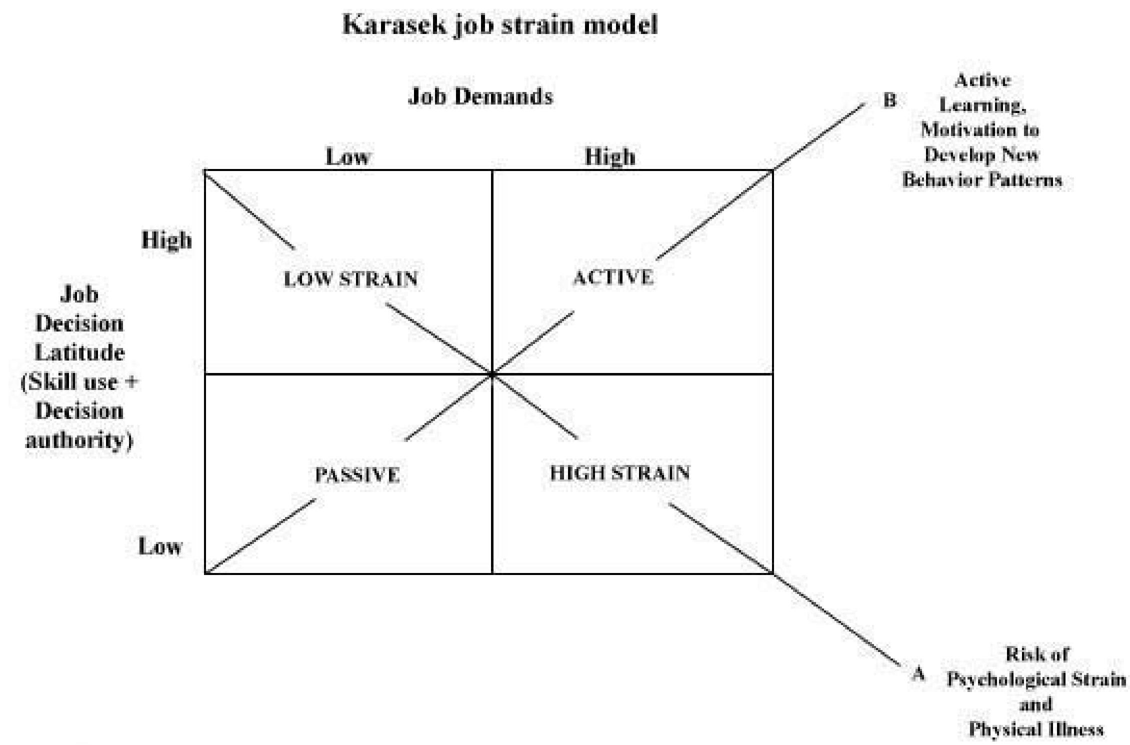
Il est important de mentionner que certaines variables liées aux habitudes de vie ont possiblement un rôle intermédiaire dans l'effet de la double exposition sur la PA (133, 176) et la détresse psychologique (12). Dans la présente étude, ces variables sont : la consommation d'alcool, le tabagisme, la pratique d'activités physiques de loisir et l'IMC (cette dernière variable étant uniquement pertinente pour la PA). Des analyses de sensibilité retirant ces variables des modèles complets ont été réalisées. Ces analyses ont permis de mesurer l'ampleur de la variation des mesures d'effet avec et sans ajustement pour ces variables intermédiaires potentielles. Ces analyses ont permis de quantifier la différence entre *l'effet indépendant* de la double exposition sur les issues de santé (modèle incluant toutes les variables confondantes potentielles) et *l'effet global* (modèle excluant les variables intermédiaires potentielles) (109).

2.8 Éthique et confidentialité

Chacun des participants de l'étude a signé un formulaire de consentement. Afin d'assurer un consentement éclairé, des assistants de recherche spécialement formés étaient chargés de contacter individuellement chaque participant de l'étude afin de leur expliquer le contexte, les objectifs et le déroulement de l'étude. De plus, l'étude n'impliquait aucun risque pour la santé des participants. Les participantes ayant des mesures de PA ambulatoires qui correspondent à un diagnostic d'hypertension ont reçu une invitation à consulter un médecin. Le protocole de recherche a été approuvé par le comité d'éthique du CHU de Québec.

Figures et tableaux du chapitre 1

Figure 1. Modèle demande-latitude



Reference:Schnall PL,Landsbergis PA, Baker D.
Job Strain and Cardiovascular Disease. Annual Review of PublicHealth;15:381-411,1994

Figure 2. Modèle de déséquilibre efforts-reconnaissance

Référence: Weyers S, Peter R, Boggild, Jeppescn HJ, Siegrist J. Psychosocial work stress is associated with poor self-rated health in Danish nurses: a test of the effort-reward imbalance model. Scand J Caring Sci 2006; 20: 26-34.

Figure 3. Diagramme causal des effets potentiels des contraintes psychosociales au travail et des responsabilités familiales élevées sur la santé cardiovasculaire et mentale

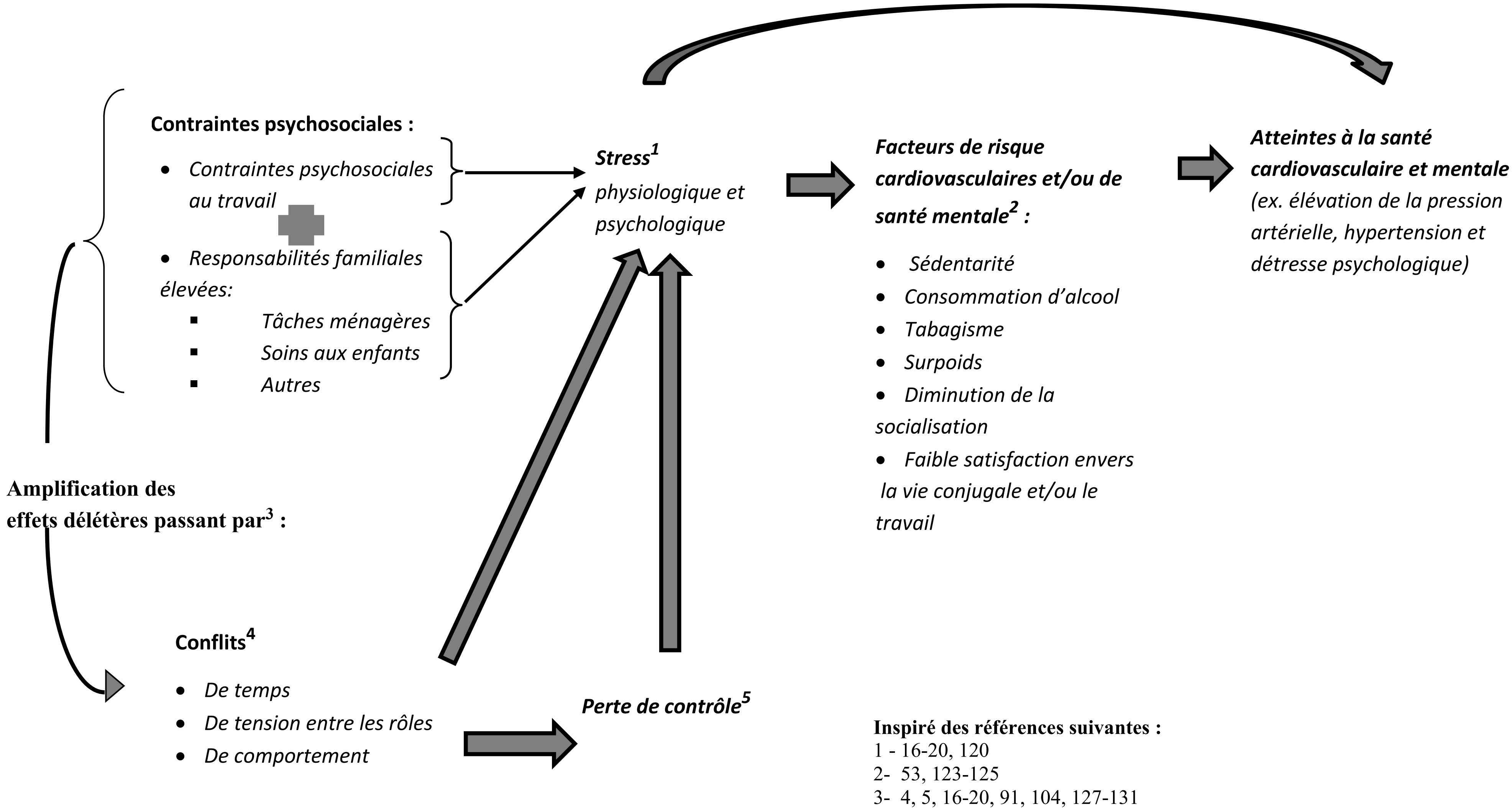


Tableau 1: Objectifs, expositions, variables dépendantes, temps de mesure, taille d'échantillon et analyses statistiques

<table>
<tr><th rowspan="2">Objectifs</th><th rowspan="2">Expositions au recrutement</th><th colspan="2">Variables dépendantes</th><th rowspan="2">Taille d'échantillon</th><th rowspan="2">Analyses statistiques</th></tr>
<tr><th>Variables</th><th>Mesures</th></tr>
<tr><td rowspan="3">Objectifs 2-3
Effet de la doulble exposition aux contraintes psychosociales et aux responsabilités familiales élevées sur la PA moyenne</td><td rowspan="3">1-Demande-latitude et responsabilités familiales
2-Déséquilibre efforts-reconnaissance et responsabilités familiales</td><td rowspan="3">Moyenne de PA</td><td>T_1*</td><td>N=1135
Les travailleuses présentes au recrutement</td><td>ANOVA</td></tr>
<tr><td>T_2</td><td>N=932 (82%)
Les travailleuses présentes au recrutement et au suivi à 3 ans</td><td>ANOVA</td></tr>
<tr><td>T_3</td><td>N=831 (73%)
Les travailleuses présentes au recrutement et au suivi à 5 ans</td><td>ANOVA</td></tr>
<tr><td rowspan="3">Objectifs 4-5
Effet de la double exposition aux contraintes psychosociales et aux responsabilités familiales élevées sur la prévalence de la détresse psychologique</td><td rowspan="3">1-Demande-latitude et responsabilités familiales
2-Déséquilibre efforts-reconnaissance et responsabilités familiales</td><td rowspan="3">Prévalence de la détresse psychologique élevée</td><td>T_1</td><td>N=1307 : Les travailleuses présentes au recrutement</td><td>Régression log-binomiale</td></tr>
<tr><td>T_2</td><td>N=1167 (89%)
Les travailleuses présentes au recrutement et au suivi à 3 ans</td><td>Régression log-binomiale</td></tr>
<tr><td>T_3</td><td>N=1087 (83%)
Les travailleuses présentes au recrutement et au suivi à 5 ans</td><td>Régression log-binomiale</td></tr>
</table>

* T_1 : Recrutement, T_2 : Suivi à 3 ans, T_3 : Suivi à 5 ans

Tableau 2. Collectes des données dans les trois organisations participantes

	Recrutement (T_1)		Suivi à 3 ans (T_2)		Suivi à 5 ans (T_3)	
	Début	Fin	Début	Fin	Début	Fin
SAAQ	Juin ‘00	Juin ‘03	Octobre ‘04	Mai ‘06	Novembre ‘06	Novembre ‘07
RRQ	Juin ‘01	Juin ‘03	Février ‘06	Octobre ‘06	Mars ‘09	Mai ‘09
CSST	Avril ‘04	Novembre ‘04	Mai ‘06	Novembre ‘06	Janvier ‘09	Mars ‘09

Tableau 3. Scénarios de la double exposition à des contraintes psychosociales au travail et à des responsabilités familiales élevées

Combinaison pour la double exposition à des contraintes psychosociales au travail et à des responsabilités familiales élevées
ANALYSES PRINCIPALES:
1. Job strain et responsabilités familiales élevées
2. Déséquilibre efforts-reconnaissance et responsabilités familiales élevées
AUTRES ANALYSES EXPLORÉES:
3. Job strain et avoir des enfants
4. Job strain et nombre et âge des enfants
5. Job strain et tâches ménagères ainsi que soins aux enfants
6. Déséquilibre efforts-reconnaissance et avoir des enfants
7. Déséquilibre efforts-reconnaissance et nombre et âge des enfants
8. Déséquilibre efforts-reconnaissance et tâches ménagères ainsi que soins aux enfants
9. Demande psychologique élevée et responsabilités familiales élevées
10. Latitude décisionnelle faible et responsabilités familiales élevées
11. Reconnaissance faible et responsabilités familiales élevées

Figure 4: Double exposition aux contraintes psychosociales au travail et aux responsabilités familiales et temps d'évaluation des effets sur les issues de santé

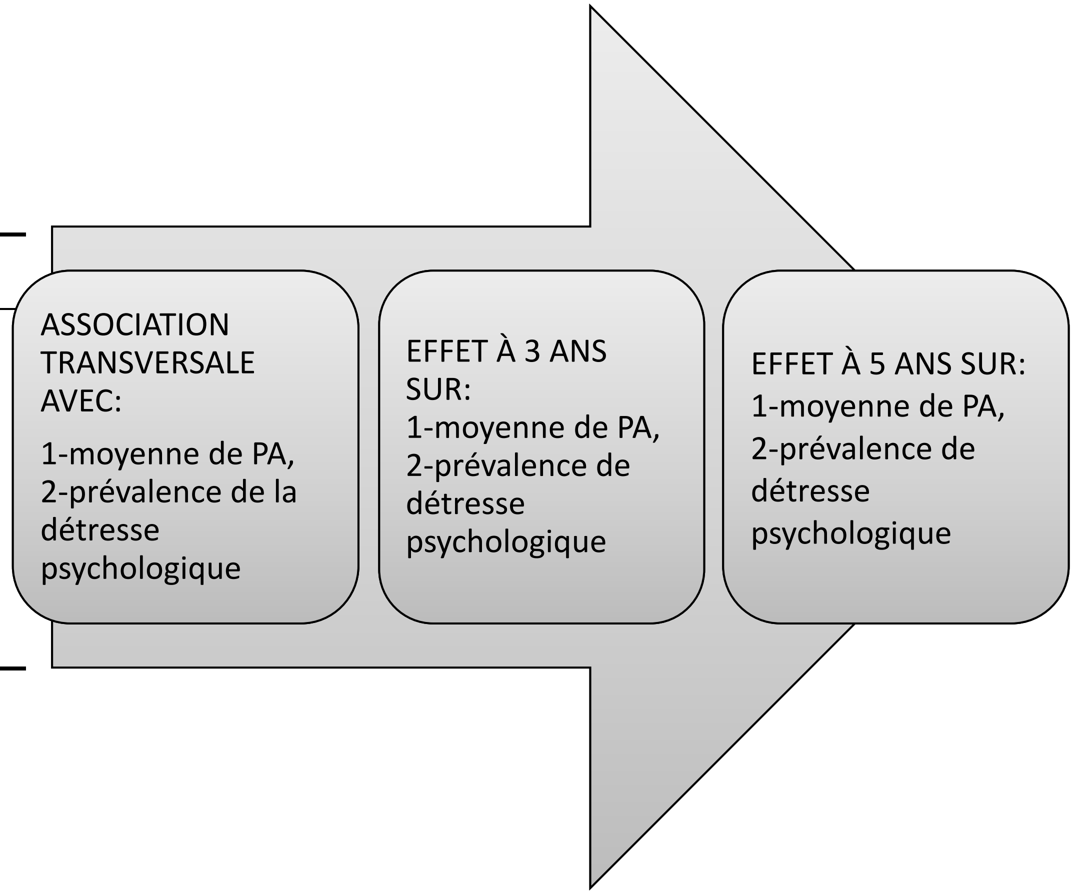
EXPOSITION AU RECRUTEMENT

Non exposés aux contraintes et aux responsabilités (référence)

Exposés uniquement aux responsabilités

Exposés uniquement aux contraintes

Exposés aux contraintes ET aux responsabilités (double exposition)



Puissance statistique

- **Tous les calculs sont réalisés pour les analyses à 5 ans (scénario le plus conservateur). Les calculs exigent donc que les travailleuses aient participé à la fois au recrutement et au suivi à 5 ans.**

OBJECTIFS 2 ET 3 :

Tableau 4. Différences de moyennes de PA systolique et diastolique minimales détectables à une puissance de 80% (puissance calculée à partir de la commande « Proc Power » du logiciel SAS)

DOUBLE EXPOSITION À :	N	DIFFÉRENCE MINIMALE DÉTECTABLE PA SYSTOLIQUE	DIFFÉRENCE MINIMALE DÉTECTABLE PA DIASTOLIQUE
ANALYSES PRINCIPALES:			
Job strain et responsabilités familiales dichotomisées à la médiane	98	+3,44 mm Hg	+2,49 mm Hg
Job strain et responsabilités familiales dichotomisées selon les tertiles	69	+3,83 mm Hg	+2,77 mm Hg
Déséquilibre efforts-reconnaissance et responsabilités familiales dichotomisées à la médiane	104	+3,39 mm Hg	+2,45 mm Hg
Déséquilibre efforts-reconnaissance et responsabilités familiales dichotomisées selon les tertiles	62	+4,04 mm Hg	+2,92 mm Hg
AUTRES ANALYSES EXPLORÉES:			
Job strain et avoir des enfants	132	+3,32 mm Hg	+2,40 mm Hg
Job strain et tâches ménagères ainsi que soins aux enfants dichotomisés à la médiane	155	+3,30 mm Hg	+2,39 mm Hg
Job strain et tâches ménagères ainsi que soins aux enfants dichotomisés selon les tertiles	82	+3,62 mm Hg	+2,62 mm Hg
Déséquilibre efforts-reconnaissance et avoir des enfants	141	+3,31 mm Hg	+2,40 mm Hg
Déséquilibre efforts-reconnaissance et tâches ménagères ainsi que soins aux enfants dichotomisés à la médiane	162	+3,36 mm Hg	+2,43 mm Hg
Déséquilibre efforts-reconnaissance et tâches ménagères ainsi que soins aux enfants dichotomisés selon les tertiles	88	+3,54 mm Hg	+2,56 mm Hg

*Écarts-types utilisés : 10,3 mm Hg pour la PA systolique et 7,5 mm Hg pour la PA diastolique.

OBJECTIFS 4 ET 5 :

Tableau 5. Rapports de prévalences de détresse psychologique élevée minimaux détectables à une puissance de 80% (puissance calculée à partir de la commande « Proc Power » du logiciel SAS)

DOUBLE EXPOSITION À :	N	RAPPORT DE PRÉVALENCES
ANALYSES PRINCIPALES		
Job strain et responsabilités familiales dichotomisées à la médiane	125	1,46
Job strain et responsabilités familiales dichotomisées selon les tertiles	88	1,53
Déséquilibre efforts-reconnaissance et responsabilités familiales dichotomisées à la médiane	144	1,48
Déséquilibre efforts-reconnaissance et responsabilités familiales dichotomisées selon les tertiles	88	1,59
AUTRES ANALYSES EXPLORÉES		
Job strain et avoir des enfants	171	1,47
Job strain et tâches ménagères ainsi que soins aux enfants dichotomisés à la médiane	197	1,46
Job strain et tâches ménagères ainsi que soins aux enfants dichotomisés selon les tertiles	106	1,48
Déséquilibre efforts-reconnaissance et avoir des enfants	199	1,49
Déséquilibre efforts-reconnaissance et tâches ménagères ainsi que soins aux enfants dichotomisés à la médiane	220	1,53
Déséquilibre efforts-reconnaissance et tâches ménagères ainsi que soins aux enfants dichotomisés selon les tertiles	124	1,50

*Prévalence de la détresse psychologique élevée utilisée : 31,1%

PUISSANCE POUR LES ANALYSES DES EFFETS MODIFIANTS POTENTIELS

- **ÂGE (<45 ans / ≥ 45 ans) ET SURINVESTISSEMENT (FAIBLE/ÉLEVÉ)** : CES DEUX VARIABLES ONT ÉTÉ DICHOTOMISÉES EN DEUX GROUPES. LA PROPORTION DE SUJETS FORMANT LE PLUS PETIT GROUPE EST DE 40% (SUR LA BASE DE NOS DONNÉES). DANS L'OPTIQUE DE PRÉSENTER LES CALCULS LES PLUS CONSERVATEURS, LA PUISSANCE STATISTIQUE A ÉTÉ CALCULÉE EN CONSERVANT 40% DE NOTRE ÉCHANTILLON.

Tableau 6. Différences de moyennes de PA systolique et diastolique minimales détectables à une puissance de 80% (puissance calculée à partir de la commande « Proc Power » du logiciel SAS)

DOUBLE EXPOSITION À :		**DIFFÉRENCE MINIMALE DÉTECTABLE**	
	N	**PA SYSTOLIQUE**	**PA DIASTOLIQUE**
ANALYSES PRINCIPALES			
Job strain et responsabilités familiales dichotomisées à la médiane	39	+5,47 mm Hg	+3,96 mm Hg
Job strain et responsabilités familiales dichotomisées selon les tertiles	27	+6,14 mm Hg	+4,44 mm Hg
Déséquilibre efforts-reconnaissance et responsabilités familiales dichotomisées à la médiane	41	+5,41 mm Hg	+3,92 mm Hg
Déséquilibre efforts-reconnaissance et responsabilités familiales dichotomisées selon les tertiles	24	+6,50 mm Hg	+4,70 mm Hg
AUTRES ANALYSES EXPLORÉES			
Job strain et avoir des enfants	52	+5,29 mm Hg	+3,83 mm Hg
Job strain et responsabilités tâches ménagères ainsi que soins aux enfants dichotomisés à la médiane	62	+5,24 mm Hg	+3,79 mm Hg
Job strain et tâches ménagères ainsi que soins aux enfants dichotomisés selon les tertiles	32	+5,80 mm Hg	+4,20 mm Hg
Déséquilibre efforts-reconnaissance et avoir des enfants	56	+5,28 mm Hg	+3,82 mm Hg
Déséquilibre efforts-reconnaissance et tâches ménagères ainsi que soins aux enfants dichotomisés à la médiane	62	+5,38 mm Hg	+3,89 mm Hg
Déséquilibre efforts-reconnaissance et tâches ménagères ainsi que soins aux enfants dichotomisés selon les tertiles	35	+5,63 mm Hg	+4,08 mm Hg

*Écarts-types utilisés : 10,3 mm Hg pour la PA systolique et 7,5 mm Hg pour la PA diastolique.

Tableau 7. Rapports de prévalences de détresse psychologique élevée minimaux détectables à une puissance de 80% (puissance calculée à partir de la commande « Proc Power » du logiciel SAS)

DOUBLE EXPOSITION À :	N	RAPPORT DE PRÉVALENCES
ANALYSES PRINCIPALES		
Job strain et responsabilités familiales dichotomisées à la médiane	50	1,74
Job strain et responsabilités familiales dichotomisées selon les tertiles	35	1,84
Déséquilibre efforts-reconnaissance et responsabilités familiales dichotomisées à la médiane	57	1,77
Déséquilibre efforts-reconnaissance et responsabilités familiales dichotomisées selon les tertiles	35	1,94
AUTRES ANALYSES EXPLORÉES		
Job strain et avoir des enfants	68	1,76
Job strain et tâches ménagères ainsi que soins aux enfants dichotomisés à la médiane	78	1,75
Job strain et tâches ménagères ainsi que soins aux enfants dichotomisés selon les tertiles	42	1,77
Déséquilibre efforts-reconnaissance et avoir des enfants	79	1,80
Déséquilibre efforts-reconnaissance et tâches ménagères ainsi que soins aux enfants dichotomisés à la médiane	88	1,86
Déséquilibre efforts-reconnaissance et tâches ménagères ainsi que soins aux enfants dichotomisés selon les tertiles	49	1,81

*Prévalence de la détresse psychologique élevée utilisée : 31,1%

- **SOUTIEN SOCIAL (FAIBLE/ÉLEVÉ)** : CETTE VARIABLE A ÉTÉ DICHOTOMISÉE EN DEUX GROUPES. LA PROPORTION DE SUJETS FORMANT LE PLUS PETIT GROUPE EST DE 45% (SUR LA BASE DE NOS DONNÉES). DANS L'OPTIQUE DE PRÉSENTER LES CALCULS LES PLUS CONSERVATEURS, LA PUISSANCE STATISTIQUE A ÉTÉ CALCULÉE EN CONSERVANT 45% DE NOTRE ÉCHANTILLON.

Tableau 8. Différences de moyennes de PA systolique et diastolique minimales détectables à une puissance de 80% (puissance calculée à partir de la commande « Proc Power » du logiciel SAS)

DOUBLE EXPOSITION À :		**DIFFÉRENCE MINIMALE DÉTECTABLE**	
	N	**PA SYSTOLIQUE**	**PA DIASTOLIQUE**
ANALYSES PRINCIPALES:			
Job strain et responsabilités familiales dichotomisées à la médiane	44	+5,14 mm Hg	+3,72 mm Hg
Job strain et responsabilités familiales dichotomisées selon les tertiles	31	+5,73 mm Hg	+4,15 mm Hg
Déséquilibre efforts-reconnaissance et responsabilités familiales dichotomisées à la médiane	46	+5,10 mm Hg	+3,69 mm Hg
Déséquilibre efforts-reconnaissance et responsabilités familiales dichotomisées selon les tertiles	27	+6,12 mm Hg	+4,43 mm Hg
AUTRES ANALYSES EXPLORÉES:			
Job strain et avoir des enfants	59	+4,97 mm Hg	+3,60 mm Hg
Job strain et tâches ménagères ainsi que soins aux enfants dichotomisés à la médiane	69	+4,96 mm Hg	+3,59 mm Hg
Job strain et tâches ménagères ainsi que soins aux enfants dichotomisés selon les tertiles	36	+5,47 mm Hg	+3,96 mm Hg
Déséquilibre efforts-reconnaissance et avoir des enfants	63	+4,98 mm Hg	+3,60 mm Hg
Déséquilibre efforts-reconnaissance et tâches ménagères ainsi que soins aux enfants dichotomisés à la médiane	72	+5,05 mm Hg	+3,65 mm Hg
Déséquilibre efforts-reconnaissance et tâches ménagères ainsi que soins aux enfants dichotomisés selon les tertiles	39	+5,33 mm Hg	+3,86 mm Hg

*Écarts-types utilisés : 10,3 mm Hg pour la PA systolique et 7,5 mm Hg pour la PA diastolique.

Tableau 9. Rapports de prévalences de détresse psychologique élevée minimaux détectables à une puissance de 80% (puissance calculée à partir de la commande « Proc Power » du logiciel SAS)

DOUBLE EXPOSITION À :	N	RAPPORT DE PRÉVALENCES
ANALYSES PRINCIPALES:		
Job strain et responsabilités familiales dichotomisées à la médiane	56	1,69
Job strain et responsabilités familiales dichotomisées selon les tertiles	39	1,80
Déséquilibre efforts-reconnaissance et responsabilités familiales dichotomisées à la médiane	64	1,73
Déséquilibre efforts-reconnaissance et responsabilités familiales dichotomisées selon les tertiles	39	1,89
AUTRES ANALYSES EXPLORÉES		
Job strain et avoir des enfants	76	1,72
Job strain et responsabilités domestiques dichotomisés à la médiane	88	1,70
Job strain et responsabilités domestiques dichotomisés selon les tertiles	47	1,73
Déséquilibre efforts-reconnaissance et avoir des enfants	89	1,75
Déséquilibre efforts-reconnaissance et responsabilités domestiques dichotomisés à la médiane	99	1,81
Déséquilibre efforts-reconnaissance et responsabilités domestiques dichotomisés selon les tertiles	55	1,76

*Prévalence de la détresse psychologique élevée utilisée : 31,1%

CHAPITRE 3 : Adverse effects of psychosocial work factors on blood pressure: A systematic review and critical synthesis of studies on demand-control-support and effort-reward imbalance models

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RÉSUMÉ

OBJECTIF: De plus en plus d'études ont évalué l'effet délétère des contraintes psychosociales au travail sur la pression artérielle (PA). L'objectif de la présente revue systématique est de documenter l'effet des stresseurs des modèles «demande-latitude» (DL) et «déséquilibre efforts-reconnaissance» (DER) sur la PA des femmes et des hommes, en fonction de la qualité méthodologique des études.

MÉTHODE: Pour être incluses, les études devaient: i) porter sur ≥1 contrainte psychosociale au travail, ii) évaluer la PA moyenne ou l'hypertension, iii) inclure ≥100 travailleurs, iv) être rédigées en français ou en anglais et v) être publiée dans un journal arbitré.

RÉSULTATS: Au total, 74 études ont été retenues. Des ces études, 64 portaient sur le modèle DL, 12 portaient sur le modèle DER et deux études portaient sur les deux modèles. Environ une étude sur deux a observé un effet significativement délétère des stresseurs sur la PA. Les différences de moyennes variaient entre +1,8 et +11 mm Hg pour la PA systolique et entre +0,8 et +17,9 mm Hg pour la PA diastolique. De plus, les rapports de cotes d'hypertension variaient entre 1.18 et 5,77. Un effet plus consistant a été observé: 1) chez les hommes que les femmes et 2) au sein des études de qualité méthodologique supérieure (ayant un devis prospectif et/ou des mesures ambulatoires de PA).

CONCLUSION: Les études de qualité méthodologique supérieure ont observé un effet délétère des stresseurs psychosociaux au travail sur la PA.

Abstract

OBJECTIVES A growing body of research has investigated the adverse effects of psychosocial work factors on blood pressure (BP) elevation. There is now a clear need for an up-to-date, critical synthesis of reliable findings on this topic. This systematic review aimed to evaluate the adverse effects of psychosocial work factors of both the demand–control–support (DCS) and effort–reward imbalance (ERI) models on BP among men and women, according to the methodological quality of the studies.

METHODS To be eligible, studies had to: (i) evaluate at least one psychosocial work factor, (ii) evaluate BP or hypertension, (iii) comprise ≥100 workers, (iv) be written in English or French, and (v) be published in a peerreviewed journal.

RESULTS A total of 74 studies were included. Of these, 64 examined the DCS model, and 12 looked at the ERI model, with 2 studies considering both models. Approximately half the studies observed a significant adverse effect of psychosocial work factors on BP. A more consistent effect was observed, however, among men than women. For job strain, a more consistent effect was also observed in studies of higher methodological quality, ie, studies using a prospective design and ambulatory BP measures.

CONCLUSIONS A more consistent adverse effect of psychosocial work factors was observed among men than women and in studies of higher methodological quality. These findings contribute to the current effort of primary prevention of cardiovascular disease by documenting the psychosocial etiology of elevated BP, a major cardiovascular risk factor.

Introduction

Cardiovascular diseases (CVD) are the leading cause of death worldwide (1). In Canada, these diseases account for one third of male and female deaths (2) and are the most costly group of health problems in terms of hospitalization (3). High blood pressure (BP) is a major risk factor for CVD (4). Indeed, it accounts for an estimated 54% of all strokes and 47% of all ischemic heart disease events globally (5). Among adults, almost one American in five (6) and one Canadian in five (7) has high BP. The risk of cardiovascular mortality grows linearly with BP from 115/75 mm Hg among adults aged 40–69 years-old with no CVD. At the population level, even a mean systolic BP that was 2 mm Hg lower would lead to a reduction in middle-age mortality from coronary heart disease and stroke of approximately 7% and 10%, respectively (8, 9). Over recent decades, a growing number of studies have investigated the adverse effects of psychosocial factors, including those of the workplace (ie, work stress), on BP elevation.

Two well-defined and internationally recognized theoretical models have been used to assess the adverse effects of psychosocial work factors on BP: the demand–-control–support (DCS) (10) and the effort–reward-imbalance (ERI) (11) models. The DCS model suggests that workers simultaneously experiencing high psychological demands and low job control are more likely to develop stress-related health problems (10). Psychological demands mainly refer to an excessive workload, very hard or overly fast work, and conflicting demands. Job control is a combination of skill discretion (eg, learning new things, opportunities to develop skills, creativity, a variety of activities, non-repetitive work) and decision authority (eg, taking part in decisions affecting oneself, making one's own decisions, having a say on the job, and freedom as to how the work is accomplished) (10). Johnson et al (12) introduced poor social support as a third component of the demand–control model. This component refers to a lack of help and cooperation from supervisors and coworkers. The ERI model proposes that extrinsic efforts (eg, pressure to work overtime, increasingly demanding work, constant time pressure, repeated interruptions) should be rewarded in various ways, namely: financially (income), socially (respect, esteem), and organizationally (job security, promotion prospects) (13). Workers are in a state of detrimental imbalance when high extrinsic efforts are accompanied by low reward and thus more susceptible to health problems. A third component, overcommitment, is a personal coping style that presents as being unable to withdraw from work obligations, being impatient and irritable, and having a high need for approval (14). Overcommitment may act either directly or as a modifier (ie, amplifier) of the ERI effect (14).

Two main biological pathways have been suggested to explain how psychosocial work factors contribute to BP elevation. Firstly, CVD results from a chain of events linking risk factors to cardiovascular events, which is summarized in Dzau's CVD "continuum" (15, 16). First, asymptomatic damage occurs from interactions between genetic and environmental risk factors (15, 16). This damage then amplifies over time to trigger cardiovascular events. For example, BP elevation could successively lead to hypertension, arterial stiffness, and stroke or ischemic heart disease. Several epidemiological studies have demonstrated that psychosocial stressors might contribute to the incidence of CVD. Even though possible mechanisms are not clearly defined (17), based on experimental studies, one can reasonably assume that the deleterious effects of psychosocial stressors arise from the cumulative impact of multiple and prolonged exposures. These studies have provided evidence that the sympathetic nervous system, a primary mediator of the stress response, is one of the major pathways activating the renin-angiotensin system (18, 19). Stress can therefore stimulate the secretion of renin and increase plasma levels of angiotensin II, which has a significant effect on blood vessel walls. Indeed, angiotensin II plays a crucial role in the development of CVD by causing vasoconstriction, endothelial dysfunction, cellular proliferation, and inflammation that promotes atherosclerosis (20–22). In conjunction with sympathetic activation and hypothalamo-pituitary-adrenal axis stimulation, activation of the renin–angiotensin system can lead to hypertension and cardiovascular events (18, 19). Secondly, psychosocial work factors could act more indirectly on BP through known risk factors or risk behaviors (eg, obesity, smoking, lack of physical exercise, or excessive alcohol consumption) (23–26).

Six systematic reviews have been conducted to investigate the adverse effect of psychosocial work factors on CVD (27–31, 32). These reviews concluded that these psychosocial factors play an important role in the etiology of CVD. Five reviews also reported that adverse effects were more consistently observed among men than women (27, 29, 30, 31, 33). A possible explanation for these gender differences is the fact that on average, CVD occur ten years later among women (34). Therefore, work-related CVD might occur at the end of or after the work period among women, leading to low statistical power to detect an effect in some studies. However, such a limitation might be of lesser importance in studies on BP, since BP elevations tend to occur earlier in life than CVD. It is also worth adding that large studies conducted in the US and Europe observed a consistently higher proportion of women exposed to adverse psychosocial work factors than men (35). High job strain and ERI are therefore a frequent psychosocial exposure among women.

Two recent literature reviews (36, 37) have presented evidence that adverse psychosocial work factors may also be a risk factor for BP elevation. Based on 22 cross-sectional studies, Landsbergis et al (37) presented higher pooled BP means of +3.43 mmHg (systolic) and +2.07 mm Hg (diastolic) among workers exposed to high job strain as compared to non-exposed workers. However, 13 of 22 studies observed no significant effects (37), thereby indicating inconsistencies. These two literature reviews were limited by the fact that they: (i) took a narrative approach (non-systematic) (36), (ii) did not systematically evaluate ERI (36, 37), and (iii) did not systematically investigate the effects on hypertension (36, 37). Therefore, no previous systematic review has investigated the adverse effects of both the DCS and ERI factors on BP level and hypertension. There is thus a need to investigate the consistency of effects according to gender and the methodological quality of studies.

The general objective of this systematic review was to evaluate the effects that the psychosocial work factors of both the DCS and ERI models had on BP among men and women. The period under study was 1979 (year of the first publication presenting the demand–control model) (10) to 4 November 2011. The following specific objectives were assessed: (i) Do workers exposed to psychosocial work factors of the DCS and ERI models have higher BP than unexposed workers? (ii) Are there gender differences in the effects of these psychosocial work factors on BP? (iii) Do studies of higher methodological quality, particularly studies with a prospective design and ambulatory BP measures, present more consistent adverse effects than studies of lesser methodological quality?

Methods

Search strategy

We conducted a systematic review to evaluate the association between adverse psychosocial work factors and BP among men and women. All relevant citations were collected and analyzed with a predefined strategy. Relevant citations were extracted from PubMed, Embase, Web of Science, and PsycInfo databases from 1979 to January 2011. Keywords and MeSH terms were combined to generate lists of publications. The databases were searched with a combination of three types of search strings (the complete search strategy is available on request) with terms related to: (i) the work setting: job, work, occupation, occupations, workplace, worker, employee; (ii) psychosocial factors: psychosocial factors, psychosocial work factors, psychosocial work-related factors, job stress, job-related stress, work stress, work-related stress, psychosocial, psychosocial stress, psychological demand, job demand, demand, job control, job control, job strain, iso-strain, social support, reward, effort–reward imbalance, effort reward, Karasek, Siegrist, psychosocial environment; (iii) BP: BP, hypertension, ambulatory BP, BP monitoring, cardiovascular responses, cardiovascular risk factors, systolic BP, and diastolic BP.

For practical reasons, publications had to be available in English or French. For scientific reasons, such as improved credibility and relevance, publications had to be available in peer-review journals. In the first step, a first reviewer selected studies on the basis of the title. In the second step, the abstracts of all the selected titles were sorted for a more detailed evaluation. Two independent reviewers read the abstracts and categorized them as relevant, not relevant, and possibly relevant. The same two reviewers fully reviewed, synthesized, and approved the relevant and possibly relevant publications. The quality and integrity of this review were optimized by following the validated PRISMA (preferred reporting items for systematic reviews and meta-analyses) recommendations (38).

Selection criteria

The selected populations had to include populations of >100 workers at baseline. Workers had to be exposed to psychosocial work factors of the DCS and/or ERI models. The comparison groups had to be composed of workers unexposed to the corresponding psychosocial work factors. The cut-offs between exposed and unexposed workers were generally determined by the median score of the study population or by the median score observed in a reference population (eg, the working population of a given country). To be included, a study also must have assessed these psychosocial work factors at the individual level. Articles based on imputed job title exposure score were therefore excluded since they are more vulnerable to misclassification (29, 30, 39).

The outcome had to be defined by (i) BP level (ie, mean or coefficient) or (ii) hypertension incidence or prevalence. Studies using office BP or ambulatory measurements were included. Office hypertension was generally defined as systolic or diastolic BP mean ≥140 mm Hg and ≥90 mm Hg, respectively. Ambulatory hypertension was generally defined as systolic or diastolic BP mean ≥135 mm Hg and ≥85 mm Hg, respectively (40). However, some studies used higher cut-offs to define hypertension (see tables A–C, available at www.sjweh.fi/data_repository.php). Studies on gestational hypertension were excluded.

Cross-sectional, prospective, and case–control studies were included. Narrative reviews and duplicates were excluded. Multiple publications based on the same study population were retained if the analyses were conducted for different exposures or outcomes.

Statistical analysis

An effect was defined as being a statistically significant difference in BP between workers exposed to psychosocial work factors and those unexposed. Effect measures [differences in mean, beta coefficients, correlation coefficients, risk ratios (RR), and odds ratios OR)] and their P-value or 95% confidence interval (95% CI) were presented for each study, when available. Effects were presented for combinations of psychosocial work factors and for each factor taken separately. Results were also synthesized according to study design (cross-sectional, prospective, case–control), type of BP measures (office, ambulatory), and outcome (BP level, hypertension).

Results

Overview of included studies

The literature search provided 2913 citations, 161 of which were selected as potentially relevant (figure 1). After a complete review of the full articles, 87 studies were excluded because they: (i) did not measure the psychosocial work factors of the DCS and/or ERI models (N=39) (41–79), (ii) did not individually assess exposure to psychosocial factors (N=3) (80–82), (iii) comprised a population of high school students (not a working population) (N=1) (83), (iv) included <100 participants (N=13) (84–96); (v) were not written in English or French (N=4) (97–100), (vi) were not published in a peer-reviewed publication (N=16) (11, 98–112), (vii) did not measure BP (N=8) (72, 113–119), or (viii) did not distinctly evaluate exposure to psychosocial work factors (N=3) (123–125). Because these last studies evaluated interaction with multiple exposures, it was not possible to isolate the impact of the psychosocial factors that were of interest in our review (123–125). A total of 74 studies were ultimately included (24, 35, 46, 126–195).

The 74 studies were published between 1982–2011; 57 were cross-sectional, 15 prospective cohorts, and 2 case–control studies. Among the prospective studies, the follow-up durations ranged from 6 weeks to 12 years. Office and ambulatory BP measures were used in 45 and 28 studies, respectively. There were 64 studies on the DCS model (tables A and B) and 12 studies on the ERI model (table C), two studies considered both models (151, 155). Studies were conducted in 18 countries and included various working populations aged ≥15 years (representative samples of the general working population, white-collar workers, bus drivers, nurses, teachers, patrol officers, etc.; tables A–C).

Except for five studies on the DCS model (154, 161, 174, 175, 181), the studies included in this review controlled for at least one potential confounder. Potential confounders were sociodemographic (age, gender, ethnicity), socioeconomic (education, income, occupation), lifestyle risk factors (smoking, alcohol or caffeine consumption, physical activity, stressful situations, personality traits), biological risk factors (body mass index, waist circumference, known history of CVD, diabetes, medication for hypertension, menopausal status, estrogen medication, pregnancy history, sodium intake, cholesterol), and other factors (marital status, number of children, posture, stress outside work, having eaten a meal, length of time in the current job, and social support at work and outside work).

Studies on DCS model

Tables 1 and 2 summarize the results of the studies on the DCS model according to methodological characteristics and gender, while tables A and B (www.sjweh.fi/data_repository.php) detail the characteristics and results of these studies.

Overall, 21/40 studies observed a significant deleterious effect of job strain on BP level and 7/19 studies observed such an effect on hypertension (table 1). Significant deleterious effects were also observed for high psychological demands in 7/25 studies on BP level and 2/7 studies on hypertension, and for low social support in 1/9 studies on BP level. As well, a significant effect was observed for high job control (protective effect) in 9/25 studies on BP level and 3/6 studies on hypertension. However, no significant effects were observed in the three studies on iso-strain.

Of the 40 cross-sectional studies on job strain (table A, figures 2–4), 16 observed a significant deleterious effect, namely: (i) differences in systolic and diastolic BP means ranging respectively from +2–+10.2 mm Hg (130, 134, 149, 152–154, 171, 172, 174, 183) and from +2–+17.97 mm Hg (134, 149, 153, 154, 171, 172, 174, 183); (ii) OR ranging from 1.18–2.9 (133, 179, 183); (iii) beta coefficients of systolic and diastolic BP of 4.53 (177) and 0.23 (180) respectively; and (iv) P-values <0.05 for the association between job strain and mean systolic BP (46, 140) (table 1). Two studies reported a significant protective effect of job strain on hypertension (122, 132, 139): OR for hypertension of 0.61 (122) and 0.63 (systolic hypertension) (132).

Of the 12 prospective studies on job strain (table B, figures 2–4), 9 observed a significant deleterious effect, namely: (i) differences in systolic and diastolic BP means ranging respectively from +1.2–+7.7 mm Hg (143, 157, 162, 182, 184) and from +0.8–+7 mm Hg (162, 184); (ii) a hypertension OR of 1.27 after being exposed to job strain at baseline and an OR of 2.06 for a change from low to high job strain during an 8-year follow-up (156); (iii) RR for a systolic BP increase in the highest quintile of 1.33 among men (143); (iv) a beta coefficient of systolic BP of 0.19 (168); and (v) a P-value of <0.01 for the association between job strain and mean systolic BP (178) (tables 2 and A). Contrary to what was expected, one study observed a significant protective effect of job strain on BP (139).

The two case–control studies observed that job strain had a significant deleterious effect on hypertension (table 1) (164, 169). The OR for hypertension were 2.6 and 2.7, respectively. One of these studies also presented differences in mean BP (systolic: +6.8 mm Hg, diastolic: +2.6 mm Hg) (169). It is also worth noting that one case–control study evaluated the effect of low social support at work and observed no effect among either men or women (164).

Gender. A majority of the 40 cross-sectional studies on job strain presented results separately for men and women; 19 presented results solely for men, and 15 presented results solely for women (table 2, figures 2–4). A higher proportion of studies observed a deleterious effect among men (BP level: 6/18 studies, hypertension: 2/5 studies) than women (BP level: 1/10 studies, hypertension: 0/7 studies) (table 2, figures 2–4). Two studies on hypertension reported a significant deleterious effect among men [OR 1.18 (179) and 2.9 (183)], while none (0/7 studies) observed such an effect among women.

In addition, a slightly higher proportion of cross-sectional studies observed a deleterious effect of high psychological demands (4/11 studies) and high job control (6/10 studies) among men compared to women (demands: 2/11 studies, control: 5/11 studies) (table A).

Of the 12 prospective studies on job strain, 5 presented separate results for men and 4 presented separate results for women (table 2, figures 2–4). In studies on BP level, a higher proportion observed a deleterious effect among men (5/5 studies) compared to women (2/4 studies) (table 2). Moreover, the only study on hypertension reported a deleterious effect among men versus no effect among women (143) (table 2).

The effects of high psychological demands and low job control that were observed in prospective studies were not consistent among either men (demands: 2/7 studies, control: 2/7 studies) or women (demands: 2/5 studies, control: 3/5 studies) (table 2). In addition, the only study that evaluated the effect of low social support observed a deleterious effect among women but not men (131) (table 2).

Study design. For job strain, a higher proportion of prospective studies yielded a deleterious effect on BP mean level as compared to cross-sectional studies (significant effect in 7/9 studies as compared to 13/30 studies) (table B). However, a prospective design did not lead to a more consistent effect in studies on hypertension (significant effect in 2/5 prospective studies as compared to 3/12 in cross-sectional studies).

Type of BP measures. Office and ambulatory BP measures were used in respectively 39 and 27 studies on job strain (table 1). Overall, a higher proportion of studies using ambulatory BP measures (13/20 studies) observed an adverse effect of job strain than did studies using office measures (12/35 studies) (table 1). This observation mostly applies for cross-sectional studies. Indeed, among cross-sectional studies, 9/15 studies using ambulatory BP measures observed a significantly deleterious effect as compared to 7/27 studies using office BP measures (table 1). However, in prospective studies on BP level, ambulatory BP measures (4/5 studies) did not lead to a more consistent deleterious effect than office measures (3/4 studies), which could be due to the small number of studies (table B). Only one prospective study on hypertension used ambulatory BP measures.

Among studies evaluating the separate effects of the demand–control–support factors, the use of ambulatory or office BP measures led to inconsistent findings for high psychological demands (ambulatory BP: 3/9 studies, office BP: 2/9 studies) and high job control (ambulatory BP: 4/9 studies, office BP: 2/9 studies) (table 1). Moreover, only 1/12 studies on the separate effect of low social support observed a significant deleterious effect (table 1).

Studies on ERI model

Tables 3 and 4 summarize the results of the studies on the model according to methodological characteristics and gender, while table C details the characteristics and results of these studies.

In studies on ERI, 4/7 studies observed a significantly deleterious effect of ERI on BP level and 5/6 studies observed such an effect on hypertension (table 3). A significant deleterious effect of overcommitment on BP level was also observed in 2/4 studies (table 3).

Of the 11 cross-sectional studies of the ERI model, 7 studies observed a significant deleterious effect (table C, figures 5–6), namely: (i) differences in systolic and diastolic BP means ranged respectively from +1.86–+4.52 mm Hg and +1.31–+4.17 mm Hg (155, 190, 191) and (ii) hypertension OR ranged from 1.62–5.77 (186 , 187, 188, 192). In addition, two cross-sectional studies evaluated the separate effect of effort and reward (155, 192). None of these studies observed significant results (table C).

A significant deleterious effect of overcommitment was observed in one out of three cross-sectional studies (195). This study observed a higher ambulatory systolic BP mean among men (+6.4 mm Hg) but no effects among women (195). It is also worth mentioning that no cross-sectional studies presented results for the potential modifying effect of overcommitment on the association between ERI and BP.

Only one prospective study evaluated the effect of ERI on BP (193). This study used ambulatory BP measures. Among men, no association was observed. Among women, age had a modifying effect. Women <45 years old exposed to ERI at both times (over a 3-year follow-up) had significantly higher BP means at follow-up than those unexposed (systolic: +1.86 mm Hg, diastolic: +1.48 mm Hg) (table C, figure 6). Among women ≥45 years old, the cumulative incidence of hypertension was 2.78 times higher among those exposed to ERI at both times (table C and figure 6). In this study, no modifying effects were observed for overcommitment. However, men and women in the higher tertile of overcommitment also had higher BP means than those in the lower tertile (men: systolic +1.66 mm Hg, diastolic non-significant; and women: systolic: +1.28 mm Hg, diastolic +1.02 mm Hg) (table C).

Gender. Of the 11 cross-sectional studies on ERI, 6 presented results separately for men and women (table C, figures 5–6). The deleterious effect of ERI was more consistent among men (5/6 studies) than women (1/6 studies) (table C, figures 5–6).

Methodological characteristics. For the ERI model, there were 11 cross-sectional studies and only 1 prospective study (table 3). More prospective studies are needed to compare results according to study designs.

A higher proportion of studies using ambulatory BP measures (3/4 studies) observed an adverse effect of ERI as compared to studies using office measures (5/8 studies, table 3). However, this comparison should be interpreted cautiously due to the small number of cross-sectional (N=3) and prospective (N=1) studies using ambulatory BP measures.

Discussion

Of the 74 studies on the adverse effects of psychosocial work factors on BP, 64 looked at the DCS model and 12 at the ERI model, with two studies considering both models (151, 155). For both models, a more consistent adverse effect has been observed for men compared to women. In studies on job strain, those of higher methodological quality (ie, studies using a prospective design and/or ambulatory BP measures) observed a more consistent effect than those of lesser quality.

Gender

In line with the results of the current review, previous reviews on BP (196) and CVD (29, 30, 33, 196–198) also observed a more consistent adverse effect of psychosocial work factors among men than women (29, 30, 33, 196–198). However, a recent meta-analysis of coronary heart disease European cohort studies, including 197 473 workers, observed a similar effect in both genders (32). Gender differences may be due to the fact that BP elevations tend to arise later in women's lives than men's. Indeed, until age 45, a lower percentage of women have high BP (199). Therefore, among women, age might modify the effect of psychosocial work factors on BP, leading to a stronger effect in older than younger women. Supporting this hypothesis, Gilbert-Ouimet et al (193) observed an adverse effect of ERI on hypertension among women aged ≥45 years old, while no such effect was observed among younger women. It is thus possible that studies observing no significant adverse effect (in particular studies on hypertension) would have observed such effect after stratifying on age. However, since only two studies stratified their results on women's age (both having observed an adverse effect) (131, 193), it would be important to further evaluate this potential modifying effect.

Gender differences could also be explained by women having different occupational trajectories than men (more often characterized by absences or reduced hours of paid work due to family responsibilities), resulting in less continuous exposure to psychosocial work factors. In addition, it is also possible that being exposed to adverse psychosocial work factors might only add a little adverse impact to that already encountered by experiencing the burden of large family responsibilities. As pointed out by Messing et al (200), multiple roles and complex exposures make it difficult to pin down risks for working women. In the current review, only three studies have taken family responsibilities into account (143, 160, 201). Future studies would benefit from evaluating the potential modifying or confounding effect of family responsibilities. Marital cohesion would also be of interest since previous studies have observed that a lack of it amplified (ie, modified) the adverse effect of psychosocial work factors on BP (178, 202).

Gender differences in the experience of stress (203) may also lead to differential self-reported exposures to psychosocial work factors (197). In line with this, two studies that used both self-reports and external observations to assess psychosocial work factors noted that women tended to overestimate their self-reported job control, while no such phenomenon was observed among men (80, 204). For women, this may lead to an underestimation of the prevalence of high job strain. Such non-differential misclassification could dilute the adverse effect of high job strain on BP among women.

Another potential explanation for gender differences might lie in the effect of social support at work among women. As shown for the association between job strain and depression (205), high social support at work may moderate the adverse effects of job strain among women. None of the studies included in the current review evaluated the potential modifying effect of social support on the association between psychosocial work factors and BP according to gender. It is thus possible that studies showing no significant adverse effect among women would have observed such an effect after stratifying on social support. It is also worth noting that only one study (131) evaluated the separate effect of social support. This study observed an adverse effect among women but no effect among men. More studies evaluating the separate and modifying effects of social support at work according to gender are needed.

Finally, the gender differences observed in the current review rely partly on a comparison of studies comprising solely men or women. A potential limitation of comparing such studies is that gender differences might result from inter-study differences (eg, differences in design, BP measurements, and definition of psychosocial exposures) instead of true gender differences. We therefore conducted a complementary analysis to verify this hypothesis by comparing only studies including both men and women. For job strain, a higher proportion of studies observed a deleterious effect among men (7/15 studies) than women (1/15 studies) (tables A and B, figures 2–4), which is in line with the findings of the overall analysis. For ERI, only three studies including both men and women presented results according to gender (187, 192, 193). A deleterious effect was observed among men and women in 2/3 and 1/3 of the studies, respectively (table C, figures 5–6). More studies including men and women are needed on ERI that include both men and women. These additional studies would allow a comparison of the consistency of the effect of ERI according to gender.

Methodological characteristics

Study design. A prospective design is more appropriate than a cross-sectional one, especially for studies on hypertension. Indeed, cardiovascular alterations such as hypertension could take years to develop. A prospective design has a considerable advantage in that it allows for a time lag between exposure and outcome measurements, circumventing an eventual reverse causation bias.

In this review, studies used different study designs to evaluate the effect of psychosocial work factors on BP. For job strain, a higher proportion of prospective studies (7/9 studies) yielded a deleterious effect on BP mean level compared to cross-sectional studies (13/30 studies) (table B). However, the prospective design did not lead to a more consistent effect in studies on hypertension (significant effect in 2/5 prospective studies compared to 3/12 in cross-sectional studies). This may be due to the low number of prospective studies on hypertension (N=5) and their predominant use of office BP measures (4/5 studies) (table 1).

More studies combining a prospective design and ambulatory BP measures are needed to evaluate the role of job strain in the etiology of hypertension.

For the ERI model, there was only one prospective study (193), which emphasizes the need for more studies using this design.

Types of BP measures. A higher proportion of studies using ambulatory BP measures showed an adverse effect of job strain (13/20 studies) and ERI (3/4 studies) as compared to studies using office measures (12/35 and 5/8 studies, respectively) (tables 1 and 3). Ambulatory BP measures are known to sidestep the observer error (the so-called "white-coat effect"). They also provide better precision by capturing the BP fluctuations related to daily life and make it possible to capture "masked" hypertension, defined as elevated daytime ambulatory BP (≥135/85 mmHg) in the face of normal office BP (<140/90 mm Hg). The prevalence of masked hypertension has been estimated to be between 8–30% in the general population (206–208, 209). Several population-based studies and prospective clinical trials have provided clear evidence of the superiority of ambulatory over office BP measures in predicting cardiovascular risks (154, 210–213).

Besides comparing clinical to ambulatory BP measures, a distinction can be made according to the moment of BP collection (ie, during work, at home, over 24 hours, and during sleep). We performed a complementary analysis of studies that measured BP during and outside work (N=10) (46, 128, 129, 134, 138, 140, 153, 171, 177, 183) (tables A and B). Most of these studies were cross-sectional (N=9) and used ambulatory BP measures (N=9) (tables A and B). All the studies (except reference #46) presenting significant results found a deleterious effect in both BP at work and: (i) at home (134, 140, 153, 183), (ii) over 24 hours (134, 177), and (iii) during sleep (134). The effect forces were comparable for all periods. This suggests that the deleterious effect of psychosocial work factors not only contributed to inflate daytime BP but also persisted after work. It is likewise noteworthy that most studies included in this review (N=66/76) only measured daytime BP. Boggia et al (210) showed that daytime BP predicts the 10-year incidence of fatal and non-fatal strokes, cardiac, and coronary events just as well as nighttime BP. Indeed, hazard ratios for the combination of these cardiovascular events were 1.33 and 1.25 for systolic and diastolic daytime BP, respectively, compared to 1.31 and 1.28 for nighttime BP (in continuous analyses).

Limitations

Methodological choices. As Belkic et al (30) emphasises, publication bias and heterogeneity are major reasons for skepticism towards meta-analyses of non-experimental studies (30, 219, 220). There is also an increasing need for qualitative approaches and the identification of the best way of evaluating effects (30). The current review does not provide meta-analytical estimates since the available data did not meet the criteria for homogeneity in methods used to assess job strain and ERI, confounders, outcome measures, and biases potentially affecting internal validity. Our review however provides an in-depth analysis of several potential explanations for data inconsistencies (ie, gender, study design, types of BP measures, instruments for measuring psychosocial factors, categorization of exposure to psychosocial factors, control for potentially confounding factors, and participation rate). Such analysis allowed the identification of "optimal" methods to consistently observe the deleterious effect of psychosocial work factors on BP, namely the use of a prospective design and ambulatory BP measures.

However, the calculation of a meta-analytical estimate based on a sub-sample of studies with comparable methodological characteristics would partly circumvent the pitfalls of heterogeneity. The only subsample comprising a sufficient number of studies (N>5) of higher methodological quality (ie, studies having either a prospective design or ambulatory BP measures) would be the cross-sectional studies evaluating the association between job strain and mean level of ambulatory BP. However, Landsbergis et al (37) already calculated such an estimate in a very recent meta-analysis. Indeed, based on 22 cross-sectional studies, they presented higher pooled ambulatory BP means of +3.43 mmHg (systolic) and +2.07 mm Hg (diastolic) among workers exposed to high job strain compared to non-exposed workers (37).

Also, it is worth mentioning we could have missed potentially relevant papers in the first step of data selection when we selected citations on the basis of their titles rather than reviewing abstracts, which would have minimized the chance of introducing such bias. However, the references of all included studies and prior literature reviews have been thoroughly consulted and no additional studies were added. Even though it cannot be ruled out, a potential bias resulting from this data selection step seems unlikely.

In line with previous literature reviews on psychosocial work factors and cardiovascular health (30, 33, 197, 198), we evaluated the consistency of the effects on the basis of statistical significance. However, gainful but non-significant effects have also been observed in studies on job strain (N=13) (tables A and B) (no such effects have however been observed in studies on ERI, table C). Only three of these studies (N=3) had a sample size <200 (N=100–175, table A), which suggests that statistical power is unlikely to explain why results were not significant. It is also noteworthy that most of these studies were cross-sectional (12/13 studies) and used clinical BP measures (9/13 studies), which supports the hypothesis that poorer methodological quality leads to lower effect consistency.

Publication bias. A potential publication bias might have been introduced due to the inclusion of articles written only in English or French. To document this potential bias, a sensitivity analysis including articles written in other languages was conducted. This complementary search led to the identification of four potentially relevant articles written in Chinese, Italian, Persian, and Spanish (214–217). The potential relevance of these articles was based on the titles and abstracts, which were written in English. Three articles were on the DCS model (214, 216, 217) and two were on the ERI model (215, 217). One article included both models. Based on the abstracts, only one study (216) observed significant results. This cross-sectional study looked at the DCS model and used ambulatory BP measures. However, since it included only 30 men, it would not have been eligible for the current review (studies had to include ≥100 workers). Thus, this sensitivity analysis revealed that three possible eligible studies with negative results were omitted. Of these, two were cross-sectional (215, 217) (the other one did not mention the study design in the abstract). The abstracts did not mention the type of BP measurement used in these studies.

Another publication bias could have arisen from the fact that statistically significant results are more likely to get published than non-significant results. Such publication bias is assumed to be present if larger studies (in which it is easier for smaller effects to be significant) report smaller effects than small studies (larger effects are needed for significant findings) (218). To investigate the presence of this bias, the test for funnel plot asymmetry is generally conducted (218). However, due the diversity of effect measures, psychosocial exposures, study designs, and outcomes used in the reviewed studies, such a test could not be performed. The current review was restricted to studies including ≥100 workers. This makes it easier to achieve satisfactory statistical power, which reduces the likelihood of a publication bias due to non-significant findings. In addition, approximately one in two reviewed studies reported non-significant results, which shows that such results are frequently published in this field. It is, however, important to point out that other non-significant results might not have been presented. As mentioned above, only one study on ERI presented an investigation of the potential modifying effect of overcommitment. This however does not definitively suggest that such analyses were not performed. Presenting non-significant modifying effects is needed to further document the psychosocial etiology of BP elevation. The force of such publication bias cannot be estimated.

The potential biases of the reviewed studies are detailed below.

Selection bias. A selection bias could have been introduced in studies where participants and non-participants differed with regard to both psychosocial work factor exposure and BP (219). Studies having a low participation rate at baseline and/or follow-up are particularly vulnerable to such bias (221). In a recent literature review, Galea et al (222) reported that a participation rate of ≥75% is generally considered satisfactory in epidemiological studies. In the current review, 20 studies had participation rate(s) <75% (24, 129–131, 133, 134, 142, 144, 150, 151, 155, 160, 163, 167, 168, 178–180, 190, 195) (tables A–C). Almost half of these (9/20 studies) documented the potential differences between participants and non-participants (24, 129, 142, 150, 151, 160, 167, 178, 223). Those suspecting a differential participation (4/9 studies): (i) observed higher cardiovascular risk factor prevalence (160) combined with lower socioeconomic status (179) or with a higher prevalence of psychosocial work factors in non-participants (24, 150), and (ii) noted that, since recruitment was by advertisements, it is possible that the study attracted predominantly "stressed" subjects as volunteers (178). These observations suggest that a selection bias due to differential participation could lead to an under- or overestimation of the true effects. It is important to mention that participation rate(s) were not reported in a third of the studies (26/76 studies, 34%) (121, 122, 126–128, 132, 135, 137, 139, 141, 145, 148, 154, 156, 158, 162, 164, 166, 170, 175, 183, 185, 187, 188, 192, 195) (tables A–C). Such a high proportion of non-reporting of participation is in line with what Morton et al (221) observed in a recent review of articles published in major epidemiology journals. They noted comparable or poorer reporting of participation rates in cross-sectional (participation rate not mentioned in 41% of studies), case–control (66%), and prospective (68%) studies. Since selection bias may threaten the internal validity of epidemiologic studies, authors should report participation rate(s) consistently.

The well-documented selection bias of the "healthy worker effect" (219) might also have been introduced in some of the included studies. This bias, which is more likely to occur in cross-sectional than prospective studies (219, 224), generally leads to an underestimation of the true effect (219). In occupational studies, a healthy worker effect can arise from: (i) a differential participation at baseline or follow-up (discussed above) and (ii) the application of selection criteria. In prospective studies on hypertension, this second mechanism could for example be introduced by excluding hypertensive workers at baseline, who are "sicker" than normotensive workers. However, creating prospective cohorts free of the outcome under study at baseline is an important methodological quality since it allows causal inferences to be made by ensuring that the exposure precedes the outcome. In keeping this rationale, most prospective studies on hypertension (4/6 studies) opted to exclude hypertensive workers at baseline (140, 145, 157, 194) (tables A–C).

It is also noteworthy that, in occupational studies, the healthy worker effect has mostly been observed in studies on cardiovascular disease, diabetes, and respiratory disorders (219, 224) due to the fact that such diseases are symptomatic. Studies on BP mean level or hypertension are less prone to such bias because: (i) BP elevations and hypertension are generally asymptomatic, and (ii) over 50% of individuals with high BP are unaware of their condition (225). Nevertheless, the healthy worker effect can occur in cross-sectional studies on hypertension and generally lead to an underestimation of the true effect (219).

Information bias. An information bias might have resulted from the fact that psychosocial work factors are notoriously difficult to measure. Indeed, psychosocial work factors are known to be more difficult to measure than standard cardiovascular risk factors such as smoking, alcohol consumption, or abdominal adiposity. More specifically, the concept of psychological demands measured by the DCS model has been criticized for not measuring emotional demands, which include becoming emotionally involved during work or having to face emotionally disturbing situations (226). Thus, the concept of psychological demands might underestimate the actual "demands" to which workers are exposed. This could lead to a non-differential information bias underestimating the true adverse effect of psychological demands (219).

Another potential information bias might have resulted from the use of different instruments to measure the psychosocial work factors of both the DCS and ERI models. Of the 64 studies on the DCS model, 53 used Karasek's Job Content Questionnaire (JCQ) (10) (tables 1 and 2). A majority of these studies observed significant effects of the DCS factors (32/53) (tables A and B). Among the studies using instruments other than the JCQ, a majority (9/11 studies) also observed significant effects (tables A and B). For the ERI model, 10/12 studies used the recommended Siegrist questionnaire (13) (table C), 7 of which observed a significant effect (table C). The two studies that used other instruments partly (193) or entirely (187) also observed significant effects. However, comparing the effect consistency observed in studies on the basis of the instrument used to measure psychosocial factors is complex since studies also differ with regard to other methodological characteristics. Uniformity in measuring psychosocial work factors is nevertheless recommended to improve interstudy comparability.

A misclassification bias might also have resulted from the fact that studies on job strain used different categorizations of exposure. Some studies (19/52 studies) categorized job strain in quadrants as recommended (10) (tables A and B). These quadrants classify workers as unexposed (low demands, low control), passive (low demands, high control), active (high demands, high control), or high strain (high demands, low control). Even though quadrants are recommended, a majority of studies (28/52 studies) used a dichotomous exposure, comparing the high strain category (as “exposed”) to the combination of unexposed, passive, and active categories (as “unexposed”) (tables A and B). A dichotomous job strain categorization might lead to an important misclassification bias. Such a bias would lead to a dilution of the adverse effect of high job strain. A complementary analysis showed that studies using the job strain quadrants did not yield a more consistent effect than studies using a dichotomous exposure (8/19 compared to 12/25 studies, tables A and B). As mentioned previously, such a comparison is limited by the fact that studies differ in other methodological characteristics. It is also noteworthy that three studies using the job strain quadrants observed deleterious effects in the active group (223) or in both the active and passive groups (35, 164).

In the same vein, a misclassification bias might also have resulted from the use of different scales to measure the ERI factors. A majority of studies (8/12) used an agreement scale with answers varying from “strongly agree” to “strongly disagree” (156, 186, 189–191, 193, 194, 197). The four other studies (151, 186, 187, 191) used a scale measuring both the agreement and the intensity of distress experienced. In these studies, participants who agreed to a given item had to indicate the level of distress experienced, ranging from “very distressed” to “not at all distressed”. Measuring both the employees’ agreement and distress intensity may have led to a more acute exposure to ERI than measuring only the employees’ agreement. In line with this hypothesis, a slightly higher proportion of studies combining both agreement and distress intensity observed a significant deleterious effect of ERI (3/4 versus 4/8 studies). In future studies, measuring psychosocial work factors with standardized instruments would favor interstudy comparability.

Another potential information bias might have arisen from the use of a single time-point exposure. Only 7 (138, 152, 153, 156, 184, 193, 223) of 64 studies evaluated the effect of job strain or ERI using more than a single time-point. Of these, 5 observed a significant adverse effect, which is a higher proportion than that observed in studies using a single time-point exposure (28/57 studies, table A). In line with this, data from the British Whitehall II study and the Quebec post-myocardial infarction cohort showed that a single time-point measurement underestimated the effect of job strain on first and recurrent coronary heart disease (29, 227). Measuring psychosocial work factors repeatedly makes it possible to take changes in exposure into account. It also makes it possible to identify chronically exposed subjects, who may have a higher cardiovascular risk than subjects exposed for a shorter period. There is too little empirical evidence to suggest an optimal number of measures or an ideal interval of time between psychosocial work factor measurements. According to experimental studies, it is however reasonable to assume that the deleterious effect of psychosocial stressors on BP elevations, particularly on hypertension, would arise from prolonged exposures (18, 20, 228–231).

An additional information bias might have occurred in studies on BP level that did not take hypertension medication into account. Since hypertension medication leads to artificially lowered BP measures, not considering it might contribute to underestimating the true adverse effect of psychosocial work factors on BP level. A total of 18/59 studies on BP means (142, 144, 147, 148, 159, 161–163, 166, 169, 180–182, 184, 185, 189, 191, 194) did not take hypertension medication into consideration (ie, workers on medication were not excluded or not controlled for in analyses) (tables A–C). Of these 18, 10 studies observed an adverse effect of psychosocial work factors, which is, however, comparable to the overall proportion of studies observing such an effect.

It is also worth mentioning that: (i) 2 of 3 prospective studies on hypertension did not consider workers taking hypertension medication at follow-up as "hypertensive cases" (ie, as having the outcome under study) (table B); and (ii) of 14 cross-sectional studies on hypertension, 1 excluded workers taking hypertension medication and 5 controlled for the consumption of such medication (table A). Since workers taking hypertensive medication have the outcome under study, not considering them as "cases" leads to a misclassification that might bias the estimates toward the null.

One can also argue that another misclassification bias could have been introduced by assessing psychosocial work factors using self-reported questionnaires. In theory, self-reported data tend to introduce more misclassification bias than objective data (219). However, it has been suggested that the individual's judgment may bring about most of the deleterious effects of psychosocial work factors on health (232). In addition, job title exposure score has been shown to involve more misclassification than self-reported measures due to an incomplete capture of psychosocial work exposure (generally leading to an underestimation of estimates) (29, 30, 233).

Finally, it is worth noting that some studies included populations of workers from only one or two occupations [ie, bus drivers (124), nurses (128, 140, 168), police officers (126), and teachers (128, 171, 194)](tables A–C). In these studies, the range of variation of exposure to psychosocial work factors might have been limited due to considerable similarity in job characteristics. Little variation due to restricted working areas may lead to lower effect estimates compared to those that would have been observed in representative samples of the active working population. Also, as Landsbergis et al (153) states, a limited range of variation in exposure due to study design might reduce the statistical power available to detect main effects of psychosocial work factors.

Confounding. Confounding biases also need to be addressed. The five studies on the DCS model (154, 161, 173, 175, 181) that did not control for any cofactors are the most prone to confounding bias. Confounding might also be present in other studies due to a lack of control for cardiovascular risk factors. For example, some studies did not control for age (126, 133, 146, 148, 176) or family history of CVD (61 studies) (24, 46, 122, 125–130, 132–142, 144–153, 155, 157–160, 162–170, 173, 176, 180, 182, 183, 185, 187–191, 194, 195, 234, 235) (tables A–C), which constitute major risk factors for high BP. Residual confounding might also have resulted from the fact that none of the studies on job strain controlled for ERI or vice-versa. Finally, residual confounding might have been present due to psychosocial work factors of emerging models, such as organizational injustice (236) and managerial leadership (237), which have been suggested to be causally related to cardiovascular risk (29, 237). It is worth mentioning that recent studies have presented evidence of a complementary adverse effect of job strain and ERI on BP and coronary heart disease (238 and Trudel X, Brisson C, Milot A, Vézina M, Masse B. Psychosocial work environment and ambulatory blood pressure: independent effect of demand-control and effort-reward imbalance models. In preparation). Similarly, a recent systematic review observed that procedural and relational injustice (ie, two components of the organizational injustice model) can be considered a different and complementary model to the DCS and ERI models. It is also possible that simultaneous exposures to psychosocial work factors would lead to an increased adverse effect on BP compared to single exposures. Such a phenomenon has been observed in job strain and ERI with regard to the risk of acute myocardial infarction among men and women of a large case–control study (N=951 cases and 1147 referents) (240).

A large majority of studies presented effect measures adjusted for lifestyle risk factors that might have acted as mediating variables (62/77 studies) in the causal pathway linking work stress and BP (29, 30). Indeed, psychosocial work factors have been associated with lifestyle, cardiovascular risk factors such as increased smoking intensity (241), reduced leisure-time physical activity (241), unhealthy diet (242), weight gain, and obesity (29, 243). Adjusting for mediating factors may result in controlling for a part of the effect under study, which contributes to an underestimation of the overall effect of psychosocial work factors on BP (219). To avoid such a limitation, five studies (24, 122, 125, 188, 189) evaluated the additional effect of adjusting for lifestyle, cardiovascular risk factors in a supplementary statistical model (ie, sequential adjustment). In all of these studies, this additional adjustment only resulted in a slight change in the effect measures presented. Studies using structural equation modeling are, however, needed to quantify the potential causal pathway linking psychosocial work factors, lifestyle risk factors, and BP.

Generalization

The results of the current study can be generalized to working populations from various countries. Indeed, participants in a large proportion of studies (N=35/78) were recruited from representative samples of the active working population. The remaining studies included workers from various but restricted working areas (ie, public employees, bus drivers, nurses, and teachers; tables A–C), which may limit the external validity of their results (155, 178).

Concluding remarks

The present review has some strengths. It gathered and summarized empirical evidence through an explicit, systematic, and objective research strategy known for minimizing bias (38). This is also the first systematic review on the effects of both the DCS and the ERI models on BP level and hypertension. This review also provides an in-depth analysis of gender differences. In addition, the systematic approach made it possible to explore five methodological characteristics as potential explanations for the data inconsistencies observed in the literature: (i) study design, (ii) types of BP measures (office versus ambulatory), (iii) instruments for measuring psychosocial factors, (iv) categorization of exposure to psychosocial factors, (v) control for potentially confounding factors, and (vi) participation rate.

In conclusion, the present review contributes to current efforts of primary prevention of CVD by providing an up-to-date, systematic synthesis of reliable findings on the psychosocial etiology of BP, a major CVD risk factor. Overall, approximately half the studies observed a significant adverse effect of psychosocial work factors on BP. However, the extensive body of research on this topic showed a more consistent effect for men than for women. In studies on job strain, a more consistent effect was also observed in studies of higher methodological quality that is studies using: (i) a prospective design and (ii) ambulatory BP measures. The numerous evidences presented in this review supports the need for workplace intervention studies to evaluate the effect that reducing psychosocial work factors has on BP among various working populations.

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Table 1. Number of studies reporting a statistically significant deleterious effect/total number of studies having these methodological characteristics(reference number) reporting a deleterious effect of the demand–control–support factors on blood pressure according to study designs (cross-sectional, prospective or case–control), blood pressure (BP) measurements (office or ambulatory), and outcome (hypertension or BP level)

	Cross-sectional studies (N=50) [a]		Prospective studies (N=14)		Case-control studies (N= 2)		Total
	Office BP (N=29/50)	Ambulatory BP (N= 21/50)	Office BP (N=9/14)	Ambulatory BP (N=5/14)	Office BP (N=1/1)	Ambulatory BP (N=1/1)	
Job strain (N=52)							
Hypertension	1[b] (179) / 10 (35, 122, 124, 125, 132, 135, 149, 151, 179, 201)	2 (133, 183) / 2 (133, 183)	2 [c] (143, 156) / 4 (24, 143, 150, 156)	0 / 1 (138)	1 (164) /1 (164)	1 (169) / 1 (169)	7 / 19
BP level	6 [d] (130, 140, 149, 154, 174, 180) / 17 (130, 137, 139, 140, 144, 147-149, 154, 159, 161, 167, 173-175, 180)	7 (46, 134, 152, 153, 171, 177, 183) / 13 (46, 126, 127, 129, 134, 152, 153, 155, 158, 171, 172, 177, 183)	3 (143, 162, 182) / 4 (143, 150, 162, 182)	4 (157, 178, 184, 223) / 5 (138, 157, 178, 184, 223)	0 /0	1 (169) / 1 (169)	21 / 40

[a] Studies on both BP level and hypertension (138, 149, 159, 163, 169).
[b] Two studies also reported a significant protective effect of job strain (122, 132).
[c] The estimated risk ratios (RRs) for blood pressure increases in the highest quintile for each job strain group (143).
[d] One study also reported a significant protective effect of job strain (139).

Table 2. Number/proportion of studies (reference number) reporting a deleterious effect of job strain on blood pressure (BP) according to gender, study designs (cross-sectional, prospective or case–control), BP measurements (office or ambulatory) and outcome (hypertension or BP level).

	Cross-sectional studies (N=26)		Prospective studies (N=6)		Total
	Office BP (N=18/26)	Ambulatory BP (N= 8/26)	Office BP (N=3/6)	Ambulatory BP (N=3/6)	
Women					
Hypertension	0 / 6 (122, 132, 135, 151, 179, 201)	0 / 0	0 / 1 (143)	0 /0	0 / 7
BP level	1 (139)/ 7 (130, 139, 144, 154, 167, 173, 180)	1 (152) / 3 (127, 152 , 158)	1 (182) / 3 (143, 162, 182)	1 (223) / 1 (223)	4 / 14
Men					
Hypertension	1 (179) / 4 (122, 135, 149, 179)	1 (183) / 1 (183)	1 (143) / 1 (143)	0 / 0	3 / 6
BP level	5 (130, 149, 154, 174, 180) / 11 (130, 139, 144, 147-149, 154, 161, 173, 174, 180)	2 (153, 183) / 6 (126, 127, 129, 153, 158, 183)	3 (143, 162, 182) / 3 (143, 162 , 182)	2 (157, 184) / 2 (157, 184)	12 / 22

Table 3. Number/proportion of studies (reference number) reporting a deleterious effect of the effort-reward imbalance (ERI) factors on blood pressure (BP) according to study designs (cross-sectional, prospective, or case-control), BP measurements (office or ambulatory), and outcome (hypertension or BP level).

	Cross-sectional studies (N=11)		Prospective study (N=1)		Total
	Office BP (N=8/11)	Ambulatory BP (N=3/11)	Office BP (N=0/1)	Ambulatory BP (N=1/1)	
ERI (N=12)					
Hypertension	4 (186-188, 192) / 5 (151, 186-188, 192)	0 / 0	0 / 0	1 (193) / 1 (193)	5 / 6
BP level	1 / 3 (184, 188; Xu, 2004}	2 (155, 190) / 3 (155, 190, 195)	0 / 0	1 (193) / 1 (193)	4 / 7

Table 4. Number/proportion of studies (reference number) reporting a deleterious effect of effort-reward imbalance (ERI) on blood pressure (BP) according to gender, study designs (cross-sectional, prospective or case-control), BP measurements (office or ambulatory) and outcome (hypertension or BP level).

	Cross-sectional studies (N=11)		Prospective study (N=1)		Total
	Office BP (N=8/11)	Ambulatory BP (N=3/11)	Office BP (N=0/1)	Ambulatory BP (N=1/1)	
Women					
Hypertension	0 / 3 (151, 187, 192)	0 / 0	0/0	1 (193) / 1 (193)	1 / 4
BP level	1(191) / 2(185, 191)	0 / 0	0/0	1 (193) / 1 (193)	2 / 3
Men					
Hypertension	4 (186-188, 192) / 4 (186-188, 192)	0 / 0	0/0	0 / 1 (193)	4 / 5
BP level	0 / 0	1 (190) / 1 (190)	0/0	0 / 1 (193)	1 / 2

Supplemental table 1. Cross sectional and case-control studies on the demand-control-support (DCS) model according to types of blood pressure (BP) measures (office or ambulatory) [BMI=body mass index; Diast=diastolic; ERI=effort reward imbalance; JCQ=Job content questionnaire; OC=over-commitment; NS=not significant; Syst=systolic)

First author, year (reference)	N participants (N men / women) Participation rate (PR)	Age, Population type[a], Country	D C S indicator, assessment[b] and prevalence	Outcome[c-d]	Covariates[e]	Main results / Comments	
						Results for men	Results for women
Office BP measures							
Winnubst, 1982 (1)	1,246 participants (1,167 men and 79 women) PR: 80%	34-75 years old (Mean 45), workers of 3 different industrial organizations, Netherlands Workers on medication for hypertension not excluded	Organizational Stress Questionnaire	Office mean BP	Crude results	**Both Gender** Crude difference in mean BP **S superior**: Syst. BP: +0.05 mm Hg (NS) Diast. BP: +0.04 mm Hg (NS) **S coworker**: Syst. BP: +0.05 mm Hg (NS) Diast. BP : +0.06 ($0.05<p<0.10$)	
Netterstrom, 1991 (2)	1,504 participants (748 men and 756 women) PR: 75%	30, 40, 50, and 60 years old (selected on this basis) Living in 11 municipalities Copenhagen, Denmark Workers on medication for hypertension	A questionnaire was used (but not JCQ), Dichotomous	Office mean BP Office hypertension (160/95 mm Hg or medication)	Age, gender, weight, height, smoking, social network, physical activity	**Both Genders** Adjusted differences in mean BP: **Job strain**: Syst. BP: +1.7 mm Hg Diast. BP: -0.4 mm Hg. No significant results	

First author, year (reference)	N participants (N men / women) Participation rate (PR)	Age, Population type[a], Country	D C S indicator, assessment[b] and prevalence	Outcome[c-d]	Covariates[e]	Main results / Comments	
						Results for men	Results for women
		not excluded					
Albright, 1992 (3)	1,396 participants, PR:77%	20-65 years old (mean: 42), Bus drivers, USA Workers on medication for hypertension not excluded	JCQ, English version Quadrant	Office hypertension (140/90 mm Hg or medication)	Age, gender, race, education, income, marital status, years employed, BMI, family history of heart disease, alcohol intake, caffeine and physical activity	**Both Genders** Adjusted odds ratios **D:** 0.95 (0.84–1.03) **C:** 0.92 (0.81–1.04) Job strain: 0.98 (0.86–1.13)	
Light, 1992 (4)	129 participants (65 men and 64 women) PR: Not mentioned	18-47 years old, healthy working men and women (mean age 32.9 in men and 31.3 in women), USA Hypertensive workers excluded on the basis of BP value (not medication).	JCQ, English version Dichotomous	Office mean BP	No adjustment	Differences in mean BP **Job strain**	
						Syst. BP: + 6mmHg. P<0.05 Diast. BP: +4mmHg , p <0.05	Syst. BP:-1 mmHg (ns) Diast. BP:-2.2mmHg (ns)
Fox, 1993 (5)	136 women, PR: 76%	21-60 years old. nurses, USA Workers on	D: 45-item questionnaire by Motowidlo et al. C: with a 22-	Office mean BP	Age, weight, caffeine consumption	**Both Genders** Differences in systolic mean BP: **Work load and low C**: positively relate to systolic BP at work and at home (results shown in Figures 3, 4, 5 no data shown. No results for	

First author, year (reference)	N participants (N men / women) Participation rate (PR)	Age, Population type[a], Country	D C S indicator, assessment[b] and prevalence	Outcome[c-d]	Covariates[e]	Main results / Comments	
						Results for men	Results for women
		medication for hypertension excluded	item questionnaire by Dwyer and Ganster Also measured objectively (by the head nurse), Continuous			diastolic BP at work)	
Curtis, 1997 (6)	726 participants (273 men and 453 women) PR: not mentioned at baseline and 85% participation at follow-up	25-50 years old (mean 38.5 (men) and 38.9 years old (women), African-American working men and women, USA Workers on medication for hypertension not excluded	JCQ, English version Dichotomous	Office hypertension (≥160/95 mm Hg or medication)	Age, BMI, occupation, education, marital status, perceived stress, smoking, alcohol, physical activity, level of physical exertion at work	Adjusted odds ratios **Job strain**: 1.3 (0.50–3.29) **D (80th percentile)**: 0.9 (0.51–1.56) **C (80th percentile):** 0.46 (0.22–0.96)	**Job strain:** 1.1 (0.58–2.22) **D (80th percentile):** 1.2 (0.69–2.14) **C (80th percentile):** 1.0 (0.58–1.73)
Kawakami, 1998 (7)	2,876 men PR: 92%	38.1 years old ±9.4 and 38.4 years old ±8.5 in daytime (mean age)	JCQ, Japanese version Quadrant	Office hypertension (≥160/90 mm Hg or medication)	Age, education, obesity, physical activity, and alcohol consumption	Daytime workers Differences in mean BP: **Job strain:** Syst. BP: +2 mm Hg (p=0.005), Diast. BP: +2 mm Hg	None

First author, year (reference)	N participants (N men / women) Participation rate (PR)	Age, Population type[a], Country	D C S indicator, assessment[b] and prevalence	Outcome[c-d]	Covariates[e]	Main results / Comments	
						Results for men	**Results for women**
		(N=1,703) and rotating-shift (N=1,173) workers, workers in a large electrical company, Japan Workers on medication for hypertension not excluded		Office mean BP		(p=0.008) **D:** higher diastolic BP (p=0.003), data not given **C, S and iso-strain**: no significant effect (not shown) Hypertension odds ratio: **Job strain**: 1.28 (0.73-2.23) Rotating-shift workers Differences in mean BP: **Job strain**: Syst. BP: -1.0 mm Hg, Diast. BP: 0.0 mm Hg Hypertension odds ratio: 0.88 (0.47–1.62) **D, C, S and iso-strain**: no significant effect (not given)	
Niedhammer, 1998 (8)	12,221 participants (9,001 men and 3,220 women) PR: 45%	40-50 years old (men) and 35-50 years old (women), employed by a French electricity	JCQ, French version	Office hypertension (criteria not mentioned)	Age, education, occupation marital status, number of children, physical activity, smoking, alcohol consumption	Adjusted odds ratios **C** (low): 1.21 (1.05–1.39) **D** (high):1.00 (0.87–1.15) **S** 1.12 (0.98–1.28)	**C** (low): 0.89 (0.68–1.16) **D** (high): 1.25 (0.95–1.64) **S** 1.10 (0.85–1.42)

First author, year (reference)	N participants (N men / women) Participation rate (PR)	Age, Population type[a], Country	D C S indicator, assessment[b] and prevalence	Outcome[c-d]	Covariates[e]	Main results / Comments	
						Results for men	Results for women
		company, France Workers on medication for hypertension not excluded					
Tsutsumi, 1998 (9)	304 participants (138 men and 166 women) PR: 20%	Age 40-69 Resident of Akaike, Japan Workers on medication for hypertension not excluded	JCQ, Japanese version, DemandControl interaction	Office mean BP	Age, BMI, education, marital status, menopause, white versus blue collar workers, employment status, coffee and greasy foods intake, smoking, alcohol consumption, working hours, physical activity, social support	Adjusted beta coefficient **D C**	
						Syst. BP: NS, Diast. BP: 0.23 p=0.042	No significant results

Su, 2001 (10)	526 men PR: 77%	Age 18-65, white collar workers in private insurance companies, Taiwan Workers on medication for hypertension excluded	Job strain JCQ Taiwanese version, ratio (demand/control)	Office mean BP	Age, education, smoking, alcohol consumption	Adjusted differences in mean BP: **Job strain**: Syst. BP: +10.21 mmHg p<0.05. Diast. BP: +17.97 mmHg p<0.05	None
Tsutsumi, 2001 (11)	6,587 participants (3,187 men and 3,400 women) PR : 65.4%	Age 30-69 years old (mean: 50.8), working men and women, Japan Workers on medication for hypertension not excluded but analyzed separately	JCQ Japanese version, ratio (demand/control)	Office hypertension (160/90 mmHg or medication)	Age, job managerial, work hours, marital status, education, family history of hypertension, smoking, alcohol consumption, BMI, physical activity	Adjusted prevalence ratios **Job strain (D/C)** Multiple linear regression with syst. and diast. BP: not any significant association in men and women 1.18 (1.05–1.32).	1.01 (0.90–1.13).
Alfredsson, 2002 (12)	10,382 participants (7,146 men and 3,236 women), PR : 82%	15-64 years old, 36 occupational health service, Stockholm Workers on medication for hypertension not excluded	JCQ Swedish modified version , Dichotomous	Office hypertension (140/ 90 mm Hg or medication)	Age, socioeconomic status, smoking, physical activity, fat consumption, and BMI	**Both Genders** Adjusted prevalence ratio: D: 0.9 (0.8–1.0) C: 1.1 (1.0–1.2) Job strain vs others: 1.0 (0.9–1.1) Job strain vs relaxed: 1.0 (0.8–1.1)	

Pelfrene, 2002 (13)	21,419 participants (16,329 men and 5,090 women), PR: 48%	35-59 years-old, workers of 25 large companies, Belgium Workers on medication for hypertension not excluded	JCQ French version	Office mean BP Office hypertension (160/95 mm Hg or medication)	Age, education	Adjusted differences in mean BP alpha < 0.01 and 99% CI. **D:** Syst. BP +1.16 mm Hg (0.35-1.97), Diast BP: +0.95 mm Hg (0.41-1.50) **C:** Syst. BP -0.17 mm Hg (-0.96–0.62), Diast. BP+ 0.03 mm Hg (-0.50–0.56) **S**: Syst. BP -0.34 mm Hg (-1.16-0.48), Diast. BP -0.37 mm Hg (-0.92–0.18) Odds ratio of hypertension **D:** 1.11 (0.97–1.26) **C:** 0.90 (0.79–1.03) (p<0.05) **S:** 0.94 (0.82–1.07) Mean BP and odds ratios were also calculated for **iso-strain** but nothing was significant (Tables 4a and 4b)	Adjusted differences in mean BP alpha < 0.01 and 99% CI. **D:** Syst. BP +0.87 mm Hg (-0.57–2.42), Diast. BP+0.97 mm Hg (-0.01–1.95) (p<0.05) **C:** Syst. BP: +0.63 mm Hg (-0.86–2.11), Diast BP: +0.75 mm Hg (-0.23–1.73) (p<0.05) **S:** Syst. BP: + 0.44 mm Hg (-1.08–1.97), Diast BP: -0.11 mm Hg (-1.11–0.89) Odds ratio of hypertension **D:** 1.43 (1.08–1.84) **C**: 0.97 (0.74–1.27) **S:** 1.02 (0.78–1.34) Mean BP and odds ratios were also calculated for **iso-strain** but nothing was significant (Tables 4a and 4b)

Cesana, 2003 (14)	2,809 participants (1,799 men and 1,010 women), PR: between 66.6 and 72.5 for men and women of the four studies included in analyses	25-54 years old means of 39.9 in men (SD 8.28) and 37.1 (SD 7.77) in women, employed workers from 4 population surveys, Italy Workers on medication for hypertension excluded	JCQ short version Italian version, Quadrant	Office mean BP	Age, BMI, alcohol consumption, smoking, education, physical activity, and year of survey	Adjusted mean BP **Job strain** : Syst. BP: +3.3 mm Hg (p=0.02) **D** (highest tertile):Syst. BP: -0.4 mm Hg, not significant **C** (highest tertile): Syst. BP: + 2.9 mm Hg, (p<0.01) No significant differences for diastolic BP (not shown).	Adjusted mean BP **Job strain**: Syst. BP: -1.0 mm Hg, not significant **D** (highest tertile): Syst. BP: -2.1 mm Hg, not significant **C** (highest tertile): Syst. BP: -0.2 mm Hg, not significant No significant differences for diastolic BP (not shown).
Kang, 2004 (15)	169 men, PR: not mentioned	≥40 years old, employed in a shipbuilding industry, Korea Workers on medication for hypertension not excluded	JCQ Korean version, Dichotomous	Office mean BP	BMI, waist-hip ratio, hypertension hyperlipidemia, homocystinuria, glucose, blood coagulation VII, VIII	Adjusted difference in mean BP: **Job strain**: Syst. BP: +3.6 mm Hg (p=0.15) Diast. BP: +3.0 mm Hg (p=0.06)	None

Thomas, 2004 (16)	122 participants (65 men and 57 women) PR: not mentioned	Age 25-52 General working population, USA Workers on medication for hypertension not excluded (after verifying that their inclusion did not change the results)	Job strain JCQ English version, Dichotomous	Office mean BP	No adjustment	**Both Genders** Crude differences in mean BP **Job strain**: Syst. BP: +4.4 mm Hg. (ns) Diast. BP: +1.2 mm Hg(ns)	
Chikani, 2005 (17)	1,500 women, PR: not mentioned	25-71 years old (mean 47.6 years in farm residents and 47 in nonfarm residents), farm and nonfarm women, USA Workers on medication for hypertension not excluded but controlled for	JCQ English version, Quadrant	Office elevated BP (Syst. BP: ≥140 mmHg Diast. BP: ≥90 mm Hg)	Age, having ever smoked, education, farm/nonfarm resident, BMI, current use of blood pressure medication, diabetes medication, estrogen medication	None	Adjusted odds ratios **D:** Syst. BP: 0.49 (0.3–0.7) Diast. BP: 1.09 (0.7–1.7) **C (high):** Syst. BP: 0.61 (0.4–0.9) Diast. BP: 0.77 (0.5–1.1) **Job strain:** Syst. BP: 0.63 (0.4–0.9) Diast. BP: 1.33 (0.8–2.1)

Kang, 2005 (18)	152 men (substudy: we invited 160 male workers (40 people each subgroup of job strain)). PR: 95%	20-57 years old, (mean 35.1±7.0), workers in 20 companies, Korea Workers on medication for hypertension not excluded	JCQ Korean version, Quadrant	Office mean BP	Age, BMI, smoking, and social support at workplace	Adjusted difference in mean BP **Job strain:** Syst. BP: -1.85 mm Hg (p=0.51) Diast. BP: -3.25 mm Hg (p=0.35) Regression coefficients **D:** Syst. BP: -1.97 Diast. BP: -0.57 **C:** Syst. BP: -0.17 Diast. BP: 0.12 **Job strain:** Syst. BP: -4.06 Diast. BP: -1.72 **D/C:** Syst. BP: -18.15 Diast. BP: -3.75 p<0.05	None
Kobayashi, 2005 (19)	1,401 women, PR: 50%	35-63 years old, workers of a retail business in Miyagi Perfecture, Japan Workers on medication for hypertension not excluded	JCQ Japanese version, ratio (demand/control)	Office hypertension (140/90 mm Hg)	Age, smoking, alcohol consumption, physical activity, occupation education, marital status, medication, pregnancy history, weight	None	Adjusted odds ratios **Job strain:** Syst. hypertension: 1.12 (0.71–1.77) Diast. hypertension: 1.02 (0.64–1.64) **Coworkers S**: Syst. hypertension: 0.96 (0.59–1.57) Diast. hypertension: 0.98 (0.60–1.62) **Supervisor S**: Syst. hypertension: 1.37 (0.88–2.13) Diast. hypertension: 1.16 (0.72–1.87)

Nomura, 2005 (20)	396 men PR: 99.6%	Median age 30 years old, information service company, Japan Workers on medication for hypertension not excluded	Japanese version of JCQ, Dichotomous	Office median BP	Unadjusted	Crude differences in mean BP **Job strain:** Syst. BP: +8 mm Hg, Diast. BP + 9 mm Hg No statistical test (descriptive only)	None
Radi, 2005 (Cross-sectional nested case-control study) (21)	609 participants (426 men and 183 women) PR: not mentioned	Mean (men 41.8 years old, women 43.5 years old), General working population, France Workers on medication for hypertension not excluded	JCQ, French version, Quadrant	Office mean BP office hypertension (140/90mmHg or medication)	Age, education, stressful life events, social support outside work (for women only)	Adjusted odds ratios **Job strain**: 2.60 (1.15–5.85) **S** (low): 1.31 (0.80–2.12)	

<table>
<tr><td>Ducher, 2006 (22)</td><td>903 participants (regrouped from 2 prospective studies) (701 men and 202 women), PR: not mentioned</td><td>Mean age 41 ± 6, Physicians and full-time workers in a chemical company, France

Workers on medication for hypertension excluded</td><td>JCQ French version, Quadrant</td><td>Office mean blood pressure among hypertensive (≥140/90 mm Hg) and normotensive subjects</td><td>Age, BMI, alcohol consumption

Crude results presented</td><td colspan="2">Both genders
Adjusted difference mean BP
Job strain
- In systolic hypertensive:
Syst BP: -1.0 mm Hg (not significant)
Diast. BP: 0.0 mm Hg (not significant)
- In systolic normotensive:
Syst BP: +1.0 mm Hg (not significant)
Diast. BP: +1.0 mm Hg (not significant)
- In diastolic hypertensive:
Syst BP: -2.0 mm Hg (not significant)
Diast. BP: 0.0 mm Hg (not significant)
- In diastolic normotensive:
Syst BP: +2.0 mm Hg (not significant)
Diast. BP: +1.0 mm Hg (not significant)</td></tr>
<tr><td rowspan="2">Fornari, 2007 (23)</td><td rowspan="2">5,695 participants (1,909 men and 3,786 women), PR: not mentioned</td><td rowspan="2">25-54 years old, workers Municipality of Milan, Italy

Workers on medication for hypertension not excluded but separate analyses performed for untreated workers</td><td rowspan="2">JCQ Italian version, Quadrant</td><td rowspan="2">Office mean blood pressure</td><td rowspan="2">Age, education, smoking, BMI, total and high-density lipoprotein (HDL) cholesterol</td><td colspan="2">Adjusted differences in mean BP</td></tr>
<tr><td>D: Syst. BP: -0.73 mm Hg
Diast. BP: -0.67 mm Hg
C : Syst. BP: -2.48 mm Hg
Diast. BP: -0.67 mm Hg
Job strain
Syst. BP: -2.25 mm Hg
Diast. BP: -0.45 mm Hg</td><td>D: Syst. BP: -0.67 mm Hg
Diast. BP: -0.71 mm Hg
C :Syst. BP: -1.81 mm Hg
Diast. BP: -1.98 mm Hg
Job strain: Syst. BP: -2.23 mm Hg
Diast. BP: -2.2 mm Hg</td></tr>
</table>

De Mello Alves, 2009 (24)	1,716 women, PR: 78%	Age not mentioned (three categories mentioned: <35, 35-44 and ≥45), technical-managerial workers from a university, Brazil Workers on medication for hypertension not excluded	JCQ Portuguese version, Quadrant	Office hypertension (≥140/90 mm Hg or medication)	Age, ethnic group, education, income, marital status, number of children, occupational status, length of time in job	None	Adjusted odds ratios **Job strain**: 0.93 (0.72–1.20)
Thomas, 2010 (25)	7,916 participants (4,132 men and 3,784 women) PR:78%	Age 45 years old (age cohort) Workers born in 1956, London Workers on medication for hypertension not excluded but controlled for	Job strain JCQ English version	Office mean BP	Gender, time of day In an additional multivariate regression model: mutually adjusted workplace factors, (>48h/week), night work, low control, low demands.	**Both Genders** Adjusted differences in mean BP **C** (high): Syst. BP: +1.00 mm Hg (ns). Diast. BP: +0.5 mm Hg (ns) **D** (high): Syst. BP: -0.4 mm Hg (p=0.016). Diast. BP: +0.2 mm Hg (ns) Multivariate regression Nothing significant after adjustment for listed covariates	

<table>
<tr><td rowspan="1">Trudel, 2010
(26)</td><td>2,357
participants:
(910 men and
1,447 women)
PR:80%</td><td>Mean age: 44
years old,
White- collar
workers,
Canada

Workers on
medication for
hypertension
not excluded</td><td>JCQ
French
version,
Quadrant</td><td>Masked
hypertension
Defined as
Office BP <
140/90 and
Ambulatory
BP at least
135/85
mmHg</td><td>Age, education
(controlled but not
retained: smoking, BMI
alcohol consumption,
family history of CVD)</td><td colspan="2">Both Genders
Adjusted odds ratio
Job strain
Men and women: no significant results (not
shown)</td></tr>
<tr><td rowspan="2">Mezuk, 2011
(27)</td><td rowspan="2">3,561 (with
valid BP
values)
participants
Health and
Retirement
Study
PR not
mentioned</td><td rowspan="2">≥50 years- old
(mean age
61.6) Currently
employed full
time, part-time
or partially
retired) USA

Workers on
medication for
hypertension
not excluded</td><td rowspan="2">Psychosocial
Leave-Behind
15 items
derived from
Karasek’s job
strain,
Dichotomous</td><td rowspan="2">Office
hypertension
(140/90
mmHg or
medication)</td><td rowspan="2">Age, gender, race,
marital status,
education, labor force
status, type of work,
smoking, alcohol
consumption, BMI</td><td colspan="2">Adjusted odds ratio
Job strain : 0.75, (0.63–0.89)</td></tr>
<tr><td>0.61, (0.47–0.79)</td><td>ns (not shown)</td></tr>
</table>

Ambulatory BP measures							
Schnall, 1992 (cross-sectional nested case-control study) (28)	264 men PR: 75%	30-60 years old (mean: 44.3, SD: 8.7), general working population, USA Workers on medication for hypertension not excluded	Job Content Questionnaire (JCQ),Dichotomous	Ambulatory hypertension (140/90 mm Hg or medication) and Ambulatory mean BP	Age, race, BMI, work site, education, type-A behavior, physical activity, 24-h urine sodium, smoking	Adjusted differences in mean BP: **Job strain:** Syst. BP: + 6.8 mmHg ($p=0.002$), Diast. BP : + 2.6 mm Hg ($p=0.03$) Hypertension odds ratio: 2.7 ($p<0.05$)	None
Landsbergis, 1994 (29)	262 men, PR: not mentioned	Mean of 44.3 (8.6)years-old, workers from eight New-York worksites, USA Workers had to stop taking their medication three weeks before BP measurements	JCQ English version, Dichotomous	Ambulatory mean BP	Age, race, education, BMI, smoking, alcohol consumption, physical activity, urine sodium, type A behavior, and worksite	**Job strain,** Syst. BP: +6.mmHg ($p<0.05$), Diast. BP: +2.7mmHg ($p<0.05$). Odds ratio of hypertension increased. 2.9 (1.3–6.6) All formulations of job strain exhibited significant associations with systolic blood pressure at work and home. Not with DBP.	None

Blumenthal, 1995 (30)	99 participants (61 men and 38 women), PR: not mentioned	29-59 years old, mild hypertensive patients (syst. BP: ≥ 140 and ≤ 180mm Hg, diast. BP ≥ 90 and ≤ 105 mm Hg), USA Workers on medication for hypertension excluded	JCQ English version, Dichotomous	Ambulatory mean blood pressure	Age (controlled but not retained: BMI and posture)	Adjusted mean BP estimated from a figure: Syst. BP: -4 mm Hg Diast. BP: not shown no statistical test	Adjusted mean BP estimated from a figure Syst. BP: + 6 mmHg Diast. BP: not shown no statistical test
Cesana, 1996 (31)	527 men, PR: 69.5%	25-64 years old, employed normotensive or mild hypertensive (< 165/100 mm Hg) residents of the city of Monza, Italy Workers on medication for hypertension excluded	JCQ short version Italian version, Quadrant	Ambulatory mean blood pressure	Age, education, overweight, BMI and a work physical-activity (controlled but not retained: occupational level)	**Job strain** - 24h monitoring: Syst. BP: +1.8 mm Hg Diast. BP: +0.2 - Working hour monitoring: Syst. BP: +2.1 Diast. BP: +0.4 None of these results were significant.	None

Kamarck, 1998 (32)	120 participants (46 men and 64 women, PR: 92%	23-50 years old (mean 35), full-time workers, married, USA Workers on medication for hypertension excluded	Diary of Ambulatory Behavioral States (DABS) questionnaire	Ambulatory mean BP	Posture, physical activity, caffeine, meal, alcohol, meal, talk, cold, hot	**Both genders** Correlation coefficients: **D**: not significantly associated with blood pressure (not shown) **C:** lower DBP, b=-.39, t(119)=-3.15, p<.01, and marginally associated with smaller SBP readings as well, b = -.29, t(119) = -1.88, p=.06.	
Laflamme, 1998 (33)	210 women, PR : 76%	18 to 64 years old employed as white-collar workers, Quebec, Canada Workers on medication for hypertension excluded	JCQ French version Current and cumulative with past exposure, Dichotomous	Ambulatory mean BP	Age, smoking, use of oral contraceptive	None	Differences in mean BP: **Job strain at both times**: Syst. BP: + 2 mm Hg, Diast. +1.7 mm Hg, not significant. There was a modifying effect of education. High education Syst. BP: + 8.2mmHg (p=0.004) Low education Syst. BP: -0.6mmHg (p=0.72) Diast. BP not shown.
Steptoe, 1998 (34)	162 participants (60 men and 102 women) PR: 87.1%	22 to 58 years old, teachers, London No hypertensive workers included (did not mentioned hypertension definition)	Questionnaire adapted from Karasek, Dichotomous	Ambulatory mean BP	Age, BMI, baseline blood pressure	**Both genders** Adjusted difference in mean syst. BP from day to evening **Low job strain** : -3.72 mmHg **High job strain** :-0.64 mmHg Mean blood pressure **Low job strain** : -4.24 mmHg **High job strain** :-1.85 mmHg	

Rau, 2000 (35)	149 men PR :88%	35 to 55 years old Stockholm BP screening program selected on borderline hypertension status (DBP 85 to 94 mmHg), Sweden No hypertensive workers included based on the BP values provided in a screening program	D 2 items C 12 items S 4 items Not JCQ	Ambulatory mean BP	Age, BMI, physical activity	Adjusted beta coefficients: No psychosocial variable (**D, C, S**) associated with syst. and diast. BP at work (not shown)	None
Fauvel, 2001 (36)	303 participants (235 men and 68 women), PR: 78%	18-55 years old, normotensive (<140/90 mm Hg) workers in a chemical company, France Workers on medication for hypertension excluded	JCQ French version, Dichotomous	Ambulatory mean blood pressure	Crude results presented (Controlled for but not retained: age, gender, alcohol consumption, salt intake, BMI, and occupation)	**Both genders** **Job strain**: during working hours, SBP was slightly higher in the high strain (HS) group whereas DBP was significantly higher (Figure, exact numbers not given). During the remaining hours, BP was similar between groups (Figure exact numbers not given). Only N=14 high strain in BP analysis.	

Steptoe, 2001 (37)	122 school teachers W: 77 M: 45 PR: at baseline: non relevant since participants were selected from a larger sample on basis of job strain status. At follow-up: 84.6%	High control mean age 38.5 Low control mean age 39.7, teachers, London Workers on medication for hypertension not excluded	Control JCQ	Ambulatory mean BP	No adjustment. Potential effect modifier tested: age, gender, work grade, social support	**Both genders** Crude difference in mean BP: **C**: Main effect not significant (not shown).	
Kamarck, 2002 (38)	340 participants, PR: not mentioned	50-70 years old, older adults (and menopausal status for women), USA Workers on medication for hypertension excluded	Diary of Ambulatory Behavioral States (DABS) questionnaire	Ambulatory mean BP[f]	Age, gender, education, race, posture, physical activity, temperature, recent meal, snack, caffeine, or alcohol consumption within past 45 min, use of antihistamine or decongestant within past 4 h, talking during the cuff inflation, cigarette smoking within past 5 min, and number of cigarettes within past 45 min	None	Adjusted correlation coefficients: **D**: Syst. BP: 0.11 Diast. BP: 0.04 **C:** Syst. BP: -0.11 Diast. BP: -0.11 $p<0.05$

Bishop, 2003 (39)	108 men, PR: not mentioned	19-50 years old (mean 26.85±5.15), Patrol officers, Singapore Workers on medication for hypertension not excluded (but the consumption of medication was taken into account)	Questionnaire (not JCQ), Demand Control interaction	Ambulatory mean blood pressure	BMI, physical activity, posture, feeling too hot, talking, smoking, having eaten a meal, taking medication	Beta coefficients (standard-error) and t values **D:** Syst. BP: 0.16 (0.37), t value 0.44, NS Diast. BP: 0.38 (0.31), t value 1.22, NS **C:** Syst. BP: -0.32 (0.25), t value -1.26, NS Diast. BP: -0.55 (0.21), t value -2.66 ($p<0.01$) **DC:** Syst. BP: -0.30 (0.19), t value -1.63, NS Diast. BP: -0.21 (0.15), t value -1.34, NS	None
Landsbergis, 2003 (40)	213 men. PR: not mentioned	30-60 years-old (mean 43.1), white-collar and blue-collar workers, New York Workers on medication for hypertension excluded	JCQ English version Cumulative exposure, Dichotomous	Ambulatory mean BP	Age, education, race, BMI, ambulatory BP during winter months, proportion of reading in standing position, work sites	Adjusted differences in mean BP: **Job strain**: **WORK** SBP +4.8mmHg DBP +3.8 mmhg **HOME** SBP +5.7mmHg DBP +3.9mmHg $p<0.05$.	None

Gallo, 2004 (41)	108 women, PR: not mentioned	Mean age 41.7±9.2, women working at least 35 hours/week and married, USA Workers on medication for hypertension excluded	JCQ English version	Ambulatory mean BP	Age, posture (sitting vs. lying down and standing, respectively), physical activity, temperature comfort, talking at the time of cuff inflation, psychical activity and consumption of substances (caffeine, food, drugs) between readings, smoking status, BMI, menopausal status, use of birth control pill, and use of HRT, alcohol consumption	None	Beta coefficients **D:** Syst. BP: 3.14 Diast BP: 0.07 **C:** Syst. BP: -1.98 Diast BP: -0.41 **S:** Syst. BP: 2.19 Diast BP: 0.35 p<0.01
Steptoe, 2004 (42)	227 participants (121 men and 106 women) PR: not mentioned	Aged 47–59 years, white collar workers, London Hypertensive workers were excluded on the basis of the BP value and medication	Job strain, D, C JCQ, Dichotomous	Ambulatory mean BP	Age, gender, employment grade, BMI, smoking and physical activity.	**Both genders** Adjusted differences in mean BP: **Job strain**: Syst. BP: +1.5mmHg. Diast. BP: +0.4mmHg **C**: Syst. BP: + 3.3mmHg (p<0.05). Diast. BP: + 2.9mmHg (p<0.05) **D** : Syst. BP: +2.1mmHg (ns), Diast. BP: -1.5mmHg (ns)	

Tobe, 2005 (43)	248 participants (113 men and 135 women) PR: 97.6%	40-65 years old (mean 50.8 years, 6.6, SD), employed full time, Toronto, Canada Workers on medication for hypertension excluded	JCQ English version, Dichotomous	Ambulatory mean BP	Age, gender, BMI, ethnicity, family history CVD, smoking, alcohol, education, physical activity, family income	**Both genders** Adjusted beta coefficients **Job strain**: Syst. BP: 24h Beta=4.53 p=0.0007 Syst. BP: At work Beta=4.11 p=0.025

Brown, 2006 (44)	147 women (92 teachers and 55 nurses), PR: not mentioned	35.4 ± 6.6 years old nurses and 46.3 ± 7.5 teachers, Hawaii (USA) Workers on medication for hypertension excluded	JCQ, English version	Ambulatory mean BP	Age, race, BMI, menopausal status, and smoking	None	Spearman correlation coefficient **D:** Syst. BP at work: -0.31 Syst. BP at home: 0.27 Syst. BP during sleep: -0.42 Diast. BP at work: -0.40 Diast. BP at home: -0.61 Diast BP during sleep: -1.08 **C:** Syst. BP at work: -0.71 Syst. BP at home: -0.14 Syst. BP during sleep: -0.47 Diast. BP at work: 0.05 Diast. BP at home: -0.27 Diast BP during sleep: -0.47 None of these results were significant.

Clays, 2007 (45)	178 participants, (109 men and 69 women) PR: 65.6%	Mean age 51.9±4.3 in high JS group and 50.9±5 in the no JS group, 4 companies or public administrations, Belgium (sub-study of the BELSTRESS study) Workers on medication for hypertension excluded	JCQ French version, Dichotomous	Ambulatory mean BP	Age, gender, BMI, smoking, high physical demands of the job, high stress outside work, physical activity prior to BP measurements	**Both genders** Adjusted mean BP differences **Job strain:** Syst. BP at work: +5.9 mm Hg Syst. BP at home: +3.8 mm Hg Syst. BP during sleep: +4.5 mm Hg Diast. BP at work: +3 mm Hg Diast. BP at home: +2.1 mm Hg Diast BP during sleep: +3.9 **D:** Syst. BP at work: +6.5 mm Hg Diast. BP at work:+4.2 mm Hg **C (low):** Syst. BP at work: +11.7 mm Hg Diast. BP at work: +6.7 mm Hg $p< 0.05$	
Song, 2010 (46)	177 men, PR: not mentioned	Mean age 43.2 years old (25 to 61), white collar workers, Korea Hypertensive workers were excluded on the basis of the BP value and medication	Job demand only Not original instrument	Automated mean BP taken during 8 stages of an exercise session	Age, physical activity, smoking, BMI	Adjusted differences in mean BP: **D** (high)**:** Syst. BP significant only in the last two stages (the 7th and 8th): +6.2 and +7.3 mm Hg, $p<0.05$ Diast. BP significant only for the 6th stage: +3.9 mm Hg, $p<0.05$.	None

Clays, 2011 (47)	167 participants (100 men and 67 women), PR: 66%	40-64 years old, 4 companies or public administrations, Belgium (sub-study of the BELSTRESS study Workers on medication for hypertension excluded	JCQ French version, Dichotomous	Ambulatory nondipping BP (an inadequacy of the mechanisms regulating BP)	Gender, education and BMI	Odds ratios of non dipping syst. and diast. BP **Job strain:** 1.65 (1.03–2.64) **S**: 0.82 (0.48–1.40) Very low N in this analysis (< 10 per category)
Maina, 2011 (48)	100 participants (26 men and 74 women), PR: 30%	36.0±10.8 years old in men and 34.9±9.9 in women, volunteers from two call centers, Italy Workers on medication for hypertension excluded	JCQ Italian version, Quadrant	Ambulatory mean BP	Age, gender, BMI, cigarette smoking, marital status, educational, work schedule, and time of day	Beta coefficient: **Low strain**: Syst. BP: -1.5 (-6.3–3.3) Diast. BP: -1.1 (-5.1–2.8) High strain not presented because it was the reference category.
Menni, 2011 (49)	924 participants (573 men and 351 women), PR: not mentioned	25-74 years old, Caucasian workers, Italy Workers on medication for hypertension excluded	MOPSY questionnaire (short version of JCQ), Dichotomous	Ambulatory mean BP	Age, gender, total cholesterol, BMI	Differences in mean BP: **Job strain** Syst. BP: +1.2 mm Hg; Diast BP: -0.1 mm Hg; No results were statistically significant Syst. BP: -0.4 mm Hg; Diast BP: -0.3 mm Hg; No results were statistically significant.

[a] For example, the population could be composed of working participants or participants from the general population. [b] ERI: effort-reward imbalance. OC: overcommitment. ERI and OC assessment: questionnaire used (original Siegrist's questionnaire or else), number of items used and number of times assessed. [c] Hypertension or mean blood pressure. [d] Office or ambulatory. The number of readings is mentioned. [e] Listing of all covariates considered for adjustment. [f] Office measures were also taken.

Supplemental table 2. Prospective studies on the demand-control-support (DCS) model according to types of blood pressure (BP) measures (office or ambulatory) (BMI=Body Mass Index; Diast=diastolic; JCQ=Job content questionnaire; NS=not significant; Syst=systolic)

First author, year (reference)	N participants (N men / women) Participation rate (PR)	Age at baseline, Population type[a], Country	Study design	D C S indicator, assessment[b] and prevalence	Outcome[c-d]	Covariates[e]	Main results / Comments	
							Results for men	Results for women
Office BP measures								
Reed *et al.*, 1989 (50)	7,750 men PR: not mentioned	45-68 years old, men of the general working population, Honolulu Hypertension workers at baseline not excluded	Prospective 18-year follow-up	JCQ, English version	Office mean BP	Age and BMI	Adjusted differences un mean BP	
							D (high) Syst. BP: + 0 mm Hg Diast. BP: + 0 mmHg **C** (high): Syst. BP: +-2 mm Hg Diast. BP: + 0 mmHg No significant results	
Chapman *et*	2,634	Mean age 34.4	Prospectiv	Questionnaire	Office mean	Age, education, weight,	Partial regression coefficients	

First author, year (reference)	N participants (N men / women) Participation rate (PR)	Age at baseline, Population type[a], Country	Study design	D C S indicator, assessment[b] and prevalence	Outcome[c-d]	Covariates[e]	Main results / Comments	
							Results for men	Results for women
al., 1990 (51)	participants (2,100 men and 534 women), PR:57%	in men and 31.9 in women, Government workers, Australia Workers on medication for hypertension at baseline were excluded	e 5-year follow-up	not mentioned	BP	weight change, physical activity, family history of stroke or hypertension, skinfold thickness, alcohol consumption and change in consumption	no significant association (not shown)	< 35 years old: **D**: Quantitative demands: Diast. BP: 0.08 (p<0.001) **S:** Diast. BP: 0.11(p<0.01) WOMEN ≥50 years old: **C:** -0.25 (p<0.01) No significant association for systolic BP (not shown
Greenlund *et al.*, 1995 (52)	2,665 participants, PR: 57% at baseline and 90% at 7–year follow-up	18-30 years old, black and white workers, USA Hypertensive workers at baseline were not excluded	Prospective5 and 7-year follow-ups	JCQ English version	Office mean BP	Age, education, physical activity, BMI, Framingham A/B personality score, smoking and alcohol	Correlation coefficients	
							WHITE MEN **D:** Syst. BP: -0.019 Diast BP: -0.050 **C:** Syst. BP: -0.031 Diast BP: 0.022 BLACK MEN	WHITE WOMEN **D:** Syst. BP: -0.093 Diast BP: -0.060 **C:** Syst. BP: 0.118 Diast BP: 0.100

First author, year (reference)	N participants (N men / women) Participation rate (PR)	Age at baseline, Population type[a], Country	Study design	D C S indicator, assessment[b] and prevalence	Outcome[c-d]	Covariates[e]	Main results / Comments	
							Results for men	Results for women
							D: Syst. BP: 0.072 Diast BP: -0.113 **C:** Syst. BP: 0.067 Diast BP: 0.004	BLACK WOMEN **D**: Syst. BP: 0.026 Diast BP: -0.007 **C:** Syst. BP: -0.027 Diast BP: 0.017 p value <0.05
Eaker *et al.*, 2004 (53)	3,039 participants (1,711 men and 1,328 women) PR: 75%	18-77 years-old, general working population, USA Hypertensive workers at baseline were not excluded	Prospective, 10 year follow-up	JCQ original English version, Quadrant	Office systolic mean BP	Age, the ratio of total cholesterol to high density lipoprotein cholesterol, BMI, smoking, and diabetes Crude results presented.	Crude difference mean systolic BP: **Job strain**: +1.2 mm Hg p=0.02 **D** (higher median): +1.5 mm Hg (p=0.05) **C** (lowest median): +1.9 mm Hg (p=0.01)	Crude difference mean systolic BP: **Job strain**: +2.5 mm Hg p=0.05 **D** (higher median): -1.00 mm Hg (NS) **C** (lowest median): +2.9 mm Hg (p<0.01)
Markovitz *et al.*, 2004 (54)	3,200 participants (1,443 men	20-32 years old Workers of a normotensive	Longitudinal study (8-year	JCQ completed at baseline and	Office hypertension (160/95	Age, baseline BP, education, BMI, change in BMI, alcohol intake,	**Both genders** Odds ratio of hypertension: **Job strain at baseline :** 1.27	

First author, year (reference)	N participants (N men / women) Participation rate (PR)	Age at baseline, Population type[a], Country	Study design	D C S indicator, assessment[b] and prevalence	Outcome[c-d]	Covariates[e]	Main results / Comments	
							Results for men	Results for women
	and 1757 women) PR: not mentioned	cohort, USA Hypertensive workers at baseline were excluded based on BP measure and medication	follow-up),	at follow-up (change in score for longitudinal analysis), Dichotomous Cumulative exposure	mmHg)	smoking, family history of high BP	(0.47–3.44) **D or C at baseline** : NS **Change in D**: 1.05 (1.01–1.09) **Change in job strain:** 2.06 (1.01–4.26)	
Guimont *et al.*, 2006 (55)	6,719 participants (3,483 men and 3,236 women), PR: 75% at baseline, 89% at follow-up	18-65 years old (mean 41.0±8.2 in men and 38±7.2), employees of 22 public organizations in Quebec City, Canada Workers on medication for hypertension at baseline were excluded	Prospective7.5-year follow-up,	JCQ French version, Quadrant	Office mean BP	Age, BMI, social support at work, living with a child, number of years working for the organization, and baseline systolic or diastolic blood pressure values (controlled but not retained: physical activity, alcohol consumption, smoking, marital status)	Adjusted differences in mean BP **Job strain at both times**: Syst. BP: +1.8 mm Hg (0.1-3.5) Diast. BP:+0.8 mm Hg (-0.5–2.0) **Risk ratios for BP increase in highest quintile** MEN: Syst. BP: 1.33 (1.01–1.76), Diast. BP: 1.07 (0.84–	Adjusted differences in mean BP **Job strain at both times:** Syst. BP:+0.5 mm Hg (-0.8-1.8), Diast. BP: +0.5 mm Hg (-0.5-1.4) **Risk ratios for BP increase in highest quintile** WOMEN: Syst. BP: 1.15 (0.93–1.41), Diast. BP: 1.06 (0.85–1.31)

First author, year (reference)	N participants (N men / women) Participation rate (PR)	Age at baseline, Population type[a], Country	Study design	D C S indicator, assessment[b] and prevalence	Outcome[c-d]	Covariates[e]	Main results / Comments	
							Results for men	**Results for women**
							1.36)	
Kivimaki *et al.*, 2007 (56)	8,086 participants (5,630 men and 2,456 women), PR: 73% at baseline	35-55 years old at baseline (mean 44.3), London-based civil servants, England Hypertensive workers at baseline were not excluded	Prospective 12-year follow-up,	JCQ English version, Quadrant	Office hypertension (≥140/90 mm Hg or medication)	Age, gender, ethnicity, and employment grade	**Both genders:** **Job strain** Prevalence of hypertension: -1.2% Difference in mean BP: Syst. BP: -1.0 mm Hg Diast. BP: 0.0 mm Hg No significant results. Baseline results are also given. There were no significant differences.	
Ohlin *et al.*, 2007 (57)	448 participants (197 men and 251 women) PR not mentioned	Under 63 years old (mean: 55 years old), employed with reading and writing skills, Sweden Hypertensive workers at baseline were not excluded	Prospective study followed for a mean of 6.5 years,	JCQ Swedish version , Quadrant	Office mean BP	Age, time to follow-up, baseline BP, hypertensive medication at baseline and education	Adjusted differences in mean BP: Job strain at baseline: Syst. BP + 7.7 mm Hg (p=0.02), Diast. +5.6 mm Hg (p=0.003) **D**: significant increase in crude syst BP (p=0.02), but when adjusted p=0.095.	Adjusted differences in mean BP: **Job strain:** No associations (not shown). **D:** No association (not shown) **C** (high): significant increase in crude syst BP (p=0.035), but when adjusted

First author, year (reference)	N participants (N men / women) Participation rate (PR)	Age at baseline, Population type[a], Country	Study design	D C S indicator, assessment[b] and prevalence	Outcome[c-d]	Covariates[e]	Main results / Comments	
							Results for men	Results for women
							Diast BP: p=0.075 **C**: no significant increases (not shown)	p=0.23.
Chandola *et al.*, 2008 (58)	10,308 participants at baseline, PR: 67% participation at follow-up (N=6,484) (baseline PR not mentioned)	35-55 years old, 20 civil service departments, London Hypertensive workers at baseline were not excluded	Prospective12-year follow-up	JCQ English version (items not mentioned), Dichotomous	Office hypertension (≥140/85 mm Hg or medication)	Age, gender, employment grade, health behaviors (alcohol consumption, smoking, physical activity, diet)	**Both genders** Adjusted odds ratios: **One report of job strain**: 0.88 (0.67–1.14) **Two reports of job strain**: 1.13 (0.91–1.40)	
Ambulatory BP measures								
Melamed *et al.*, 1998 (59)	145 men from industrial plants PR : 93%	27 to 60 years old (mean 44.1), employed in industrial plants Israel Hypertensive workers at baseline were excluded based	Longitudinal (variations within the same day),	C: 6 items. Work load: 1 item. Not the original JQC instrument. Ratio demand/control	Ambulatory mean BP[f]	Age BMI, baseline (office) BP.	Adjusted differences in mean BP: **Job strain:** Syst. BP: +4.2mmHg (p=0.001 Work load X control interaction)	None

First author, year (reference)	N participants (N men / women) Participation rate (PR)	Age at baseline, Population type[a], Country	Study design	D C S indicator, assessment[b] and prevalence	Outcome[c-d]	Covariates[e]	Main results / Comments	
							Results for men	Results for women
		on BP measure and medication					Diast. BP: +0.1 mmHg (ns) Systolic BP Main effect of **workload**: p=0.023 Main effect of **C**: p=0.046 Diast. BP: NS (not mentioned)	
Schnall *et al.*, 1998 (60)	195 men, PR: PR: 75% at baseline and 77% follow-up rate	30-60 y-old mean, general working population, USA Hypertensive workers at baseline were not excluded	Longitudinal (3 years follow-up),	JCQ English version, Dichotomous Cumulative exposure	Ambulatory mean BP	Age, BMI, race/ethnic group, alcohol use, 24-hour urine sodium excretion, Type A behavior, education, current smoking status, physical activity of the job and work site	Adjusted differences in mean BP **Job strain at both times**: Syst. BP + 11 mm Hg, Diast. BP +7 mm Hg	None
Fauvel *et al.*, 2003 (61)	303 participants (278 men and 25 women), PR: 78%	18-55 years old (mean 38.1), normotensive (<140/90 mm Hg) workers in a chemical company, France	Prospective 5-year	JCQ French version, Dichotomous Cumulative exposure	Ambulatory hypertension (≥140/90 mmHg) Ambulatory mean BP	Age, gender, BMI, alcohol consumption, occupation and sodium intake	**Both genders** Cumulative incidence of hypertension **Job strain:** No significant difference among the incidence curves. Difference mean BP:	

First author, year (reference)	N participants (N men / women) Participation rate (PR)	Age at baseline, Population type[a], Country	Study design	D C S indicator, assessment[b] and prevalence	Outcome[c-d]	Covariates[e]	Main results / Comments	
							Results for men	Results for women
		Hypertensive workers at baseline were excluded, based on BP measure and medication					**Job strain at both times:** 24h syst BP: -2.0 mmHg 24h diast BP: -1.0 mm Hg Worksite syst. BP: 0.0 mm Hg Worksite diast. BP: 0.0 mm Hg No significant results.	
Riese *et al.*, 2004 (62)	159 women PR = 60%	Mean age 35.9 (SD 8.5) years, nurses Netherlands Workers on medication for hypertension at baseline were excluded	Longitudinal study 12.2 month average	JCQ Dutch version, ratio demand/control Cumulative exposure	Ambulatory mean BP	Social support at follow-up, age, oral contraceptive use Waist-hip ratio	None	Adjusted beta coefficients **D/C**: B=0.19 for the interaction term, p=0.02 **D:** B=0.17 p=0.04 **C:** not significant (not shown)
Tobe *et al.*, 2007 (63)	229 participants (106 men and 123 women) PR:69.7%	Mean age: 50.8 (SD 6.5) years, respondents to local advertisement and seminars Toronto, Canada Workers on medication for hypertension at	Prospective 1-year follow-up	JCQ English version, Dichotomous	Ambulatory mean BP	Age gender ethnic background premature CVD education, BMI, smoking, alcohol consumption, participation in a stress management program, income, and physical activity	**Both genders** P-value for adjusted mean change over the last year **Job strain**: Syst. BP change over 1 year: (p=0.011).	

First author, year (reference)	N participants (N men / women) Participation rate (PR)	Age at baseline, Population type[a], Country	Study design	D C S indicator, assessment[b] and prevalence	Outcome[c-d]	Covariates[e]	Main results / Comments	
							Results for men	Results for women
		baseline were excluded						

[a] For example, the population could be composed of working participants or participants from the general population.
[b] ERI: effort-reward imbalance. OC: overcommitment. ERI and OC assessment: questionnaire used (original Siegrist's questionnaire or else), number of items used and number of times assessed.
[c] Hypertension or mean blood pressure.
[d] Office or ambulatory. The number of readings is mentioned.
[e] Listing of all covariates considered for adjustment.
[f] Office measures were also taken.

Supplemental table 3. Cross-sectional and prospective studies on the effort-reward imbalance (ERI) model according to types of blood pressure (BP) measures (office or ambulatory) [BMI=Body Mass Index; OC=overcommitment]

First author, year (reference)	N participants (N men / women), Participation rate (PR)	Age[a], Population type[b], Country	ERI and OC indicator, assessment[c] and prevalence	Outcome[d-e]	Covariates[f]	Main results	
						Men	Women
CROSS-SECTIONAL STUDIES							
Office BP measures							
Peter *et al.*,1997 (64)	179 men PR: 95%	40-55 years old (48.3±4.6),Middle managers in a car producing company, Germany	Original Siegrist's questionnaire	Office hypertension (160/95 mmHg)	Age, BMI, smoking, alcohol consumption, physical activity, medication for hypertension	Adjusted odds ratio: **ERI**: 5,77 (1,47–22,72)	None

First author, year (reference)	N participants (N men / women), Participation rate (PR)	Age[a], Population type[b], Country	ERI and OC indicator, assessment[c] and prevalence	Outcome[d-e]	Covariates[f]	Main results	
						Men	Women
		Workers on medication for hypertension not excluded but controlled for					
Peter *et al.*, 1998 (65)	3,427 participants (1,913 men and 1,514 women), PR: not mentioned	30-55 years old, workers from 40 companies, Sweden Workers on medication for hypertension not excluded but controlled for	Proxys to the Siegrist's questionnaire	Office hypertension (160/95 mmHg)	Age, BMI, smoking, alcohol, physical activity, cholesterol, fibrinogen, socioeconomic status	Adjusted odds ratios: **ERI:** 1.62 (1.07–2.43) **OC:** 0.83 (0.53–1.29)	Adjusted odds ratios: **ERI:** 1.56 (0.92–2.66) **OC:** 0.84 (0.48–1.45)
Peter *et al.*, 1999 (66)	2,288 men PR: not mentioned	30-55 years old, workers from 40 companies, Sweden Workers on medication for hypertension not excluded but controlled for	Original Siegrist's questionnaire	Office hypertension (160/95 mmHg)	Age, BMI, smoking, alcohol consumption, physical activity	Adjusted odds ratios: **In day workers (N=1215):** **ERI**: 1.35 (0.77–2.36) **OC**: 0.91 (0.51–1.61) **In day and late shift workers** (N=597): **ERI:** 2.21 (1.10–4.42) **OC:** 1.13	None

First author, year (reference)	N participants (N men / women), Participation rate (PR)	Age[a], Population type[b], Country	ERI and OC indicator, assessment[c] and prevalence	Outcome[d-e]	Covariates[f]	Main results	
						Men	Women
						(0.58–2.20)	
Irie *et al.*, 2004 (67)	441 participants (340 men and 101 women) PR: 87.8%	19-68 years old (men: 44.0±8.1 and women 42.8±6.9) 188 white-collar workers and 253 blue collar workers, Japan Workers on medication for hypertension not excluded	Siegrist's questionnaire, Japanese version	Office mean BP	Age, gender, BMI, smoking, physical activity, alcohol consumption, medical history	**Both genders** Adjusted Spearman's correlation coefficients **ERI:** Syst. BP: -0.024 (p=0.660) Diast. BP: -0.059 (p=0.284) **OC:** Syst. BP: -0.026 (p=0.619) Diast. BP: -0.041 (p=0.432)	
Xu *et al.*, 2004 (68)	421 women PR: 93.5%	18-59 years old (mean 38.8), General working population, China Workers on medication for hypertension not excluded	ERI questionnaire, Chinese version	Office mean BP	Age, BMI, education, physical activity (total number of walking hours during and after work), use of oral contraceptives	None	Adjusted mean BP: **ERI:** Syst. BP: +3 mmHg (p value 0.036) Diast. BP: +1.3 (p=0.184)
Kobayashi *et al.*, 2005 (19)	1,401 women PR: 50%	35-63 years old, workers of a retail business in Miyagi Prefecture, Japan	Siegrist's questionnaire, Japanese version	Office hypertension (140/90 mm Hg)	Age, smoking, alcohol consumption, physical activity, occupation, education, marital status, medication, pregnancy history, relative weight	None	Adjusted odds ratios: **ERI**: Syst. BP: 0.88 (0.55–1.40) Diast. BP:

First author, year (reference)	N participants (N men / women), Participation rate (PR)	Age[a], Population type[b], Country	ERI and OC indicator, assessment[c] and prevalence	Outcome[d-e]	Covariates[f]	Main results	
						Men	Women
		Workers on medication for hypertension not excluded but controlled for					0.92 (0.56–1.51)
Yu *et al.*, 2008 (69)	452 participants (281 men and 165 women) PR: not mentioned	22-58 years-old (37±6.5), workers from a thermal power plan, China Workers on medication for hypertension not excluded	ERI questionnaire ,Chinese version	Office hypertension (140/90 mm Hg or medication)	Age, gender, education, marital status, income, length of service, BMI, family hypertensive history, salt intake, smoking, caffeine and alcohol consumption, and physical activity	Adjusted odds ratios hypertension: **Both genders:** **ERI**: 2.12 (1.23–3.67) **OC, Effort, Reward**: not significant (not shown).	
						ERI: 3.13 (1.72–5.70)	**ERI:** 0.63 (0.20–1.98)
Bellingrath *et al.*, 2009 (70)	104 women PR: not mentioned	25-61 years old (mean: 45, 9.75), Healthy female school teachers, Germany and Luxembourg Workers on medication for hypertension not excluded	ERI, Siegrist's questionnaire, German version	Office mean BP	Age	None	Adjusted partial correlations with **ERI** (d of Cohen): Syst. BP: -0.08 mm Hg Diast. BP: 0.02 mm Hg
Ambulatory BP measures							

First author, year (reference)	N participants (N men / women), Participation rate (PR)	Age[a], Population type[b], Country	ERI and OC indicator, assessment[c] and prevalence	Outcome[d-e]	Covariates[f]	Main results	
						Men	Women
Vrijkotte *et al.*, 2000 (71)	109 men PR: 57%	47.2±5.3 years old, white-collar workers at the same company, Amsterdam, Netherlands Workers on medication for hypertension excluded	ERI questionnaire Dutch version	Ambulatory mean BP Mild hypertension (Diastolic BP: ≥85)	Age, waist-to-hip ratio, BMI, waist circumference, smoking, alcohol consumption, education, years of service, physical activity, positive mood, and negative mood	Adjusted mean BP: **ERI:** Syst. BP: +3.9 mmHg (p=0.049) Diast. BP: no effect (not shown) Mild hypertension: **ERI** had no effect (not shown)	None
Steptoe *et al.*, 2004 (72)	197 participants (105 men and 92 women) PR: 55%	45-59 years old, London-based civil servants, UK Hypertensive workers were excluded (based on a previous diagnosis or medication)	ERI questionnaire, English version (5 items efforts, 7 items reward, 5 items OC), prevalence not shown	Ambulatory mean BP	Age, BMI, smoking, physical activity, job control	**Both genders** Adjusted mean BP: **ERI**: no effect in men and women (not shown) **OC** in men over the day: **OC** in women: Syst. BP: not significantly higher in the morning, similar in the other periods of the day (not shown) **OC** had no effect on Diast. BP in men and women (p=0.20)	
Maina *et al.*, 2011 (48)	100 participants (26 men and 74 women)	36.0±2.1 years old (men) and 34.9±1.1 years old (women)	Siegrist's questionnaire, Italian version	Ambulatory mean BP	Age, gender, smoking, alcohol consumption, education	**Both genders** Adjusted mean BP: **ERI:** Adjusted Syst. BP at work:	

First author, year (reference)	N participants (N men / women), Participation rate (PR)	Age[a], Population type[b], Country	ERI and OC indicator, assessment[c] and prevalence	Outcome[d-e]	Covariates[f]	Main results	
						Men	Women
	PR: 30%	Volunteers from two call centers, Italy Workers on medication for hypertension excluded				+4.52 (0.16-9.20) Adjusted Diast. BP at work: +4.17 (0.50-7.85) Beta coefficients: **Effort:** Syst. BP: 0.5 (-3.2–4.2) Diast. BP: 1.3 (-1.9–4.6) **Reward:** Syst. BP: -0.6 (-3.6–2.5) Diast. BP: -0.3 (-2.9–2.4) **OC:** Syst. BP: -1.5 (-4.8–1.8) Diast. BP: -1.1 (-3.7–1.6)	
PROSPECTIVE STUDY							
Ambulatory BP measure							
Gilbert-Ouimet *et al.*, 2011 (73)	1,595 participant (629 men and 966 women), PR: 79.5%	44.0±8.1 years old (men) and 42.8±6.9 years old (women) White-collar workers, Quebec City (Canada) Hypertensive workers at	ERI and OC, Siegrist's questionnaire, French version Cumulative exposure	Ambulatory mean BP Cumulative incidence of hypertension (135/85 mm Hg or medication)	Age, gender, education, income, marital status, BMI, waist circumference, family history of CVD, medication, diabetes, smoking, alcohol consumption, physical activity, situations that may affect BP during measurement	**ERI:** **Adjusted mean BP:** Syst. BP: +0.17 (p=0.84) and Diast. BP: +0.42 (p=0.83) **Adjusted cumulative incidence ratios of hypertension:** 1.04 (0.56–	**ERI:** **Adjusted mean BP in women exposed at both times :** <45 years old: Syst. BP: +1.86 (p=0.05) and Diast. BP: +1.48 (p=0.02). ≥45 years old:

First author, year (reference)	N participants (N men / women), Participation rate (PR)	Age[a], Population type[b], Country	ERI and OC indicator, assessment[c] and prevalence	Outcome[d-e]	Covariates[f]	Main results	
						Men	Women
		baseline were excluded (based on BP measure and medication) (for analysis on cumulative incidence of hypertension)				1.95) **OC**: **Adjusted BP means in men in highest tertile:** Syst BP: +1.66 (p=0.02) Diast. BP: +0.89 (p=0.10)	Syst. BP: +0.06 (p=0.95) and Diast. BP: -0.26 (p=0.70). **Adjusted cumulative incidence ratios of hypertension in women exposed at both times**: < 45 years old: 1.20 (0.53–2.75) ≥45 years old: 2.78 (1.26–6.10) **OC**: Adjusted BP means in women in highest tertile: Syst BP= +1.28 (p=0.03) Diast. BP= +1.02 (p=0.01)

[a] In prospective studies, age at baseline is presented.
[b] For example, the population could be composed of working participants or participants from the general population.
[c] ERI: effort-reward imbalance. OC: overcommitment. ERI and OC assessment: questionnaire used (original Siegrist's questionnaire or else), number of items used and number of times assessed.
[d] Hypertension or mean blood pressure.
[e] Office or ambulatory. The number of readings is mentioned.
[f] Listing of all covariates considered for adjustment.

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CHAPITRE 4: Effect of the double exposure to psychosocial work factors and high family responsibilities on blood pressure: A 5-year prospective study among white-collar working women

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RÉSUMÉ

OBJECTIF: De plus en plus d'évidences montrent que les contraintes psychosociales au travail peuvent contribuer à l'augmentation de la pression artérielle (PA). Les femmes sont davantage exposées que les hommes aux contraintes psychosociales au travail des modèles demande-latitude (DL) et déséquilibre efforts-reconnaissance (DER). De plus, les femmes consacrent en moyenne deux fois plus d'heures par semaine aux responsabilités familiales que les hommes (30,1 comparées à 17,5). Endosser les rôles de mère et d'employée dans des conditions néfastes peut nuire à la santé cardiovasculaire. L'objectif de la présente étude est d'évaluer, sur 5 ans, l'effet de la double exposition à certaines contraintes psychosociales au travail (modèles DL et DER) et à des responsabilités familiales élevées sur la PA des femmes.

MÉTHODES: La présente étude inclut 1215 travailleuses de trois entreprises publiques québécoises du secteur de l'assurance. Les données ont été collectées à trois reprises; au recrutement, 3 et 5 ans plus tard. Les contraintes psychosociales des modèles DL et DER ainsi que les responsabilités familiales ont été mesurées par questionnaire. La PA ambulatoire a été mesurée aux 15 minutes, durant 7 heures de travail. Les moyennes de PA ont été modélisées par analyse de covariance.

RÉSULTATS: Aucun effet n'a été observé en fonction de la double exposition au job strain et aux responsabilités familiales élevées sur la PA moyenne. Par ailleurs, les femmes ayant une double exposition au DER et aux responsabilités familiales élevées avaient une moyenne de PA ajustée significativement plus élevée que les femmes non exposées à ces contraintes : au recrutement (diastolique : +2,75 mm Hg), à trois ans (systolique : + 2,22 mm Hg et diastolique : +2,55 mm Hg) et à cinq ans ((systolique : + 2,94 mm Hg et diastolique : +3,10 mm Hg).

CONCLUSION: Ces résultats suggèrent que la double exposition au DER et à des responsabilités familiales élevées contribue à l'élévation de la PA des femmes. Les élévations semblent se manifester rapidement et persister dans le temps.

Abstract

OBJECTIVES: A growing body of research shows that psychosocial word factors of the demand-control (DC) and effort-reward imbalance (ERI) models may contribute to increase blood pressure (BP). Women are more likely to be exposed to these psychosocial factors than men. In addition, women spend approximately twice as much time per week to family responsibilities than men (30.1 compared to 17.5). Multiple roles, such as being a mother and an employee may induce a physiological and a psychological stress leading to cardiovascular health problems. This study aims to evaluate the effect of the double exposure to adverse psychosocial work factors and high family responsibilities on women BP over a 5-year follow-up.

METHODS: The study was composed of 1,215 working women assessed at baseline and 3-year and 5-year follow-ups. Ambulatory BP measures were taken every 15 minutes during a working day. Psychosocial work factors of the DC and ERI models were self-reported by questionnaire using validated scales. Family responsibilities were also self-reported, using items related to "the number of children and their age" and "housework and children care". BP means at baseline and follow-ups were respectively modeled with analyses of covariance.

RESULTS: No effet was observed for the double exposure to job strain and high family responsibilities on women' BP. However, women having a double exposure to ERI at work and high family responsibilities had higher BP mean level than women not exposed to these factors. Indeed, statistically significant associations have been observed between the double exposure assessed at baseline and fully adjusted BP mean at baseline (diastolic: +2.75 mm Hg), at 3-year follow-up (systolic: +2.22 mm Hg and diastolic: +2.55 mm Hg), and at 5-year follow-up (systolic: +2.94 mm Hg and diastolic: + 3.10 mm Hg).

CONCLUSION: A double exposure to effort-reward imbalance at work and high family responsibilities might contribute to elevate women's BP. Also, BP elevations related to this double exposure might occur quickly and persist over several years.

Introduction

Cardiovascular diseases (CVD) are the leading cause of death worldwide (1). High blood pressure (BP) is a major risk factor of CVD (2). It accounts for an estimated 54% of all strokes and 47% of all ischemic heart diseases (3). Contrary to popular thinking, women are about as likely as men to develop high BP during their lifetimes. In Canada and USA, approximately a third of adults have high BP, with percentages being almost identical between genders (ex. 32.7% of women vs. 34.1% of men in USA) (4, 5). Prospective studies have shown that the risk of cardiovascular mortality grows linearly with BP from 115/75 mm Hg in adults aged 40-69 years-old with no CVD (6). A growing body of research shows that psychosocial work factors may contribute to increase BP (7, 8). Women are generally more exposed than men to these work factors (9).

Two well-defined and internationally recognized theoretical models are generally used to measure psychosocial work factors: the demand-control (10) and effort-reward imbalance models (11). The two-dimensional demand-control model suggests that workers simultaneously experiencing high psychological demands and low job control are more likely to develop stress related health problems (10). For its part, the effort-reward imbalance model proposes that workers are in a state of detrimental imbalance when high efforts at work are accompanied by low rewards (e.g. low respect and esteem, few promotion prospects, forced job changes) (12).

Even if women are generally more exposed than men to these work factors, the adverse effect on their BP level is still unclear. In fact, only 18% of previous studies on psychosocial work factors and BP showed an adverse effect among women (7). Family responsibilities may play an important role in this relationship. In Canada, women spend approximately twice as much time per week performing these responsibilities compared to men (30.1 compared to 17.5 hours) (13). Even if being both a mother and an employee might be stimulating and beneficial to the overall health (14), performing these roles under adverse conditions could be harmful (14). Therefore, holding both a stressful job and having high family responsibilities could lead to the development of health problems.

Four previous studies reported that being exposed to both adverse psychosocial work factors and high family responsibilities was associated with higher BP level (15-18). These studies were however limited by cross-sectional designs and by an evaluation of psychosocial work factors from only one theoretical model (demand-control or effort-reward imbalance). The current study aims to examine the effect of the double exposure to adverse psychosocial work factors and high family responsibilities on BP, using a 5-year longitudinal design and psychosocial work factors from both demand-control and effort-reward imbalance models. This study will also be the first to examine the persistence of the effect over time.

Objectives

The current study aimed to: 1) evaluate the effect of the double exposure to psychosocial work factors and high family responsibilities on women BP means and 2) explore the persistence of the effect over 3 and 5 years.

Psychosocial work factors of the demand-control and effort-reward imbalance models were evaluated separately. Also, the potentially modifying effects of age, social support at work and overcommitment were explored.

Methods

Population and study design

One thousand seven hundred fifteen women, working in three public insurance companies were invited to participate to this prospective cohort study (Figure I). Their main activities involved organizing and providing insurance services to the general population. Data collection was performed at three time points: at baseline (2000-04), 3 years later (2004-06), and 5 years later (2006-09). Participation rates of these data collections were of 80.9%, 86%, and 85% respectively.

At baseline, 1,391 women agreed to participate (Figure 1). Their jobs encompassed a wide range of white-collar occupations, including office workers (37.9%), technical (29.7%), professional (29.1%), and senior management (3.3%). To be included in this study, women had to: 1) work at least 21 hours a week, 2) have worked for one of the three organizations for more than 3 months, and 3) not be pregnant. The application of the criteria led to the inclusion of 1,215 women for the baseline data analysis (Figure I). Of the baseline population, 13% (N=158) were either dead, lost at follow-up, refused to participate, on long absence leave, or had missing values for BP at the 3-year follow-up. At the 5-year follow-up, 19% (N=226) were lost or excluded for these reasons (Figure I). The study populations were thus composed of 1,043 and 973 women at the 3- and 5-year follow-ups, respectively (Figure I).

Data collection and Variables

At baseline and both follow-ups, workers completed a self-administered questionnaire on demographic and socioeconomic characteristics, cardiovascular risk factors, characteristics of work, and family responsibilities and social life. Trained staff measured weight, height, and waist circumference.

Ambulatory blood pressure

Ambulatory BP was collected with the oscillometric device Spacelabs 90207 (Spacelabs Medical Products Ltd., St-Laurent, Quebec, Canada), which was validated by independent investigators (Association for the Advancement of Medical Instrumentation and British Hypertension Society (19)). In a research office at the participant's workplace, the device was installed on the nondominant arm if the BP difference measured on both arms was inferior to 10 mmHg. Otherwise, it was installed on the arm showing the higher BP level. After the participant had been sitting for 5 minutes, BP was measured three times in the presence of trained personnel using the office check mode of the Spacelabs monitor. These first measures were excluded from analysis. Ambulatory BP was defined as the mean of the next readings taken every 15 minutes and recorded by the same monitor during regular daytime work (from 8:00 to 16:00). In the present study, participants must have been measured at least 20 times, which is in accordance with more stringent criteria recently recommended by expert committees (20).

The outcome variable was the BP means at baseline, 3-year follow-up, and 5-year follow-up. Systolic and diastolic BP were analyzed separately.

Psychosocial work factors of the demand-control and effort-reward imbalance models

Psychosocial work factors have been collected using self-administered questionnaires. Items used a 4-point Likert-type response format ranging from 1 (strongly disagree) to 4 (strongly agree).

Psychological demands, job control (measured with 9 items each), and social support from colleagues and supervisor (measured with 6 and 5 items, respectively) were evaluated using the French version of the Karasek Job Content Questionnaire. The psychometric qualities of this version have been demonstrated (21, 22). Psychological demands and job control were dichotomized at the median that was observed in a random sample of all Quebec workers. Job strain was defined as a combination of high psychological demands and low job control. Scores of social support were divided into tertiles.

Effort was assessed using 4 items (Cronbach alpha = 0.65); two original items of the French version of the Siegrist questionnaire (“having to do overtime” and “in recent years, my job became more demanding” (23)) and two proxies ("I have enough time to do my job" and "my task is often interrupted before I finish it, so I must come back later”). Reward was evaluated using the 11 original items recommended by Siegrist: esteem (five items), promotions and salary (four items), and job security (two items) (23). Psychometric properties of this French scale have been demonstrated (24). Overcommitment was measured only at 3-year and 5-year follow-ups using the 6 original items related to the inability to withdraw from work obligations (five items), and impatience and irritability (one item).The imbalance score was obtained by calculating the ratio between effort and reward. A ratio greater than 1 indicated an imbalance between efforts and reward. Overcommitment scores in the upper tertile indicated a high level.

Missing values for one item on the effort or overcommitment scale, or for two items or less on the psychological demands, job control, social support or reward scale were imputed on the mean score drawn from the other participants’ answers to those items.

Imputation was performed for 2% of the participants. Workers with more missing values were excluded from the analyses (a total of approximately 0.5%).

Family responsibilities

Family responsibilities have been self-assessed using a questionnaire adapted from Brisson *et al.* (1999) (25). Family responsibilities were divided in two scales: "number of children and their age" and "housework and children care".

Number of children and their age: Hours spend performing family responsibilities is proportional to the number of children and their ages (26, 27). Younger children were therefore ascribed more weight than older children (26, 27). Children in the age category 0 to 5, 6 to 11, 12 to 17 et 18 to 20 years-old were, respectively, weighted 3, 2.5, 2, and 1.5 (25, 28). The algorithm applied to calculate the score of this index was: (3 x number of children aged 0 to 5 years-old) + (2,5 x number of children aged 6 to 11 years-old) + (2 x number of children aged 12 to 17 years-old) + (1,5 x number of children aged 18 to 20 years-old) (25, 28).

Housework and children care: Two tasks related to housework were evaluated: meal preparation and cleaning inside the house. Two items were used to measure children care: who takes care of the children at home and who is responsible for children care and activities outside the house (doctor, dentist, school, recreational activities, etc.). Women had to answer whether the task was: i) primarily performed by themselves, ii) performed with the help of another person (spouse, child, or someone else), iii) primarily performed by another person, or iv) not performed, which respectively gave them a score of 1, 0.5, 0, and 0. The algorithm was the sum obtained for these four tasks.

High family responsibilities: This index represents the product of both "number of children and their age" and "housework and children care" indexes' scores. The algorithm was: (number of children and their age + 1) x (housework and children care) (25, 28). The higher tertile indicated the higher level of exposure.

Double exposure to psychosocial work factors and high family responsibilities

Women were classified according the double exposure to psychosocial work factors and high family responsibilities. Four exposure categories were created: i) exposed to both psychosocial work factors and high family responsibilities (double exposure), ii) exposed only to psychosocial work factors (intermediate exposure), iii) exposed only to high family responsibilities (intermediate exposure), and iv) not exposed to either group of factors (reference group).

Psychosocial work factors of the demand-control model and of the effort-reward imbalance models were evaluated separately. Exploratory analyses were also performed to evaluate the effect of double exposures to psychosocial work factors and: i) having children (yes/no), ii) number of children and their age, and iii) housework and children care.

Covariates

Covariates included well-known and suspected cardiovascular risk factors:

Demographic characteristics: age (continuous), education (secondary school or less, college, university), and marital status (single/divorced/widower or married/civil union).

Clinical risk factors: overweight (body mass index ≥ 25, BMI = weight (kg)/height (m^2)), known family history of CVD (yes/no), diabetes (yes/no), and medication for hypertension (yes/no). Menopause (yes/no), oral contraceptives, and menopausal hormone therapy (yes/no), were only available at 3-year and 5-year follow-ups.

Lifestyle risk factors: smoking (≥ 1 cigarette/day), alcohol consumption (≥ 6 consumptions/week), and leisure time physical activity (≤ 1 time/week). The occurrence of ≥1 individual stressful life event(s) during the past twelve months was also evaluated (ex. losing one's job, being sick, divorce or death of a spouse, financial difficulties, etc.).

Repeated measures were used to take into account potential changes over time (except for age, education, and family history of CVD).

Analyses

Analyses were conducted separately for systolic and diastolic BP. Student *t* test and χ^2 analyses were used to compare baseline characteristics. Analysis of covariance (ANCOVA) was used to evaluate the association between psychosocial work factors, family responsibilities and BP means. All covariates were included in the adjusted models. Complementary analyses in which there was no adjustment for potentially intermediate factors, *i.e.* overweight, smoking, excessive alcohol consumption and leisure time activity, were also performed to evaluate an eventual over-adjustment. In addition, the potentially modifying effect of age, social support at work and overcommitment were explored using stratified analyses. Multiplicative interaction terms between the double exposures and potentially modifying factors were calculated from the adjusted model.

P-values were calculated with a partial F test. The level of statistical significance was set at 0.05. All analyses were performed with SAS 9.2 software.

Results

Table 1 summarizes the participants' baseline characteristics and presents crude BP mean level according to these characteristics. The overall mean ± standard deviation (SD) of systolic and diastolic BP were, respectively, 122.0 ± 10.3mm Hg and 78.2 ± 7.4 mm Hg. BP was higher among overweighed women, and those having sedentary behaviours, alcohol consumption or a family history of CVD. BP was also higher in women ≥ 45 years old. Smoking status, education, marital status, diabetes and oral medication (oral contraceptive and menopausal hormone therapy) were not associated with BP.

Table 2 presents adjusted BP means according to the four family responsibility measures; i) having children, ii) number of children and their age, iii) housework and children care, and iv) high family responsibilities (i.e. the summation of "number of children and their age" and "housework and children care" indexes) at baseline, 3-year follow-up, and 5-year follow-up. Only the association with "housework and children care" was borderline significant (+1.3 mm Hg).

Tables 3 and 4 present BP means according to psychosocial work factors and family responsibilities. The double exposure to job strain and high family responsibilities was not associated with BP (Table 3). However, women having a double exposure to effort-reward imbalance at work and high family responsibilities had higher BP means than women not exposed to these factors at baseline (diastolic: +2.6 mm Hg), 3-year follow-up (diastolic: +2.4 mm Hg), and 5-year follow-up (systolic: +3.1 mm Hg and diastolic: +2.6 mm Hg) (Table 4). Women having a double exposure to effort-reward imbalance and i) having ≥ 1 child or ii) high housework and children care also had higher BP mean level, mainly for diastolic BP at baseline and 3-year follow-up (Table 4).

Age had a modifying effect on the effect of psychosocial work factors and family responsibilities on BP (Appendix 6). Indeed, at the 3-year and 5-year follow-ups, women aged ≥45 years-old exposed to both job strain and high family responsibilities had significantly higher systolic and diastolic BP means compared to non-exposed women (*p*-values for interaction ≤0.05, Table 1, Appendix 6). No such differences were observed in younger women. The same phenomenon was observed for the double exposure to effort-reward imbalance and high family responsibilities at the 5-year follow-up (diastolic BP: +6.7 mm Hg, *p*-value for interaction <0.01, Table 2, Appendix 6). It is nonetheless important to be careful about these findings since they rely on very few exposed women aged ≥45 years-old (N=9 to 10).

Social support at work did not modify any association with job strain (*p*-value for interaction >0.15, Table 3, Appendix 6). Overcommitment did not modify any associations with ERI (*p*-value for interaction >0.15, Table 4, Appendix 6).

Discussion

In the current study, women had higher BP means when simultaneously exposed to effort-reward imbalance at work and high family responsibilities. The deleterious effects were observed at all three measurement points, suggesting a temporal persistence.

The BP differences observed in the current study ranged between +1.5 and +3.1 mm Hg. Such differences might have an important population-based impact (29, 30). Indeed, even a 2 mm Hg lower systolic BP would lead to a reduction of middle age mortality from coronary heart disease and stroke of about 7% and 10%, respectively (29, 30). For its part, a 2 mm Hg lower diastolic BP would translate in a reduction of 17% of hypertension prevalence (31), a major risk factor of cardiovascular diseases (2). Such reductions may thus prevent numerous premature deaths and disabling strokes (29).

Five previous studies have evaluated the effect of effort-reward imbalance on BP. Only two of out of five observed a deleterious effect (7). In the current study, exposure to both effort-reward imbalance and high family responsibilities had a stronger effect on BP than exposure to effort-reward imbalance alone. As recently pointed out by Portela *et al.* (18), this enhances the importance of evaluating men and women separately in occupational studies. It also suggests that adjusting for gender rather than stratifying may contribute to under- or overestimate the effects of psychosocial work factors due to unaccounted differences between men and women.

Only one previous study evaluated the association between the double exposure to effort-reward imbalance at work and family responsibilities and BP (17). In line with our results, Xu *et al.* (2004) observed higher systolic BP mean (+6.5 mm Hg) among women exposed to both effort-reward imbalance and family stress compared to unexposed women. Their cross-sectional study included 421 Chinese women. Family responsibilities were defined using five dimensions, namely relationship with spouse, household workload, sexual relationship, childcare and education, job and family role conflict.

Only 4/20 of the previous studies on job strain and women's BP observed an adverse effect (7). However, the three previous studies on the double exposure to job strain and high family responsibilities observed an adverse effect on women's BP (15, 16, 18).

The BP mean differences observed ranged from +1.8 to 20.5 mm Hg. Caution is nonetheless needed regarding these findings due to cross-sectional designs (15, 16, 18) and small sample sizes (N of 6 and 8 women having the double exposure (15, 18)). In the current study, women aged ≥45 years-old exposed to both job strain and high family responsibilities had a higher BP mean compared to non-exposed women (Table 3, Appendix 6). These results however rely on few exposed women (N≤10).

In the current study, the effects of the double exposure were different according to the psychosocial work factors evaluated, i.e. job strain or effort-reward imbalance. Although the job strain and effort-reward imbalance models overlap by measuring the workload (the 'efforts' and 'psychological demands' components), these models differ by measuring either job control or reward. While the job control covers task-level characteristics, reward includes broader socioeconomic conditions, such as salaries, promotion prospects and job stability. It has been hypothesized that the adverse effects could be higher when one feels that an 'injustice' is attributable to 'out of control' conditions (32). This could contribute to explain the higher estimates observed for the double exposure involving ERI, as women of the current study were working in public organizations where there are strict governmental rules concerning salaries and promotion prospects. For job control, the adverse effect could be more pronounced among older women. While younger women having high family responsibilities may benefit from a job involving less decision making and more repetitive tasks (5, 36), older women may have attained a stage in their life where children have grown and where they expect to hold a job in which their skills are solicited and enriched (a job with high job control). In line with this interpretation, only older women (≥45 years-old) exposed to job strain and high total family responsibilities had a higher systolic and diastolic BP mean in the current study (at 3- and 5-year follow-ups).

Methodological issues

The adverse effects of the double exposure to effort-reward imbalance and high family responsibilities on BP persisted over the 5-year follow-up. Complementary analyses adjusting for baseline BP level have been performed to evaluate whether these effects increased over time. After adjusting for baseline BP level, systolic and diastolic BP means at the 3-year and 5-year follow-ups were 1 to 3 mm Hg lower and became non-significant compared to BP obtained when analyses did not controlled for baseline BP (Table 5, Appendix 6). This suggests that although the adverse effects persisted over time, they did not increase. This is in line with the findings of Ohlin *et al.* (2007), who also observed a non-significant effect of job strain on BP after adjusting for baseline BP level (32). This is also in line with a potential horse racing effect (33, 34), suggesting that adjusting for baseline BP level cancel an ongoing effect at baseline.

The adjusted estimates of the current study include potentially intermediate factors (factors in the etiologic chain linking psychosocial factors to BP), which could contribute to underestimate associations (35). A complementary analysis showed that removing these factors (i.e. physical inactivity, overweight, alcohol consumption, and smoking) from the adjusted models only led to slight increases in the estimates (+0.02 to +0.32 mm Hg, Tables 6-7, Appendix 6). Keeping these factors in the adjusted models allowed estimating a more 'direct' effect of the double exposure to psychosocial work factors and family responsibilities on BP.

To obtain a more in-depth portrait of the role of family responsibilities in the relationship between psychosocial work factors and BP, we performed a complementary analysis evaluating the modifying effect of these responsibilities in the associations between i) job strain or ii) effort-reward imbalance and BP (Table 8, Appendix 6). This complementary analysis led to similar findings as those of the main analysis. However, for effort-reward imbalance, higher systolic BP mean differences were observed in this complementary analysis at baseline (+2.65 versus +1.65 mmHg) and at the 3-year follow-up (+3.42 versus +2.43 mmHg) (*p*-values for interaction <0.10, Table 8, Appendix 6). This finding is consistent with the fact that women having no ERI but having high family responsibilities had a significantly lower BP mean level than women unexposed to both exposures (main analyses, Table 4). This might be due to the fact that being a mother and holding household responsibilities comes with a beneficial feeling of accomplishment, even when those responsibilities are high, as long as efforts at work are duly rewarded.

Limitations and strengths

The current study has some limitations. First, a potential selection bias due to refusals, losts at follow-up or exclusions for missing values was investigated at the 3- and 5-year follow-ups. Complementary analyses revealed that such bias is unlikely for refusals and lost at follow-ups since these non-participants did not differ from participants regarding exposures and BP (. However, differences were observed between women included in the analyses and women excluded for missing values at the 3- and 5-year follow-ups. Women excluded were proportionnaly more likely to be exposed to ERI (34% vs. 27.6% at 3-year p=0.18 and 31.9% vs. 24.5% at 5-year, p=0.31) and job strain (32.8% vs. 22.6% at 5-year, p<0.05) than women included in the analyses (Tables 11-13, Appendix 6). Also, women excluded had higher BP means at the 3- and 5-year follow-ups (+7.1 and +16.5 mm Hg, respectively, p<0.05). A selection bias underestimating the differences observed is therefore possible. Even if these exclusions (N=94 at 3-year and N=119 at 5-year follow-ups, Figure 1) could have led to a healthier cohort, they mainly consisted of women having an insufficient number of BP measurements. These exclusions were thus performed to ensure the validity of the study outcome.

Second, only baseline exposures to psychosocial work factors and family responsibilities were evaluated. Measuring the exposures at a single time-point could have led to a misclassification bias (generally leading to an underestimation of the true effect) due to changes in exposures over the course of the follow-up. Finally, family responsibilities were measured using items related to the number of children, their age, housework, and child care. Even though these items provide a global sense of family responsibilities, they do not capture all the scope of these variables. This might have led to an underestimation of the true effects.

The current study has also several strengths. Among those are a high participation rate at all three time-points, a longitudinal design, a good consideration of potential confounders, and a large sample of women. Another strength is the use of ambulatory BP measures instead of clinical-type measures. Ambulatory measures capture the BP fluctuations related to daily life and avoid the observer error and "white-coat effect." Compared to casual clinical BP measures, ambulatory measures are a better predictor of cardiovascular outcomes (36) and are more strongly associated with various measures of target organ damage (37, 38). For practical reasons, only daytime BP measures have been taken. However, Boggia *et al.* (2007) showed that daytime BP predicts the 10-year incidence of fatal and non-fatal cardiovascular outcomes just as well as night-time BP does (42). In addition, the current study was the first to explore the temporal persistence of the deleterious effects of the double exposure to psychosocial work factors and family responsibilities on BP. Moreover, few data were missing (0.5-1.5% of subjects had missing values for psychosocial work factors and family responsibilities).

Future research

Previous studies on family responsibilities and BP did not use a standard definition to measure these responsibilities. In line with the current study, previous studies generally used items related to the number of children <18 years-old, children care and domestic work. More comprehensive measures included questions about tasks outside the house (ex. grass mowing, snow clearing), taking care of a person with loss of autonomy, family budget, car maintenance, and playtime with children. Future research would benefit from a standardized and validated questionnaire on family responsibilities.

Future research might also want to further investigate the effect of work-to-family and family-to-work conflicts on women's BP. These constructs rely on the *scarcity hypothesis,* postulating that an individual has a fix and limited quantity of energy and resources (39). The various spheres of life could thus enter in competition with each other (39). Compared to the double exposure to adverse psychosocial work factors and family responsibilities, these constructs adds complementary information by indicating whether the requirements of the professional life interfere with the requirements of the personal life (work-to-family conflict) or the reverse (family-to-work conflict) (40). Previous studies showed that working mothers tend to feel stressed out and guilty when the needs of one or the other area enter in conflict (41). To our knowledge, only one previous study evaluated the association between work-family conflict and BP (42). This study observed no significant association. However, it was limited by cross-sectional design and used clinical BP measures.

Future research might also want to account for marital cohesion since two studies showed that a low cohesion amplified the adverse effect of psychosocial work factors on blood pressure (43). Finally, other work factors may need to be measured in order to better understand the burden that could be associated with conciliating work and family responsibilities. Indeed, a recent literature review identified long working hours, atypical schedules, and unpredictability are challenging for work-family balance (44).

Conclusions

In the current study, higher BP means have been observed among women exposed to both effort-reward imbalance at work and high family responsibilities compared to women unexposed to these factors. These higher BP means were observed at baseline, 3-year and 5-year follow-ups, which suggests a temporal persistence of the adverse effect. Primary prevention aiming to reduce effort-reward imbalance at work and implement family-friendly work practices may contribute to lower women BP.

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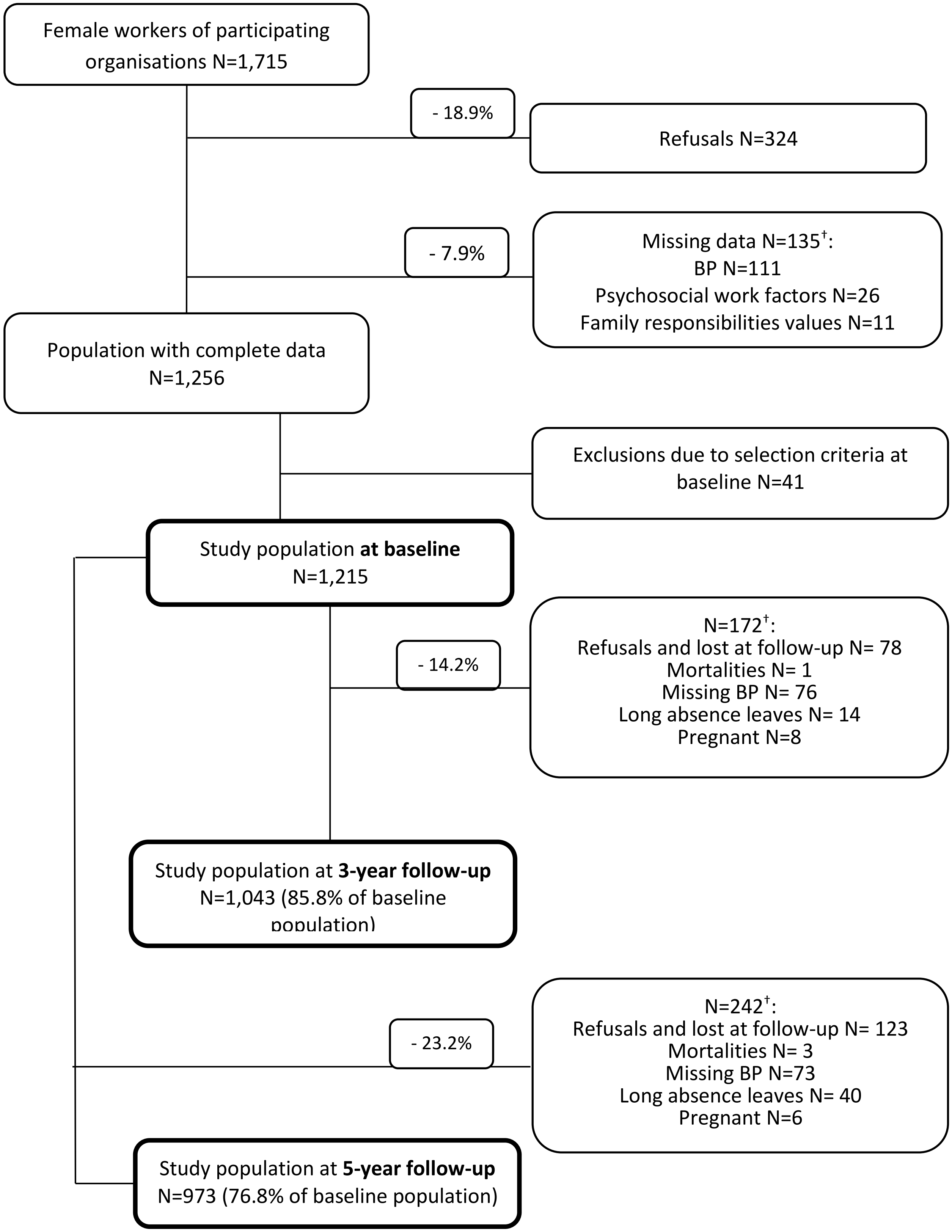
Figure 1. Study population



† Some participants were classified simultaneously in two or more selection criteria.

Table 1. Systolic and diastolic mean blood pressure (± standard deviation) according to factors that can influence blood pressure at baseline

	N (%)	SBP (MM HG)	DBP (MM HG)
Mean blood pressure	1215 (100)	122.0 ± 10.3[6]	78.2 ± 7.4
Age			
< 45 years old	713 (58)	120.8 ± 9.5	78.0 ± 7.3
≥ 45 years old	502 (42)	123.9 ± 11.2*	78.6 ± 7.6*
Completed education			
University	434 (33.8)	122.2 ± 10.1	78.5 ± 7.5
College[7] or equivalent	370 (30.5)	121.3 ± 9.4	77.8 ± 7.4
Secondary school or less	411 (35.7)	122.5 ± 11.3	78.1 ± 7.5
Marital status			
Single/divorced/widower	387 (31.8)	122.2 ± 10.0	78.2 ± 7.2
Married/civil union	828 (68.2)	122.0 ± 10.5	78.1 ± 7.5
Cardiovascular risk factors			
Smoking[8]			
No	575 (47.3)	121.7 ± 10.3	77.7 ± 7.5
Ex-smoker	404 (33.3)	122.4 ± 10.0	78.4 ± 7.2
Smoker	236 (19.4)	122.5 ± 11.0	78.9 ± 7.7
Overweight[9]			
No	838 (69.0)	120.7 ± 10.2	77.7 ± 7.5
Yes	377 (31.0)	125.0 ± 10.1*	79.1 ± 7.3*

[6] Values are mean ± standard deviation.
[7] College in the Province of Quebec generally provides a 2-year pre-university or a 3-year technical school program after termination of high school.
[8] Occasional or regular smokers were included.
[9] Had body mass index ≥25 kg/m^2.

Sedentary behaviors[10]			
No	1003 (82.5)	121.7 ± 10.2	78.0 ± 7.4
Yes	212 (17.5)	123.7 ± 11.1*	78.9 ± 7.6*
Excessive alcohol consumption[11]			
No	993 (81.7)	122.0 ± 10.4	77.9 ± 7.4
Yes	222 (18.3)	122.4 ± 10.0	79.4 ± 7.7*
Diabetics			
No	1177 (96.9)	122.0 ± 10.4	78.2 ± 7.4
Yes	38 (3.1)	123.5 ± 9.3	77.6 ± 8.7
Medication[12]			
No	151 (12.4)	121.5 ± 9.2	77.6 ± 7.2
Yes	1064 (87.6)	122.1 ± 10.5	78.2 ± 7.5
Family history of CVD[13]			
No	758 (64.6)	121.4 ± 10.1	77.8 ± 7.2
Yes	415 (35.4)	123.3 ± 10.6*	78.8 ± 7.8*

[10] Performed leisure physical activity one time or less a week.
[11] Consumed alcohol 6 times or more a week.
[12] Took at least one of the suggested medications: analgesics, Prozac, Valium, sleeping pills, diabetes medication, stomach pills, medication to reduce cholesterol levels, or mood-modifying pills.
[13] Knew that a person from the immediate family (father, mother, brother, or sister) has had a cardiac medical problem (angina, myocardial infarction, coronary bypass) or a stroke (paralysis, embolism, hemorrhage, thrombosis).

* *p-value* $< .05$ between the variable and blood pressure using a F statistic from covariance analysis.

Table 2. Adjusted[14] differences in systolic and diastolic mean blood pressure (95% confidence interval) according to family responsibilities dimensions[15] assessed at baseline

	At baseline			At 3-year follow-up			At 5-year follow-up		
	N	SBP (mm Hg)	DBP (mm Hg)	N	SBP (mm Hg)	DBP (mm Hg)	N	SBP (mm Hg)	DBP (mm Hg)
Children									
No	395	122.6	78.2	326	121.9	77.4	297	121.8	76.6
Yes	820	-0.9 (-2.2-0.4)	0.0 (-1.0-1.0)	717	-0.1 (-1.6-1.4)	0.5 (-0.5-1.6)	676	0.7 (-0.8-2.3)	0.9 (-0.2-2.1)
Number of children and their age									
Low	566	122.7	78.1	472	121.9	77.5	429	121.8	76.6
Intermed.	208	-1.0 (-2.7-0.6)	0.3 (-0.9-1.6)	178	0.6 (-1.3-2.5)	**1.4 (0.1-2.8)**	167	1.1 (-0.9-3.0)	**1.5 (0.1-2.9)**
High	441	-1.4 (-2.7-0.0)	0.0 (-1.0-1.0)	393	-0.5 (-2.0-1.1)	0.3 (-0.8-1.4)	377	0.8 (-0.8-2.3)	1.1 (-0.1-2.3)
Housework and children care									
Low	330	122.7	78.1	281	122.3	77.6	252	122.2	76.5
Intermed.	382	-0.4 (-2.0-1.1)	0.0 (-1.2-1.2)	317	-0.5 (-2.3-1.3)	0.0 (-1.3-1.3)	297	-0.3 (-2.2-1.5)	0.7 (-0.6-2.1)

[14] Adjusted for all covariates, namely: education, age, marital status, body mass index, alcohol consumption, smoking, leisure physical activity, stressful events, social support outside work, diabetes, known family history of cardiovascular diseases, and at 3-year and 5-year follow-ups menopause and menopausal hormone therapy. Categorizations used are provided in the "covariates" subsection of the methodology.
[15] Exposed categories are compared with the reference category (first category of each variable). Statistical significance of the differences is estimated by a Student's t test. Results in bold: $p<0.05$.

High	503	-1.2 (-2.7-0.2)	0.0 (-1.0-1.1)	445	-0.6 (-2.2-1.1)	0.4 (-0.8-1.6)	424	0.5 (-1.2-2.2)	**1.3 (0.1-2.5)**
High family responsibilities									
Low	290	122.9	78.3	246	122.6	78.0	219	122.4	76.8
Intermed.	528	-1.0 (-2.5-0.5)	-0.4 (-1.5-0.7)	445	-1.0 (-2.8-0.7)	-0.5 (-1.7-0.8)	422	-0.5 (-2.3-1.3)	0.3 (-1.0-1.6)
High	397	-1.3 (-2.9-0.3)	0.1 (-1.1-1.3)	352	-1.0 (-2.8-0.8)	0.0 (-1.3-1.4)	332	0.2 (-1.7-2.1)	0.9 (-0.5-2.3)

Table 3. Adjusted[16] associations between job strain and combination of job strain and high family responsibilities[17] assessed at baseline with systolic and diastolic mean blood pressure (95% confidence interval) assessed at baseline, 3- and 5-year follow-ups

	At baseline			At 3-year follow-up			At 5-year follow-up		
	N	SBP (mm Hg)	DBP (mm Hg)	N	SBP (mm Hg)	DBP (mm Hg)	N	SBP (mm Hg)	DBP (mm Hg)
High job strain									
No	937	122.1	78.0	804	121.7	77.6	753	122.2	77.2
Yes	278	-0.3 (-1.7-1.1)	0.5 (-0.6-1.5)	239	0.8 (-0.8-2.3)	1.0 (-0.2-2.1)	220	0.3 (-1.3-1.9)	0.5 (-0.7-1.7)
Job strain (high family responsibilities)									
No (no)	637	122.3	77.9	536	121.8	77.4	499	121.9	76.8
No (Yes)	300	-0.8 (-2.2-0.7)	0.4 (-0.7-1.4)	196	-0.3 (-2.0-1.3)	0.3 (-0.8-1.5)	254	1.0 (-0.7-2.6)	1.1 (-0.1-2.4)
Yes (no)	181	-0.3 (-2.1-1.4)	0.4 (-0.9-1.7)	61	0.8 (-1.2-2.7)	0.9 (-0.5-2.3)	142	1.0 (-1.0-3.0)	1.2 (-0.3-2.7)
Yes (yes)	97	-0.9 (-3.2-1.4)	0.9 (-0.8-2.6)	34	0.5 (-2.1-3.1)	1.4 (-0.5-3.3)	78	-0.1 (-2.7-2.6)	0.3 (-1.7-2.2)

[16] Adjusted for all covariates, namely: education, age, marital status, body mass index, alcohol consumption, smoking, leisure physical activity, stressful events, social support outside work, diabetes, known family history of cardiovascular diseases, and at 3-year and 5-year follow-ups menopause and menopausal hormone therapy. Categorizations used are provided in the "covariates" subsection of the methodology.

[17] Exposed categories are compared with the reference category (first category of each variable). Statistical significance of the differences is estimated by a Student's t test. Results in bold: $p<0.05$.

Table 4. Adjusted[18] associations between effort-reward imbalance and combination of effort-reward imbalance and high family responsibilities[19] assessed at baseline with systolic and diastolic mean blood pressure (95% confidence interval) assessed at baseline, 3- and 5-year follow-ups

	At baseline			At 3-year follow-up			At 5-year follow-up		
	N	SBP (mm Hg)	DBP (mm Hg)	N	SBP (mm Hg)	DBP (mm Hg)	N	SBP (mm Hg)	DBP (mm Hg)
Effort-reward imbalance									
No	878	121.6	77.7	878	121.5	77.5	755	121.7	76.9
Yes	337	**1.8 (0.5-3.1)**	**1.7 (0.7-2.6)**	337	1.4 (-0.1-2.9)	0.9 (-0.2-1.9)	288	**2.0 (0.5-3.5)**	**1.2 (0.1-2.3)**
Effort-reward imbalance (high family responsibilities)									
No (no)	578	121.9	77.6	488	121.8	77.6	450	121.6	76.8
No (Yes)	300	-1.0 (-2.4-0.5)	0.2 (-0.9-1.2)	267	-1.0 (-2.6-0.6)	-0.3 (-1.4-0.9)	255	0.5 (-1.2-2.1)	0.5 (-0.8-1.7)
Yes (no)	240	1.3 (-0.2-2.9)	**1.3 (0.2-2.5)**	203	0.5 (-1.8-2.3)	0.1 (-1.2-1.3)	191	**1.8 (0.0-3.7)**	0.9 (-0.5-2.2)

[18] Adjusted for all covariates, namely: education, age, marital status, body mass index, alcohol consumption, smoking, leisure physical activity, stressful events, social support outside work, diabetes, known family history of cardiovascular diseases, and at 3-year and 5-year follow-ups menopause and menopausal hormone therapy. Categorizations used are provided in the "covariates" subsection of the methodology.

[19] Exposed categories are compared with the reference category (first category of each variable). Statistical significance of the differences is estimated by a Student's t test. Results in bold: $p<0.05$.

Yes (yes)	97	1.7 (-0.6-3.9)	**2.6 (1.0-4.3)**	85	2.4 (-0.1-5.0)	**2.4 (0.6-4.2)**	77	**3.1 (0.5-5.7)**	**2.6 (0.6-4.5)**
Effort-reward imbalance (having ≥1 child)									
No (no)	282	122.4	77.7	234	121.9	77.3	209	121.4	76.3
No (Yes)	596	-1.3 (-2.8-0.3)	-0.1 (-1.2-1.1)	521	-0.7 (-2.4-1.0)	0.4 (-0.9-1.6)	496	0.5 (-1.3-2.2)	0.1 (-0.4-2.3)
Yes (no)	113	0.9 (-1.3-3.2)	1.6 (-0.1-3.2)	92	-0.1 (-2.7-2.5)	0.5 (-1.3-2.4)	88	1.3 (-1.3-3.9)	1.3 (-0.7-3.2)
Yes (yes)	224	0.9 (-0.9-2.8)	**1.7 (0.3-3.0)**	196	1.4 (-0.6-3.5)	**1.4 (-0.1-2.9)**	180	**2.8 (0.7-5.0)**	**2.2 (0.6-3.8)**
Effort-reward imbalance (index "number of children and their age")									
No (no)	510	122.1	77.8	469	122.0	77.8	468	121.7	76.7
No (Yes)	368	-1.4 (-2.9-0.0)	-0.2 (-1.3-0.9)	286	-1.5 (-3.1--0.2)	-0.6 (-1.8-0.6)	277	0.1 (-1.6-1.8)	0.5 (-0.7-1.8)
Yes (no)	202	1.4 (-0.3-3.0)	1.6 (0.4-2.8)	181	0.3 (-1.5-2.2)	-0.3 (-1.0-1.6)	168	1.5 (-0.4-3.4)	1.1 (-0.3-2.5)
Yes (yes)	135	1.1 (-1.0-3.1)	1.5 (0.0-3.0)	107	1.8 (-0.5-4.1)	1.3 (-0.4-2.9)	100	**2.9 (0.6-5.3)**	**2.0 (0.3-3.8)**
Effort-reward imbalance (index "housework and children care")									
No (no)	578	122.2	77.9	432	121.7	77.6	394	121.5	76.6
No (Yes)	300	**-1.5 (-2.9--0.1)**	-0.4 (-1.4-0.6)	323	-0.7 (-2.2-0.9)	-0.0 (-1.1-1.1)	311	0.5 (-1.1-2.0)	0.6 (-0.5-1.8)
Yes (no)	240	1.0 (-0.7-2.7)	1.0 (-0.3-2.2)	166	0.9 (-1.1-2.8)	0.2 (-1.2-1.6)	155	1.6 (-0.4-3.6)	0.8 (-0.7-2.3)
Yes (yes)	97	1.3 (-0.6-3.3)	**2.3 (0.8-3.7)**	122	1.5 (-0.7-3.6)	**1.7 (0.2-3.3)**	113	**3.0 (0.8-5.2)**	**2.5 (0.8-4.1)**

CHAPITRE 5: Effect of the double exposure to psychosocial work factors and high family responsibilities on psychological distress: A 5-year prospective study among white-collar working women

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RÉSUMÉ

OBJECTIFS: Les contraintes psychosociales au travail peuvent contribuer au développement des problèmes de santé mentale. Les femmes sont davantage exposées que les hommes aux contraintes psychosociales au travail des modèles demande-latitude (DL) et déséquilibre efforts-reconnaissance (DER). De plus, les femmes consacrent en moyenne deux fois plus d'heures par semaine aux responsabilités familiales que les hommes (30,1 comparées à 17,5). Endosser les rôles de mère et d'employée dans des conditions néfastes peut nuire à la santé mentale. L'objectif de la présente étude est d'évaluer, sur 5 ans, l'effet de la double exposition à certaines contraintes psychosociales au travail (modèles DL et DER) et à des responsabilités familiales élevées sur la détresse psychologique des femmes.

MÉTHODES: Le devis est une cohorte longitudinale de 1 307 travailleuses. Les données ont été collectées à trois reprises; au recrutement, trois et cinq ans plus tard. Les contraintes psychosociales des modèles DL et DER ont été mesurées par questionnaires validées. Les responsabilités familiales ont aussi été mesurées par questionnaire, à l'aide des dimensions 'nombre d'enfants et leur âge' et 'tâches domestiques et soins aux enfants'. La détresse psychologique a été mesuré par le questionnaire validé 'Psychiatric Symptoms Index' (version française). Les rapports de prévalences de la détresse psychologique ont été modélisés par régression log-binomiale.

RÉSULTATS: Comparées aux femmes non exposés, celles ayant une double exposition au job strain et à des responsabilités familiales élevées avaient un rapport de prévalence (RP) de détresse psychologique plus élevé au recrutement (RP : 1,53 (IC à 95%: 1,22-1,93) et 5 ans plus tard (RP : 1,43 (IC à 95%: 1,07-1,91). Les femmes ayant une double exposition au DER et à des responsabilités familiales élevées avaient aussi un rapport de prévalence de détresse psychologique plus élevé au recrutement (RP : 2,04 (IC à 95%: 1,68-2,49), 3 ans (RP : 1,90 (IC à 95%: 1,52-2,38) et 5 ans plus tard (RP : 1,56 (IC à 95%: 1,16-2,10).

CONCLUSION: La double exposition aux stresseurs psychosociaux au travail et aux responsabilités familiales élevées était associée à une prévalence accrue de la détresse psychologique des femmes. Ces résultats suggèrent que la réduction des contraintes psychosociales au travail et l'implantation de pratiques facilitant la conciliation travail-famille pourraient contribuer à prévenir ou à réduire la détresse psychologique des femmes.

Abstract

OBJECTIVES: Psychological distress is a strong predictor of major depression. Assuming multiple roles, such as being mother and employee, under stressful conditions may favour the development of mental health problems. This study evaluated for the first time the longitudinal adverse effect of the double exposure to psychosocial work factors (*i.e.* work stressors) and high family responsibilities on women psychological distress.

METHODS: Women were assessed at baseline (N=1,307) and 3- and 5-year follow-ups. Psychosocial work factors of the demand-control and effort-reward imbalance models were measured using validated questionnaires. Family responsibilities were self-assessed and referred to "the number of children and their age" and "housework and children care". Psychological distress was measured with the validated Psychiatric Symptoms Index questionnaire. Prevalence ratios (PR) of psychological distress were modeled with log-binomial regression.

RESULTS: Compared to unexposed women, women having a double exposure to job strain and high family responsibilities had a higher prevalence of psychological distress at baseline (PR: 1.53 (95% CI:1.22-1.93) and at the 5-year follow-up (PR: 1.43 (95% CI:1.07-1.91). Women having a double exposure to effort-reward imbalance and high family responsibilities had also a significantly higher prevalence of psychological distress at baseline (PR: 2.04 (95% CI:1.68-2.49)), 3-year (PR: 1.90 (95% CI:1.52-2.38), and 5-year follow-up (PR: 1.56 (95% CI:1.16-2.10).

CONCLUSION: In this study, a double exposure to job strain or effort-reward imbalance and high family responsibilities increased the prevalence of high psychological distress over a 5-year follow-up. Primary prevention aimed at reducing psychosocial work factors and implementing family friendly organizational practices may contribute to lower mental health problems.

Introduction

Major depression will be the second leading cause of incapacity worldwide by 2020 according to the World Health Organization (1). Psychological distress is a strong predictor of major depression (2, 3). A large body of evidence showed that women are more likely than men to develop mental health problems (4-6). Recent data for example showed that women of industrialized countries are twice more likely than men to have an episode of depression (6-8) .

A growing body of research shows that psychosocial work factors of the demand-control (9) and effort-reward imbalance models (10) might contribute to the development of mental health problems, including psychological distress (11, 12). The two-dimensional demand-latitude model suggests that workers simultaneously experiencing high psychological demands and low decision latitude (job control) are more likely to develop stress related health problems (9). For its part, the Siegrist ERI model proposes that workers are in a state of detrimental imbalance when high efforts at work are accompanied by low reward, and thus more susceptible to health problems (13). Women are more likely than men to be exposed to these psychosocial work factors (6, 14). In addition, Canadian and American women spend approximately twice as much time per week performing family responsibilities than men (approx. 30 compared to 17 hours for both countries) (15, 16). Previous studies suggested that assuming multiple roles under adverse conditions may induce a physiological and a psychological stress favouring the development of mental health problems (17).

Only one previous study evaluated the association between a double/combined exposure to adverse psychosocial work factors and high family responsibilities and a mental health problem (18). This cross-sectional study observed that the association between job strain and depressive symptoms was amplified by receiving a low level of social support at work and having at least one child <18 years-old (OR=2.9 (95% CI: 1.7-4.2)) (18).

The current study is the first to evaluate the effect of the double exposure to adverse psychosocial work factors and high family responsibilities on mental health using a prospective design. It is also the first study evaluating psychosocial work factors of both demand-control and effort-reward imbalance models and exploring the temporal persistence of the deleterious effects.

Objectives

The current study aimed to: 1) evaluate the effect of the double exposure to psychosocial work factors and high family responsibilities on the prevalence of psychological distress in women and 2) explore the persistence of the effect over 3 and 5 years.

Psychosocial work factors of the demand-control and effort-reward imbalance models were evaluated separately. Also, the potentially modifying effect of age was explored.

Methods

Population and study design

One thousand seven hundred fifteen women, working in three public insurance companies were invited to participate to this prospective cohort study (Figure 1). Their main activities involved organizing and providing insurance services to the general population. Data collection was performed at three time points: at baseline (2000-04), 3 years later (2004-06), and 5 years later (2006-09). Participation rates of these data collections were of 80.9%, 89.2%, and 83.2% respectively.

At baseline, 1,350 women agreed to participate and had complete data (Figure 1). Their jobs encompassed a wide range of white-collar occupations, including office workers (37.9%), technical (29.7%), professional (29.1%), and senior management (3.3%). To be included in this study, women had to: 1) work at least 21 hours a week at baseline, 2) work for one of the organizations for more than three months at baseline, and 3) not be pregnant at either times. A total of 1,307 women were included in the baseline data analysis (Figure

1). Of the baseline population, 1,167 and 1,087 women were included in the 3-year and 5-year analysis, respectively (Figure 1).

Data collection and Variables

At baseline and follow-ups, participants completed a self-administered questionnaire on demographic and socioeconomic characteristics, psychological distress, and characteristics of work, family responsibilities, and social life.

Psychological distress

Psychological distress was measured with the French validated short-version of the Psychiatric Symptoms Index questionnaire (14 items) (19). This questionnaire measures the frequency of symptoms of depression, anxiety, aggressively, and cognitive impairment that occurred in the previous week. Women with scores ≥26.19 were considered as *prevalent cases* (20). This categorisation has been associated with health professional consultation, hospitalisation for a mental health problems, suicide (thoughts or attempt) and psychotropic consumption (19).

Psychosocial work factors of the demand-control and effort-reward imbalance models

Psychological demands and job control (measured with 9 items each) were evaluated using the validated French version of the Karasek Job Content Questionnaire (21, 22). Psychological demands and job control were dichotomized at the median observed in a random sample of all Quebec workers. Job strain was defined as a combination of high psychological demands and low job control.

Efforts were assessed using 4 items (Cronbach alpha = 0.65); two original items of the French version of the Siegrist questionnaire (“having to do overtime” and “in recent years, my job became more demanding” (23)) and two proxies ("I have enough time to do my job" and "my task is often interrupted before I finish it, so I must come back later”). Reward was evaluated using the validated French version of the Siegrist questionnaire (11 items) (24). A ratio of effort/reward greater than 1 indicated an imbalance.

Family responsibilities

Family responsibilities have been measured using a questionnaire adapted from Brisson *et al.* (1999) (25). Family responsibilities referred to: the "number of children and their age" and "housework and children care".

Number of children and their age: Hours spent performing family responsibilities is proportional to the number of children and their ages (26). Accordingly, younger children were therefore ascribed more weight than older children (26). Children in the age categories 0 to 5, 6 to 11, 12 to 17 and 18 to 20 years-old were, respectively, weighted 3, 2.5, 2, and 1.5 (25). The algorithm applied to calculate the score of this index was: (3 x number of children aged 0-5 years-old) + (2.5 x number of children aged 6-11 years-old) + (2 x number of children aged 12-17 years-old) + (1.5 x number of children aged 18 to 20 years-old) (25).

Housework and children care: Two tasks were evaluated: meal preparation and cleaning inside the house. Two items were used to measure children care: who takes care of the children at home and who is responsible for children care and activities outside the house (doctor, dentist, school, recreational activities, etc.). Women indicated whether the task was: i) primarily performed by themselves, ii) performed with the help of another person (spouse, child, or someone else), iii) primarily performed by another person, or iv) not performed, which respectively gave them a score of 1, 0.5, 0, and 0.

Family responsibilities: This index represents the product of both "number of children and their age" and "housework and children care" indexes' scores. The algorithm was: (number of children and their age + 1) x (housework and children care) (25). The highest tertile indicated a high level of exposure.

Double exposure to psychosocial work factors and high family responsibilities

Four exposure categories were created: i) exposed to both psychosocial work factors and high family responsibilities (double exposure), ii) exposed only to psychosocial work factors (intermediate exposure), iii) exposed only to high family responsibilities (intermediate exposure), and iv) not exposed to either group of factors (reference group).

Psychosocial work factors of the demand-control model and of the effort-reward imbalance models were evaluated separately. Exploratory analyses were also performed to evaluate the effect of double exposures to psychosocial work factors and: i) having children (yes/no), ii) number of children and their age, and iii) housework and children care.

Covariates

Covariates included well-known and suspected risk factors of mental health problems: i) Demographic characteristics: age (continuous), education (secondary school or less, college, university), and marital status (single/divorced/widower or married/civil union), ii) Clinical risk factors: overweight (body mass index ≥ 25, BMI = weight (kg)/height (m^2)), menopause (yes/no, available at 3- and 5-year follow-ups) and menopausal hormone therapy (yes/no, available at 3- and 5-year follow-ups), and iii) Lifestyle risk factors: smoking (≥ 1 cigarette/day), alcohol consumption (≥6 consumptions/week), and leisure time physical activity (≤1 time/week). The occurrence of ≥1 individual stressful life event(s) during the past 12 months was also evaluated (ex. losing one's job, being sick, divorce or death of a spouse, financial difficulties).

At the 3- and 5-year follow-ups, repeated measures were used to take into account for potential changes over time (except for age, education, and family history of CVD).

Statistical analyses

χ^2 analyses were used to compare baseline characteristics. Prevalence ratios of high psychological distress were modeled using log-binomial regression. All covariates were included in the adjusted statistical models. Complementary analyses in which no adjustment was performed for potentially intermediate factors, i.e. overweight, smoking, excessive alcohol consumption and leisure time activity, were also performed to evaluate an eventual over-adjustment. Stratified analyses were used to examine the potential modifying effect of age (27) and multiplicative interaction terms were calculated (from the adjusted statistical model).

P-values were calculated with a partial F test. The level of statistical significance was set at 0.05. All analyses were performed with SAS 9.2 software.

Results

Table 1 summarizes the participants' baseline characteristics. A majority of the participating women were aged below 45 years-old (57.6%), married or in a civil union (67.9%), and ex-smokers or former smokers (52.9%). Participants were almost equally distributed between education levels (secondary or less, college, and university). A minority was overweighed (30.9%, sedentary (18.8%) or had an excessive alcohol consumption (18.7%). Over one in three women (37.9%) had high psychological distress.

Table 2 presents adjusted prevalence ratios of psychological distress according to the subscales and the total index of family responsibilities. At baseline and at the 3-year follow-up, the prevalence ratios of psychological distress were significantly higher among women having high family responsibilities (baseline: 1.35 (95% CI: 1.11-1.64), 3-year: 1.27 (95% CI: 1.02-1.59)), compared to unexposed women. Effects were no longer significant at the 5-year follow-up.

Table 3 presents adjusted prevalence ratios of psychological distress according to either job strain or effort-reward imbalance. Compared to women having no job strain, women exposed to job strain (dichotomized or in quadrants) had higher prevalence ratios of psychological distress than women unexposed at baseline, 3-year follow-up, and 5-year follow-up, ranging from 1.17 to 2.19. Among women exposed to effort-reward imbalance, higher prevalence ratios of psychological distress were also observed at baseline (1.69 (95% CI: 1.48-1.93), 3-year follow-up (1.65 (95% CI: 1.42-1.91), and 5-year follow-up (1.51 (95% CI: 1.27-1.80).

Table 4 presents adjusted prevalence ratios of psychological distress according to the double exposure to psychosocial work factors and high family responsibilities. Compared to unexposed women, those having a double exposure to job strain and high family responsibilities had a higher prevalence of psychological distress at baseline (1.53 (95% CI: 1.22-1.92)) and at the 5-year follow-up (1.44 (95% CI: 1.07-1.92), but not at the 3-year follow-up (1.17 (95% CI: 0.88-1.54). Women having a double exposure to effort-reward imbalance and high family responsibilities had a significantly higher prevalence of psychological distress at baseline (2.04 (95% CI: 1.68-2.49)), 3-year follow-up (1.87 (95% CI: 1.49-2.34), and 5-year follow-up (1.56 (95% CI: 1.15-2.10) (Table 4).

In exploratory analyses, similar patterns were observed for the double exposure to either job strain or effort-reward imbalance and i) having ≥ 1 child or ii) according to the number of children and their age or ii) high housework and children care (Tables 1 and 2, Appendix 7).

A significant modifying effect of age was also observed for the double exposure to job strain and high family responsibilities (*p* for interaction <0.10, Table 3, Appendix 7). Younger women (<45 years-old) with this double exposure had higher prevalence ratios of psychological distress at baseline (1.48 (95% CI: 1.16-1.90)) and at the 5-year follow-up (1.41 (95% CI: 1.03-1.92) compared to unexposed women of the same age (Table 3, Appendix 7). No such effect was observed among older women (≥45 years-old). Also, age did not modify the effects of the double exposure to effort-reward imbalance and high family responsibilities on psychological distress (*p* for interaction >0.10, Table 4, Appendix 7).

Complementary analyses removing physical inactivity, overweight, alcohol consumption, and smoking from the adjusted models (i.e. potentially intermediate factors) led to almost identical estimates (Tables 5-6, Appendix 7).

Discussion

The current study is the first longitudinal study to evaluate the effect of the double exposure to adverse psychosocial work factors and high family responsibilities on mental health. Women experiencing this double exposure had a 1.44 to 2.04 increased prevalence ratio of high psychological distress over a 5-year period. Psychological distress is a strong predictor of severe mental health problems (2, 3) that affects more that one in four working women (6, 28) (37.9% in the current study). Preventing this early mental health disorder is thus of major public health importance.

Only one previous study evaluated the association between a double exposure to adverse psychosocial work factors and high family responsibilities and mental health (18). This cross-sectional study evaluated the association between job strain and self-reported depressive symptoms among 431 employees in four extended care facilities. In this study, the association between job strain and depressive symptoms was amplified by receiving low social support at work and having at least one child <18 years-old (OR=2.9 (95% CI: 1.7-4.2)) (18). However, this association was no longer statistically significant after adjusting for potential confounding factors. An adjustment for physical pain might however have contributed to lower the true association since this factor can be on the causal path between psychosocial work factors and depressive symptoms.

The current study showed an adverse effect of the double exposure to job strain and high family responsibilities on high psychological distress at baseline and 5 years later, but not at the 3-year follow-up (Table 4). An interpretation could be that at first women are struggling to adjust to their reality. After a few years (here 3 years), children may have grown and women may have gotten accustomed to their reality. This refers to the habituation hypothesis (30), suggesting that an individual can get used to repeated stress. Indeed, the force of the hypothalamic-pituitary-adrenal (HPA) activation occurring in response to a stressor tend to decline with repeated exposure to that same stressor (30). Also, the 3-year absence of effect could be due to the fact that women facing high family responsibilities may find comfort in a job involving less decision making and more repetitive tasks, *i.e.* the component 'low job control' of the job strain construct. Supporting this hypothesis, a complementary analysis showed that, while the double exposure to low job control and high family responsibilities had an adverse effect on psychological distress at baseline, this double exposure did not have an adverse effect at the 3- and 5-year follow-ups (Table 7, Appendix 7). In line with this, two recent cohort studies showed that having low job control may protect against major depression in women (6, 31). It is however noteworthy that the adverse effect of the double exposure to job strain and high family responsibilities reappeared at the 5-year follow-up in the current study. At that moment, women could: i) have faced the initial distress arising from having young children and holding a stressful job (baseline), ii) have attained an intermediate somewhat comfortable period (3-year period), and iii) may now be ready to accomplish more, to have a job where their skills are solicited and enriched without having to face a work overload (high job control accompanied with low psychological demands). In line with this interpretation, the adverse effect of the double exposure to job strain and high family responsibilities on psychological distress was only present in younger women of the current study (≤45 years-old) (Table 3, Appendix 4), which are more likely to be starting a family and go throught the three phases hypothesized.

In the current study, the adverse effect of the double exposure to effort-reward imbalance at work and high family responsibilities on psychological distress was observed at all three time points, but attenuated over time (Table 4). This could be due to a progressive reduction of the initial distress arising from performing high family responsibilities (as observed in Table 2) as the mother adjust to her routine (habituation hypothesis (30)) and as children grow. One should however be careful with this interpretation since the attenuation of the effect could also be due to methodological limitations (see the first three limitations described in the next section).

The effects of the double exposure were slightly different according to the psychosocial work factors evaluated, *i.e.* job strain or effort-reward imbalance. The prevalence ratios observed at baseline and 3-year follow-up were slightly higher for the double exposure involving effort-reward imbalance (+0.51 and +0.71). Although the job strain and effort-reward imbalance models overlap by measuring the workload (the 'efforts' and 'psychological demands' components), these models differ by measuring either job control or reward. While the job control covers task-level characteristics, reward includes broader socioeconomic conditions, such as salaries, promotion prospects and job stability. It has been hypothesized that the adverse effects could be heightened when one feels that the 'injustice' is attributable to 'out of control' conditions (32). This could contribute to explain the higher estimates observed for the double exposure involving ERI, as women of the current study were working in public organizations where there are strict governmental rules concerning salaries and promotion prospects.

While the double exposure to psychosocial work factors and high family responsibilities led to significantly higher prevalences of psychological distress in the current study, these effects were not substantially higher than those of psychosocial work factors evaluated separately (*i.e.* double vs single exposures) (Table 4). An explanation would be that being a mother and taking care of the family could favor psychological well-being by providing satisfaction and self-rewards (33, 34). The adverse effect may however be exacerbated among those having to face a conflict between work and family responsibilities, e.g. when these central spheres of life enter in competition with each other. The only prospective study evaluating the effect of work-family conflict on mental health observed an increased risk of common mental disorders (adjusted OR: 1.76 (95% CI: 1.36-2.20)) (35). Further prospective investigations of this relationship are however needed since this study used a single item to measure work-family conflict among participants aged precisely 42 years-old. Also, as described hereafter, methodological limitations might have contributed to underestimate to effect of the double exposure.

Limitations and strengths

The current study has limitations. First, a *common method bias* could have been introduced. This bias occurs when effect measures are inflated due to the fact that both the exposure and outcome are self-reported and measured simultaneously (107). For example, women experiencing high psychological distress could be more likely to 'blame it on' work stress or high family responsibilities, thereby overestimating their exposures. This hypothesis seems plausible in the current study since the prevalence ratios observed were slightly higher when exposures and outcome were measured simultaneously, i.e. at baseline vs. 3- and 5-year follow-ups (+0.10 to +0.67, Tables 3-4). Therefore, a common method bias of small to moderate force cannot be ruled out. Nonetheless, it is also possible that the higher prevalence ratio observed at baseline was due to stronger short-term effects. In the current study, having measured the outcome 3- and 5-year after the exposures contributed to minimizing the common method bias at these time points (12, 36).

Second, only baseline exposures to psychosocial work factors and family responsibilities were evaluated. Measuring the exposures at a single time-point could have led to a considerable misclassification bias (potential underestimation of the true effect) due to changes in exposures over the course of the follow-up. Third, psychosocial work factors and family responsibilities were dichotomized in order to create the double exposures categories, which could have led to an underestimation of the true effects. Prevalence ratios of psychological distress tended to be higher (+0.15 to +0.84) when using the refined categorizations (Tables 2 and 3). Unfortunateley, statistical power did not allow the use of finer categories for the double exposure.

Fourth, a potential non-differential misclassification bias could have been introduced due to an ‘incomplete’ measure of family responsibilities. Previous studies on family responsibilities did not use a standard definition to measure these responsibilities. However, in line with the current study, previous studies generally used items related to the number of children <18 years-old, children care and domestic work. More comprehensive measures included questions about tasks outside the house (ex. grass mowing, snow clearing), taking care of a person with loss of autonomy, family budget, car maintenance, and playtime with children. Not having measured these responsibilities could have led to an underestimation of the burden, i.e. of the adverse effect.

Complementary analyses evaluating the potential introduction of a selection bias due to non-participation (refusals or lost at follow-up) or exclusions were performed. At baseline, 3-year and 5-year follow-ups, few differences between participants and non-participants were observed for either exposures or the outcome (Tables 8-12, Appendix 7). A selection bias seems unlikely since individuals would have had to differ regarding both exposures and psychological distress to introduce such bias.

The current study also has important strengths. Among them is the use of a 5-year follow-up which allowed the first longitudinal evaluation of the adverse effects of the double exposure to psychosocial work factors and high family responsibilities on mental health. Other important strengths are the evaluation of the psychosocial work factors from the two most validated and internationally recognized theoretical models, high participation rates at all three time-points, consideration of several potential confounders, and having a large sample of women.

Women of the current study were allowed to take a 1-year paid maternity leave. Also, governmental financial support was offered to those having children aged ≤18 years old. Therefore, the findings of the current study might mainly be exportable to women of industrialized countries where there are governmental measures supporting families with children. In countries where there are no such measures, the stressful exposure to high family responsibilities may be stronger which could lead to greater deleterious effects on mental health.

Conclusions

Among women, being simultaneously exposed to psychosocial work factors and high family responsibilities had an adverse effect on psychological distress over a 5-year period. These findings suggest that reducing psychosocial work factors and implementing family friendly work practices may contribute to prevent women from developing psychological distress, a strong risk factor of major depression.

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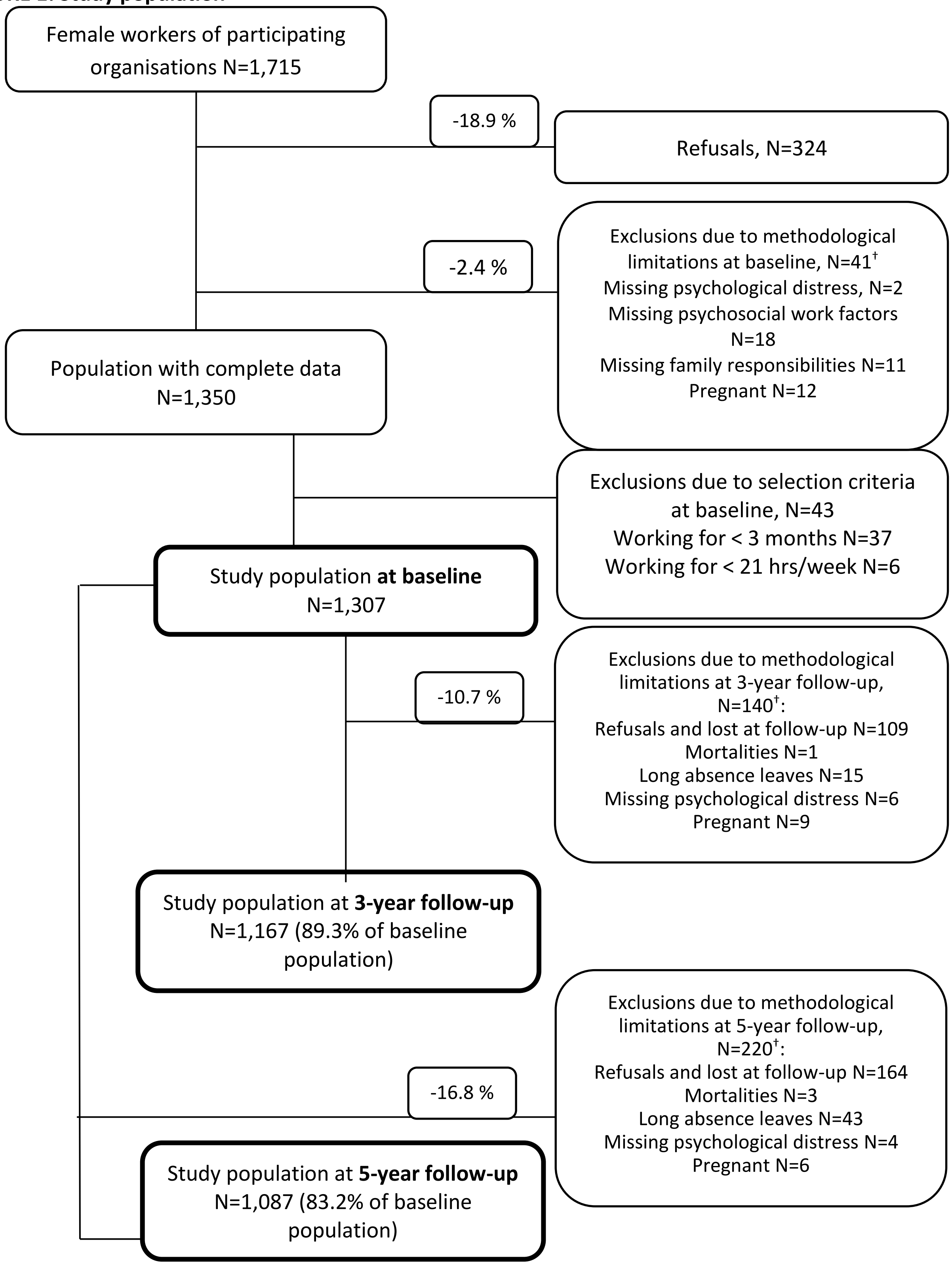
FIGURE 1: Study population



† Some participants were classified simultaneously in two or more selection criteria.

Table 1. Baseline characteristics among 1,307 participants at baseline

	N (%)
Prevalence of psychological distress	496 (37.9)
Age	
< 45 years old	754 (57.7)
≥ 45 years old	553 (42.3)
Completed education	
University	470 (36.0)
College[20] or equivalent	398 (30.5)
Secondary school or less	439 (33.5)
Marital status	
Single/divorced/widower	420 (32.1)
Married/civil union	887 (67.9)
Smoking[21]	
No	616 (47.1)
Ex-smoker	432 (33.1)
Former smoker	259 (19.8)
Overweight[22]	
No	903 (69.1)
Yes	404 (30.9)
Sedentary behaviors[23]	
No	1074 (82.2)
Yes	233 (17.8)
Excessive alcohol consumption[24]	
No	1063 (81.3)
Yes	244 (18.7)

[20] College in the Province of Quebec generally provides a 2-year pre-university or a 3-year technical school program after termination of high school.
[21] Occasional or regular smokers were included.
[22] Had body mass index ≥25 kg/m^2.
[23] Performed leisure physical activity one time or less a week.
[24] Consumed alcohol 6 times or more a week.

Table 2. Adjusted[25] prevalence ratios (PR) of psychological distress (95% confidence interval; 95% CI) according to family responsibilities dimensions[26] assessed at baseline

	N	At baseline PR (95% CI)	N	At 3-year PR (95% CI)	N	At 5-year PR (95% CI)
Subscales of family responsibilities:						
A- Children						
No	430	1.00	373	1.00	339	1.00
Yes	877	**1.30 (1.10-1.53)**	794	1.17 (0.99-1.39)	748	1.16 (0.96-1.41)
B- Number of children and their age						
Low	624	1.00	542	1.00	493	1.00
Intermed.	221	**1.27 (1.06-1.52)**	196	1.23 (1.00-1.52)	184	0.90 (0.69-1.16)
High	462	*1.18 (1.00-1.39)*	429	1.16 (0.97-1.38)	410	1.13 (0.93-1.38)
C- Housework and children care						
Low	361	1.00	316	1.00	286	1.00
Intermed.	411	1.09 (0.90-1.33)	360	1.18 (0.95-1.47)	335	0.98 (0.78-1.24)
High	535	**1.23 (1.03-1.47)**	491	**1.31 (1.08-1.60)**	466	0.95 (0.76-1.18)

[25] Adjusted for all covariates, namely: education, age, marital status, body mass index, alcohol consumption, smoking, leisure physical activity, stressful events, social support outside work, and at 3-year and 5-year follow-ups menopause and menopausal hormone therapy. Categorizations used are provided in the "covariates" subsection of the methodology.
[26] Results in bold: p<0.05. Results in italic: 0.05≤p<0.10.

Total responsibilities (subscales B + C)[27]						
High family responsibilities[28]						
No	889	1.00	780	1.00	720	1.00
Yes	418	**1.20 (1.04-1.39)**	387	1.08 (0.92-1.28)	367	1.07 (0.89-1.28)
Family responsibilities tertiles						
Low	320	1.00	278	1.00	252	1.00
Intermed.	569	*1.19 (0.98-1.44)*	502	**1.27 (1.04-1.57)**	468	0.98 (0.77-1.23)
High	418	**1.35 (1.11-1.64)**	387	**1.27 (1.02-1.59)**	367	1.05 (0.82-1.34)

[27] The algorithm was: (number of children and their age + 1) x (housework and children care).
[28] Variable used for calculating the double exposure to psychosocial work factors and high family responsibilities (Table 4). The 'yes' group represents the highest tertile and the 'no' group combines the low and intermediate tertiles.

Table 3. Adjusted[29] prevalence ratios of psychological distress (95% confidence interval) assessed at baseline, 3- and 5-year follow-ups according to job strain or effort-reward imbalance[30] assessed at baseline

		At baseline		**At 3-year**		**At 5-year**
	N	PR (95% CI)	N	PR (95% CI)	N	PR (95% CI)
High job strain[31]						
No	1016	1.00	903	1.00	838	1.00
Yes	291	**1.35 (1.17-1.56)**	264	*1.17 (1.00-1.38)*	249	**1.33 (1.10-1.60)**
Job strain quadrants						
Unexposed	176	1.00	157	1.00	153	1.00
Passive	550	**1.60 (1.18-2.19)**	482	**1.37 (1.03-1.83)**	439	1.05 (0.77-1.44)
Active	290	**2.02 (1.47-2.77)**	264	**1.55 (1.15-2.09)**	246	**1.46 (1.06-2.00)**
High strain	291	**2.19 (1.60-2.99)**	264	**1.59 (1.18-2.14)**	249	**1.54 (1.12-2.11)**
Effort-reward imbalance[12]						
No	952	1.00	845	1.00	787	1.00
Yes	355	**1.69 (1.48-1.93)**	322	**1.65 (1.42-1.91)**	300	**1.51 (1.27-1.80)**

[29] Adjusted for all covariates, namely: education, age, marital status, body mass index, alcohol consumption, smoking, leisure physical activity, stressful events, social support outside work, and at 3-year and 5-year follow-ups menopause and menopausal hormone therapy. Categorizations used are provided in the “covariates” subsection of the methodology.
[30] Results in bold: p<0.05. Results in italic: 0.05≤p<0.10.
[31] Variables used for calculating the double exposure to psychosocial work factors and high family responsibilities (Table 4).

Table 4. Adjusted[32] prevalence ratios of psychological distress (95% confidence interval) assessed at baseline, 3- and 5-year follow-ups according to the double exposure to high job strain or effort-reward imbalance and high family responsibilities[33] assessed at baseline

	At baseline N	At baseline PR (95% CI)	At 3-year N	At 3-year PR (95% CI)	At 5-year N	At 5-year PR (95% CI)
High job strain and (high family responsibilities)						
No (no)	698	1.00	608	1.00	559	1.00
No (Yes)	318	**1.24 (1.05-1.48)**	295	1.14 (0.94-1.38)	279	1.05 (0.85-1.31)
Yes (no)	191	**1.41 (1.18-1.69)**	172	**1.25 (1.03-1.53)**	161	**1.31 (1.04-1.65)**
Yes (yes)	100	**1.53 (1.22-1.92)**	92	1.17 (0.88-1.54)	88	**1.44 (1.07-1.92)**
Effort-reward imbalance and (high family responsibilities)						
No (no)	636	1.00	553	1.00	508	1.00
No (Yes)	316	**1.25 (1.03-1.51)**	292	1.06 (0.85-1.32)	279	1.17 (0.93-1.47)
Yes (no)	253	**1.73 (1.46-2.05)**	227	**1.60 (1.34-1.92)**	212	**1.62 (1.31-2.01)**
Yes (yes)	102	**2.04 (1.68-2.49)**	95	**1.87 (1.49-2.34)**	88	**1.56 (1.15-2.10)**

[32] Adjusted for all covariates, namely: education, age, marital status, body mass index, alcohol consumption, smoking, leisure physical activity, stressful events, social support outside work, and at 3-year and 5-year follow-ups menopause and menopausal hormone therapy. Categorizations used are provided in the "covariates" subsection of the methodology.
[33] Results in bold: p<0.05.

CHAPITRE 6 : Résultats complémentaires portant sur l'interaction

Ce chapitre présente des résultats complémentaires à ceux figurant dans les articles des chapitres 4 et 5. Ces résultats découlent de la préoccupation grandissante d'évaluer et de quantifier l'interaction statistique additive et multiplicative au sein des études épidémiologiques (198). Ce chapitre vise ainsi à vérifier la présence d'interaction entre les contraintes psychosociales au travail et les responsabilités familiales, et ce, pour la pression artérielle et la détresse psychologique. Les résultats présentés ci-dessous feront l'objet de publications ultérieures.

6.1 Interaction statistique additive et multiplicative entre les contraintes psychosociales et les responsabilités familiales

L'interaction statistique peut être additive ou multiplicative. Elle est synonyme d'hétérogénéité de l'effet, sous le postulat d'une absence de biais (109). Cette interaction peut être positive (délétère) ou négative (protectrice). L'interaction positive est observée lorsque la somme des effets individuels sur l'échelle additive ou le produit de ces effets sur l'échelle multiplicative est dépassé en présence des expositions combinées ('departure' from additivity or multiplicativity of effects on the chosen outcome scale, (109)). À l'inverse, il peut y avoir une interaction négative lorsque l'effet des expositions combinées est inférieur à la somme des effets individuels sur l'échelle additive ou au produit de ces effets sur l'échelle multiplicative.

L'interaction additive peut se calculer avec la formule suivante : $(R_{11} – R_{00}) – [(R_{10} – R_{00}) + (R_{01} – R_{00})]$. Les risques (ou mesures d'effet) observables correspondent à R_{11}, R_{01}, R_{10} et R_{00}. Ainsi, en présence d'interaction, l'effet des expositions combinées $(R_{11} – R_{00})$ ne correspondra pas à la somme des effets des expositions individuelles $(R_{10} – R_{00}) + (R_{01} – R_{00})$. Pour sa part, l'interaction multiplicative est le plus souvent calculée mathématiquement, au moyen d'un terme d'interaction entre les expositions. Il est recommandé d'ajouter ce terme d'interaction au modèle statistique ajusté pour les variables de confusion potentielles (109). Lorsque les mesures d'effet sont calculées sur l'échelle multiplicative (par exemple, rapport de risques), une mesure descriptive de l'interaction multiplicative peut également être calculée avec la formule : RR_{11} / (RR_{01} * RR_{10}). En présence d'interaction, ce ratio est différent de 1.

6.1.1 Pression artérielle

Pour la pression artérielle, **l'interaction additive** a été calculée pour les différences de moyennes observées en fonction de la double exposition au déséquilibre efforts-reconnaissance et à des responsabilités familiales élevées. Il y avait présence d'interaction statistique additive au recrutement (PA diastolique), au suivi à 3 ans (PA systolique et diastolique) et au suivi 5 ans (PA systolique et diastolique). L'effet combiné du déséquilibre efforts-reconnaissance et des responsabilités familiales élevées était plus élevé de 0,8 mm Hg à 2,6 mm Hg par rapport à ce qui est attendu sous l'échelle additive en absence d'interaction (Tableau 1). Il y avait donc une interaction statistique additive positive entre les contraintes psychosociales au travail du modèle déséquilibre efforts-reconnaissance et les responsabilités familiales élevées pour l'ensemble des différences de moyennes de PA statistiquement significatives (PA diastolique aux trois temps et PA systolique au suivi à 5 ans). Cela signifie que cette double exposition mène, chez les femmes de la présente étude, à des effets néfastes plus forts sur la pression artérielle que les contraintes psychosociales au travail ou les responsabilités familiales évaluées séparément.

L'interaction multiplicative n'a pas été présentée puisque la mesure d'effet utilisée était la différence de moyenne de pression artérielle, soit une une mesure d'effet calculée sur l'échelle additive.

6.1.1 Détresse psychologique

Pour la détresse psychologique, les interactions statistiques multiplicatives et additives ont été calculées pour les doubles expositions aux contraintes psychosociales au travail (job strain et déséquilibre efforts-reconnaissance) et à des responsabilités familiales élevées. L'interaction multiplicative a été évaluée au moyen des rapports de prévalences, sur la base de i) la formule $RP_{11} = RP_{01} * RP_{10}$ (109) et ii) de termes d'interaction ajoutés aux modèles statistiques ajustés pour l'ensemble des variables de confusion potentielles (109). Des valeurs variant de 0,82 à 1,13 ont été obtenues pour l'interaction multiplicative calculée au moyen de la formule ci-dessus (Tableau 2). Ces valeurs étaient donc près de 1, c'est-à-dire près de la valeur indiquant l'absence d'interaction. De plus, l'ensemble des valeurs-*p* des termes d'interaction étaient non significatifs (p>0.10) (Tableau 2).

L'interaction statistique additive a dans un premier temps été calculée à partir des prévalences (mesures d'effet sur l'échelle additive), tel que recommandé par Rothman (2008) (109), avec la formule $(R_{11} – R_{00}) – [(R_{10} – R_{00}) + (R_{01} – R_{00})]$. L'effet combiné du job strain ou du déséquilibre efforts-reconnaissance et des responsabilités familiales élevées était de -12,3 à +9,5 différents de que ce qui était attendu sous l'échelle additive en absence d'interaction. Trois valeurs étaient négatives; celles de la double exposition au job strain et aux responsabilités familiales au recrutement (-5,6) et au suivi à 3 ans (-12,3) et celle de la double exposition au déséquilibre efforts-reconnaissances et aux responsabilités familiales au suivi à 5 ans (-10,8) (Tableau 2). Il est toutefois important de noter que les prévalences de la détresse psychologique étaient presqu'identiques en présence de ces doubles expositions qu'en présence de l'exposition aux contraintes psychosociales évaluées séparément (-0,06 et +0,12) (Tableau 2). Les autres valeurs d'interaction statistique additive suggéraient une interaction positive (délétère) pour la double exposition au déséquilibre efforts-reconnaissance et aux responsabilités familiales élevées au recrutement (+2,2) et au suivi à 3 ans (+9,5) et pour la double exposition au job strain et aux responsabilités familiales élevées au suivi à 5 ans (+3,8) (Tableau 2).

L'interaction statistique additive a dans un deuxième temps été calculée à partir des rapports de prévalences, avec l'index RERI (*relative excess risk due to interaction*). L'utilisation de cet index a récemment été recommandée pour évaluer l'interaction additive sur la base de mesures d'effets relatives (échelle multiplicative) (198). L'index RERI a été calculé avec la formule : $RP_{11} - RP_{01} – RP_{10} + 1$, où RP désigne les rapports de prévalences. Une valeur inférieure à 0 signifie qu'il y a une interaction négative (protectrice) et, à l'inverse, une valeur supérieure à 0 correspond à une interaction positive (délétère). Tel qu'observé pour l'interaction calculée avec les mesures d'effets absolues (prévalences), les index RERI étaient négatifs pour la double exposition au job strain et aux responsabilités familiales au recrutement (-0,13) et à 3 ans (-0,2) et pour la double exposition au déséquilibre efforts-reconnaissances et aux responsabilités familiales au suivi à 5 ans (-0,23). Deux autres valeurs des index RERI étaient presque nulles; pour la double exposition au job strain et aux responsabilités familiales élevées au suivi à 5 ans (0,01) et pour la double exposition au déséquilibre efforts-reconnaissance et aux responsabilités familiales élevées au recrutement (0,08). Enfin, la valeur de l'index RERI pour la double exposition au déséquilibre efforts-reconnaissance et aux responsabilités familiales élevées au suivi à 3 ans était de 0,24. Il est important de noter que la valeur de l'index RERI indique la présence ou l'absence d'interaction, mais n'est pas recommandé pour juger de la force de l'interaction (198).

Globalement, la double exposition aux contraintes psychosociales au travail et aux responsabilités familiales élevées avait un effet néfaste sur la détresse psychologique des femmes. Toutefois, la force de la plupart des rapports de prévalences n'étaient que légèrement plus élevés pour la double exposition comparée à l'exposition aux contraintes psychosociales au travail évaluées séparément. Seuls les effets de la double exposition au déséquilibre efforts-reconnaissance et aux responsabilités familiales élevées au recrutement et au suivi à 3 ans étaient plus forts que les effets des contraintes psychosociales au travail évaluées séparément (+0.32 et +0.30, respectivement). Par ailleurs, aucune interaction statistique multiplicative significative n'a été observée.

Des effets néfastes plus forts étaient attendus pour les doubles expositions comparées aux expositions aux contraintes psychosociales au travail évaluées séparément. Une piste d'explication des résultats obtenus est que, pour les femmes, être mère et prendre soin de sa famille favoriserait le bien-être psychologique en procurant de la satisfaction et en favorisant l'estime de soi (178, 179) (tel que discuté au chapitre 5). Le fait de réaliser des responsabilités familiales élevées est possiblement plus susceptible d'entraver la santé psychologique lorsqu'il y a un conflit entre la vie personnelle et la vie professionnelle, c'est-à-dire lorsqu'il y a un conflit travail-famille (111). D'autres limites méthodologiques discutées dans l'article sur la détresse psychologique (chapitre 5) sont également susceptibles d'avoir entrainé une sous-estimation des effets de la double exposition et ainsi, potentiellement, une sous-estimation de l'interaction.

Table 1. Adjusted[34] associations between effort-reward imbalance and high family responsibilities[35] assessed at baseline with systolic and diastolic mean blood pressure (95% confidence interval) assessed at baseline, 3- and 5-year follow-ups; calculation of additive and multiplicative interaction

	At baseline			**At 3-year follow-up**			**At 5-year follow-up**		
	N	SBP (mm Hg)	DBP (mm Hg)	N	SBP (mm Hg)	DBP (mm Hg)	N	SBP (mm Hg)	DBP (mm Hg)
Effort-reward imbalance (high family responsibilities)									
No (no)	578	121.9	77.6	433	121.8	77.6	381	121.6	76.8
No (Yes)	300	-1.0	0.2	253	-1.0	-0.3	232	0.5	0.5
Yes (no)	240	1.3	**1.3**	170	0.5	0.1	156	**1.8**	0.9
Yes (yes)	97	1.7	**2.6**	77	2.4	**2.4**	62	**3.1**	**2.6**
Additive statistical interaction[1]		1.4	1.1		1.4	2.6		0.8	1.2

1. Additive statistical interaction. No interaction if $R_{11} - R_{00} = (R_{10} - R_{00}) + (R_{01} - R_{00})$.

[34] Adjusted for all covariates, namely: education, age, marital status, body mass index, alcohol consumption, smoking, leisure physical activity, stressful events, social support outside work, diabetes, known family history of cardiovascular diseases, and at 3-year and 5-year follow-ups menopause and menopausal hormone therapy. Categorizations used are provided in the "covariates" subsection of the methodology.

[35] Exposed categories are compared with the reference category (first category of each variable). Statistical significance of the differences is estimated by a Student's t test. Results in bold: $p<0.05$.

Table 2. Adjusted[36] prevalence (prev) and prevalence ratio (PR) of psychological distress assessed at baseline, 3- and 5-year follow-ups according to the double exposure to high job strain or effort-reward imbalance and high family responsibilities[37] assessed at baseline; calculation of additive and multiplicative interaction

	At baseline			**At 3-year**			**At 5-year**		
	N	Prev	PR	N	Prev	PR	N	Prev	PR
High job strain (high family responsibilities)									
No (no)	698	44.7	1.00	608	55.8	1.00	559	53.0	1.00
No (Yes)	318	**55.6**	**1.24**	295	63.3	1.14	279	55.9	1.05
Yes (no)	191	**63.2**	**1.42**	172	**69.9**	**1.25**	161	**69.4**	**1.46**
Yes (yes)	100	**68.5**	**1.53**	92	65.1	1.19	88	**76.1**	**1.52**
Additive statistical interaction[2]		-5.6			-12.3			+3.8	
RERI (additive)[3]			-0.13			-0.2			0.01
Multiplicative interaction[4]			0.87			0.83			0.99
p-value of multiplicative interaction term[5]		0.23				0.66			0.72

[36] Adjusted for all covariates, namely: education, age, marital status, body mass index, alcohol consumption, smoking, leisure physical activity, stressful events, social support outside work, and at 3-year and 5-year follow-ups menopause and menopausal hormone therapy. Categorizations used are provided in the "covariates" subsection of the methodology.
[37] Results in bold: p<0.05.

Effort-reward imbalance (high family responsibilities)

No (no)	636	38.9	1.00	553	46.0	1.00	508	45.5	1.00
No (Yes)	316	**48.6**	**1.24**	292	48.8	1.06	279	53.2	1.17
Yes (no)	253	**67.7**	**1.72**	227	**73.5**	**1.60**	212	**73.9**	**1.62**
Yes (yes)	102	**79.6**	**2.04**	95	**85.8**	**1.90**	88	**70.8**	**1.56**
Additive statistical interaction[1]		+2.2			+9.5			-10.8	
RERI (additive)[2]			0.08			0.24			-0.23
Multiplicative interaction[3]			1.13			1.12			0.82
p-value of multiplicative interaction term[4]		0.31				0.42			0.27

1. Additive statistical interaction. No interaction if R_{11}- R_{00} = (R_{10} - R_{00}) + (R_{01} - R_{00}).
2. RERI: RP_{11} - RP_{01} – RP_{10} + 1. Score < 0 means protective interaction. Score > 0 means adverse interaction.
3. Multiplicative interaction. No interaction if RP_{11} = RP_{01} * RP_{10}
4. Multiplicative interaction term: RP = βpsychosocial_factors + βresponsibilities + **βpsychosocial_factors*responsibilities** + βconfusion_factors. P-value of the bold term.

CHAPITRE 7 : Discussion et conclusion

7.1 Rappel du contexte et des principaux résultats

7.1.1. Revue systématique

Avant d'étudier les effets de la double exposition aux contraintes psychosociales au travail et aux responsabilités familiales élevées sur la pression artérielle, une revue systématique de l'effet de ces contraintes sur la pression artérielle a été réalisée. L'objectif était de mieux comprendre les évidences disponibles en les synthétisant et en y jetant un regard critique. Il s'agissait de la première revue systématique des études ayant porté sur l'effet des contraintes psychosociales au travail des modèles DL et DER sur la PA moyenne et l'hypertension. Globalement, un effet délétère significatif a été observé dans environ une étude sur deux. L'effet des contraintes psychosociales au travail sur la PA était ainsi inconsistant au sein des études antérieures. L'analyse des études en fonction de leur qualité méthodologique et du genre des participants (hommes et femmes) a permis de mieux comprendre ces inconsistances. Un effet délétère plus consistant a été observé parmi les études de qualité méthodologique supérieure, soit les études ayant un devis prospectif et celles ayant eu recours à une mesure ambulatoire de la PA. Plus précisément, un effet délétère a été observé au sein de : 8/12 études prospectives et de 6/7 études prospectives ayant eu recours à des mesures ambulatoires de PA (Annexe 1). Les différences de moyennes de PA systolique et diastolique observées variaient respectivement entre +1,2 et +7,7 mm Hg (48, 50, 52, 54, 55, 59) et entre +0,8 et +7 mm Hg (52, 55, 59) et les rapports de cotes ou risques relatifs d'hypertension variaient entre 1,27 et 2,78 (49, 50, 59) (Annexe 1). Ces résultats montrent que l'utilisation d'un devis prospectif et de mesures de PA ambulatoires favorisent l'observation d'un effet délétère.

Cette revue systématique montre également un effet délétère plus consistant chez les hommes que chez les femmes. Pour le job strain, 13/28 études ont observé un effet délétère significatif chez les hommes comparées à 3/21 études chez les femmes. De même, pour le déséquilibre efforts-reconnaissance, 5/6 études ont observé un effet délétère significatif chez les hommes comparées à 1/6 études chez les femmes. Cinq des six revues systématiques et/ou méta-analyses antérieures sur les contraintes psychosociales et les maladies cardiovasculaires ont également observé un effet délétère plus consistant chez les hommes que chez les femmes (8, 11, 133, 134, 177). La présente thèse de doctorat visait notamment à évaluer la piste d'explication selon laquelle l'effet moins consistant observé chez les femmes pouvait être lié au fait de ne pas avoir évalué l'exposition combinée à ces contraintes et à des responsabilités familiales (double exposition).

7.1.2 Étude de la double exposition aux contraintes psychosociales au travail et aux responsabilités familiales élevées

Cette thèse de doctorat visait à faire avancer les connaissances au sujet des effets des contraintes psychosociales au travail et des responsabilités familiales sur la santé cardiovasculaire et mentale des femmes. Cette thèse inclut la première évaluation des effets de la double exposition à ces contraintes et responsabilités sur la PA et la détresse psychologique, sur la base d'un devis longitudinal et d'une mesure des contraintes psychosociales au travail des modèles DL et DER. De plus, cette thèse a permis d'explorer pour la première fois la persistance des effets délétères de cette double exposition dans le temps.

7.1.2.1 Effets sur la pression artérielle (objectifs 2 et 3)

Les femmes ayant une double exposition au **job strain** et à des responsabilités familiales élevées avaient des moyennes de PA systolique et diastolique similaires à celles des femmes non-exposées. Pour leur part, les femmes ayant une double exposition au **déséquilibre efforts-reconnaissance** et à des responsabilités familiales élevées avaient des moyennes de PA plus élevées que les femmes non exposées à ces contraintes : au recrutement (diastolique : +2.75 mm Hg), à 3 ans (systolique : + 2.22 mm Hg et diastolique : +2.55 mm Hg) et à 5 ans (systolique : +2.94 mm Hg et diastolique : +3.10 mm Hg).

7.1.2.2 Effets sur la détresse psychologique (objectifs 4 et 5)

Comparées aux femmes non exposées, les femmes ayant une double exposition au **job strain** et à des responsabilités familiales élevées avaient un rapport de prévalences de détresse psychologique plus élevé au recrutement (RP : 1,53 (IC à 95% : 1,22-1,93) et 5 ans plus tard (RP : 1,43 (IC à 95% : 1,07-1,91). De plus, les femmes ayant une double exposition au **déséquilibre efforts-reconnaissance** et aux responsabilités familiales élevées avaient un rapport de prévalences de détresse psychologique plus élevé au recrutement (RP : 2,04 (IC à 95% : 1,68-2,49)), au suivi à 3 ans (RP : 1,90 (IC à 95% : 1,52-2,38) et au suivi à 5 ans (RP : 1,56 (IC à 95% : 1,16-2,10). Globalement, les effets délétères persistaient sur la période de 5 ans.

7.2 Considérations méthodologiques

7.2.1 Période de latence et persistance de l'effet

Aucune des études prospectives antérieures ayant porté sur l'effet délétère des contraintes psychosociales au travail sur la PA ou la détresse psychologique n'a examiné la période de latence requise pour observer un effet délétère (par exemple à l'aide de quelques temps de mesures). Les auteurs de revues de la littérature sur les contraintes psychosociales et la PA (46, 47) ou la détresse psychologique (72, 73) mentionnent d'ailleurs qu'il est difficile de se prononcer au sujet d'une période de suivi minimale. Il demeure néanmoins possible d'observer que les effets délétères des contraintes psychosociales sur ces issues de santé ne sont pas plus consistants parmi les études prospectives ayant de longues durées de suivi comparées aux études ayant de plus courts suivis (5 ans et plus versus moins de 5 ans) (résultat tiré de la revue systématique du chapitre 3 sur la PA et de l'annexe 2 sur la détresse psychologique). Une explication potentielle réside dans le fait qu'il est probable que les expositions aux contraintes psychosociales aient commencé avant le début des études ayant de plus courtes durées de suivi. Par exemple, il est tout à fait plausible qu'un employé occupant le même poste depuis 10 ans ait déjà une exposition chronique à certaines contraintes psychosociales au début d'une étude. Les questionnaires auto-administrés des contraintes psychosociales des modèles demande-latitude et déséquilibre efforts-reconnaissance permettent de mesurer l'exposition « actuelle » et non le temps depuis lequel un employé est exposé. Ainsi, identifier le début de l'exposition aux contraintes psychosociales est particulièrement difficile.

Dans la présente étude, un effet délétère de la double exposition aux contraintes psychosociales et aux responsabilités familiales élevées a été observé au recrutement et aux suivis à 3 et 5 ans pour la détresse psychologique et la pression artérielle. Comme ces deux issues sont des indicateurs précoces de problèmes de santé, il est plausible que les contraintes psychosociales et les responsabilités familiales aient eu un effet délétère à court terme. Cependant, il n'est pas possible de statuer quant à cet éventuel effet proximal sur la base des données de notre étude. Tel que mentionné ci-dessus, il n'est pas possible d'identifier le moment où les expositions ont débuté. Comme 1024 des 1087 femmes incluses dans notre étude occupaient leur emploi depuis plus 6 mois au recrutement, il est fort probable qu'elles aient été exposées aux contraintes psychosociales depuis des mois ou même des années. Pour ce qui est des responsabilités familiales, elles tendent à augmenter avec la venue du premier enfant [72, 73]. Dans la présente étude, 774 femmes avaient au moins un enfant au recrutement, ce qui laisse présager que l'exposition aux responsabilités élevées ait également débuté avant le début de l'étude. Ainsi, bien qu'un effet proximal soit envisageable, une grande prudence est requise quant aux conclusions à tirer par rapport à la période de latence. Malgré cette importante considération méthodologique, notre étude pose le premier jalon dans l'évaluation de la période de latence requise pour observer les effets délétères des contraintes psychosociales et des responsabilités familiales, à la fois sur la pression artérielle et la détresse psychologique. Le fait que les effets délétères aient été présents dès le recrutement va dans le même sens que notre hypothèse de départ. En effet, compte tenu du caractère précoce des atteintes étudiées (détresse psychologique et élévation du niveau de PA), nous envisagions une période de latence relativement courte. Notre autre hypothèse initiale, selon laquelle les effets de la double exposition perdureraient durant toute la période de suivi (5 ans), a également été confirmée. Des études futures estimant plus précisément le début des périodes d'expositions sont toutefois requises.

7.2.2 Analyses longitudinales : ajustement pour la valeur initiale de la pression artérielle

Aux suivis à 3 et 5 ans, la PA moyenne a été évaluée sans ajustement pour la valeur initiale de la PA. Des analyses complémentaires ajustant pour cette valeur initiale ont été réalisées. Dans ces analyses, des différences de moyennes de PA moins élevées (-1 à -3 mm Hg) que celles des analyses principales ont été observées (Tableau 5, Annexe 6). Cela suggère que les élévations de la PA observées au départ persistent, mais n'augmentent pas dans le temps. Tel que discuté précédemment, il est plausible que des valeurs de PA plus élevées au départ aient résulté d'une augmentation de la PA déjà en cours avant le début de l'étude (180). Ainsi, l'ajustement pour la valeur initiale de la PA annulerait un « horse-racing effect », où des différences de PA initiale attribuables à l'exposition passée ne sont plus considérées (181). Autrement dit, tel que mentionné par Glymour *et al.* (173), il est possible qu'en ajustant pour la valeur initiale de PA, nous ajustions pour une partie de l'effet à l'étude (mesures d'effets sous-estimées). Dans la présente étude, afin de ne pas atténuer une partie de l'effet évalué, il était ainsi préférable de ne pas ajuster pour la valeur initiale de la PA dans les analyses principales.

7.2.3 Échelles alternatives de responsabilités familiales

Il n'existe pas de mesure standardisée et validée des responsabilités familiales. Par ailleurs, ces responsabilités ont généralement été mesurées par une combinaison plus ou moins grande d'indicateurs liés au nombre d'enfants d'âge mineur, aux soins qui leur sont prodigués et à la réalisation de tâches ménagères (incluant le plus souvent le ménage, les courses et la préparation des repas) (23, 24, 28, 30, 93-96). Dans la présente étude, ces indicateurs ont été mesurés et intégrés à l'échelle totale de responsabilités familiales. Cette échelle de responsabilités était composée de deux dimensions : 1) le nombre d'enfants et leur âge et 2) les tâches ménagères et les soins prodigués aux enfants. L'algorithme utilisé pour calculer les responsabilités familiales était le suivant : (nombre d'enfants et leur âge + 1) * (tâches ménagères et soins aux enfants). Une valeur de 1 était ajoutée à la première mesure pour éviter qu'une femme qui n'a pas d'enfant se retrouve avec un score de 0. Cet algorithme a été utilisé dans deux études antérieures [33, 84]. Afin d'évaluer la robustesse des résultats obtenus dans la présente étude, trois formulations alternatives ont été évaluées. Les tableaux de ces analyses complémentaires sont présentés aux annexes 6 (pour la pression artérielle) et 7 (pour la détresse psychologique).

i) Échelle utilisée dans les analyses principales : (nombre d'enfants et leur âge + 1) * (tâches ménagères et soins aux enfants). Avec cette échelle, les scores variaient de 0 à 40. La multiplication des scores obtenus aux deux dimensions apporte une grande variabilité des scores totaux.

ii) Échelle alternative #1 : nombre d'enfants et leur âge + tâches ménagères et soins aux enfants. Cette échelle fait la somme plutôt que le produit des scores des dimensions. Additionner les scores des dimensions d'une échelle est une méthode très fréquemment utilisée dans les études épidémiologiques. Les scores totaux de cette échelle alternative variaient de 0 à 16,5.

iii) Échelle alternative #2 : pondération plus conservatrice de la dimension 'nombre d'enfants et leur âge'. La pondération de la dimension 'nombre d'enfants et leur âge' utilisée dans les analyses principales est : (nombre d'enfants de 0 à 5 ans * 3) + (nombre d'enfants de 6 à 11 ans * 2,5) + (nombre d'enfants de 12 à 17 ans * 2) + (nombre d'enfants de 18 à 20 ans * 1,5). La pondération plus conservatrice évaluée ici est : 1 + (nombre d'enfants de 0 à 5 ans * 2) + (nombre d'enfants de 6 à 11 ans * 1,5) + (nombre d'enfants de 12 à 17 * 1) + (nombre d'enfants de 18 à 20 ans * 0,5). La décision d'évaluer une pondération plus conservatrice provient de la constatation selon laquelle, pour les femmes ayant deux enfants ou plus appartenant au même groupe d'âge, la pondération originale attribuait des poids qui peuvent sembler élevés. En effet, 2 enfants de 18-20 ans ajoutaient l'équivalent de 2 fois la charge nécessaire pour s'occuper de soi-même (c.-à-d. la charge attribuée à un adulte sans enfant), 2 enfants de 12-17 ajoutaient 3 fois la charge, etc. La pondération plus conservatrice donne le même score que la pondération utilisée dans les analyses principales lorsqu'une femme a un seul enfant par groupe d'âge, mais ajoute des scores plus conservateurs lorsqu'une femme a plus d'un enfant dans le même groupe d'âge.

iv) Échelle alternative #3 : même pondération conservatrice que celle utilisée dans l'échelle alternative #2. Cependant, les deux dimensions sont additionnées plutôt que multipliées, suivant la même rationnelle que l'échelle alternative #1 (nombre d'enfants et leur âge + tâches ménagères et soins aux enfants).

Les échelles alternatives #1-3 et l'échelle utilisée dans les analyses principales étaient fortement corrélées, avec des coefficients de Pearson variant entre 0,975 et 0,985. Les résultats obtenus en utilisant les échelles alternatives étaient très similaires à ceux obtenus dans les analyses principales pour la pression artérielle (tableaux 14 et 15, annexe 6) et la détresse psychologique (tableau 13, annexe 7). Les seules différences étaient des différences de moyennes de pression artérielle systolique et diastolique plus faibles et non significatives pour la double exposition au déséquilibre efforts-reconnaissances et aux responsabilités familiales élevées au suivi à 5 ans. Ces différences peuvent notamment être attribuables au fait que, comparées aux analyses principales, l'échelle des responsabilités familiales alternative #1 fait la somme des dimensions 'nombre d'enfants et leur âge' + 'tâches ménagères et soins aux enfants' plutôt que le produit de ces dimensions. La variabilité des scores de responsabitliés familiales est par le fait même considérablement réduite, ce qui peut contribuer à diluer les effets. Pour leur part, les échelles alternatives #2 et #3 accordent un poids plus conservateur à la dimension 'nombre d'enfants et à leur âge' comparées aux analyses principales. Cela signifie que des femmes ayant moins d'enfants ou ayant des enfants plus âgés puissent faire partie du tertile supérieur de ces échelles alternatives. En somme, sur une période de 5 ans, il est possible que la force des effets de la double exposition au déséquilibre efforts-reconnaissances et aux responsabilités familiales élevées sur la pression artérielle moyenne ait été moins forte au sein des analyses alternatives.

Enfin, les scores de la dimension 'nombre d'enfants et leur âge' variaient entre 0 et 11 alors que les scores de la dimension 'tâches ménagères et soins aux enfants' variaient entre 0 et 4. La standardisation des scores obtenus pour ces dimensions n'a pas été réalisée pour deux raisons : 1) Pour les femmes ayant le plus grand nombre d'enfants, les scores de la dimension 'nombre d'enfants et leur âge' variaient entre 5 et 11. Un poids plus élevé était ainsi accordé à cette dimension. Puisque les responsabilités augmentent considérablement en fonction de cette dimension, il était conceptuellement souhaitable que celle-ci ait un poids plus élevé pour les femmes ayant plusieurs enfants, surtout lorsqu'ils sont en bas âge [71, 73]. 2) Les scores varient entre les mêmes valeurs, soit de 0 à 4, pour 80% de l'échantillon.

7.3 Forces

7.3.1 Revue systématique

Notre revue systématique sur l'effet des contraintes psychosociales au travail et la pression artérielle comporte d'importantes forces. Parmi celles-ci figure l'application des critères de qualité PRISMA, qui permettent de réaliser une recherche systématique, explicite et objective de la littérature en minimisant l'introduction de biais (153). Une autre force majeure consiste à avoir approfondi plusieurs pistes pour expliquer les effets inconsistants observés dans les études antérieures. Ces pistes sont : i) le genre (hommes / femmes), ii) le devis d'étude, iii) le type de mesures de la pression artérielle (cliniques ou ambulatoires), iv) les instruments de mesures des contraintes psychosociales, v) la catégorisation des contraintes psychosociales, vi) le contrôle pour les facteurs de confusion potentiels et vii) le taux de participation.

7.3.2 Études sur la pression artérielle et la détresse psychologique

Les études sur la pression artérielle et la détresse psychosologique ont plusieurs forces, dont : i) d'excellents taux de participation (>80%), ii) un devis longitudinal comprenant trois temps de mesure, iii) des instruments de mesure validés pour le job strain, le déséquilibre efforts-reconnaissance, la détresse psychologique et la pression artérielle, iv) une bonne prise en compte des facteurs de confusion potentiels et v) la robustesse des résultats en fonction des définitions alternatives des responsabilités familiales. Plusieurs de ces forces relèvent de choix méthodologiques posés afin de contourner les principales limites de la littérature actuelle.

De plus, la mesure ambulatoire de la PA constitue une importante force. Les résultats d'études prospectives montrent que les mesures ambulatoires de PA s'avèrent un meilleur prédicateur du risque de MCV (38, 40, 41) et d'événements cardiovasculaires (42-45) que les mesures cliniques. Les moyennes quotidiennes diurnes de PA ambulatoire sont également plus reproductibles que les mesures cliniques.

Enfin, des intervalles de confiance le plus souvent étroits témoignent d'une bonne précision de nos résultats principaux. De plus, moins de deux pourcents des données étaient manquantes pour les échelles des contraintes psychosociales au travail et les responsabilités familiales. Les données manquantes à un item d'efforts ou de demande psychologique ou à deux items ou moins de latitude décisionnelle ou de reconnaissance ont été imputées selon la moyenne des réponses du participant pour l'échelle concernée (0,5% à 1,5% des sujets, dépendant des variables).

7.4 Limites

7.4.1 Revue systématique

Les limites de la revue systématique sont discutées en profondeur au chapitre 3. Afin de limiter les redondances, cette section abordera uniquement les limites que nous jugeons plus importantes.

Un biais de publication a pu être introduit par le fait d'avoir inclus uniquement les études rédigées en anglais ou en français. Une analyse complémentaire a été réalisée à partir des titres et des résumés des articles recensés. Cette analyse a permis d'identifier les études exclues sur la base de la langue de publication. Trois études transversales n'ayant pas observé d'effet significatif entre le job strain ou le déséquilibre efforts-reconnaissance et la pression artérielle ont été exclues. Ce résultat va dans le même sens que celui de la revue systématique montrant que les effets néfastes sur la pression artérielle ne sont pas consistants parmi les études transversales.

Dans la présente revue systématique, aucun estimé global (méta-analyse) n'a été calculé. La rationnelle était liée à la grande hétérogénéité des études incluses. En effet, le critère d'homogénéité n'était pas rencontré pour : les intruments de mesures des contraintes psychosociales, la catégorisation de ces expositions (qui ont été modélisées selon la médiane de l'échantillon, la médiane de la population, en continu, en ratio, en tertiles, etc.), le contrôle de la confusion (ajustement pour des différents facteurs), la mesure de la pression artérielle (mesures cliniques ou ambulatoires) et la modélisation de la pression artérielle (moyennes et prévalences ou cotes d'hypertension). Le calcul d'un estimé global pour un sous-groupe d'études ayant des caractéristiques et qualités méthodologiques communes a été envisagé. Le sous-groupe d'études répondant à ce critère a fait l'objet d'une méta-analyse publiée en 2013 (37). Cette méta-analyse, de Landsbergis *et al*., était constituée des études transversales sur le job strain et les moyennes de pression artérielle ambulatoires (N=22 études). Les estimés globaux étaient de +3.43 mmHg pour la PA systolique et de +2.07 mm Hg pour la PA diastolique des travailleurs exposés au job strain comparés aux travailleurs non-exposés (37). Il est toutefois important de noter que l'hétérogénéité de ces estimés était forte, particulièrement pour la PA systolique (coefficient I^2= 62,3% pour la PA systolique et coefficient I^2= 42,3% pour la PA diastolique). Cela signifie que 62,3% de la variabilité observée entre les estimés des études, pour la PA systolique, était attribuable à l'hétérogénéité entre les études plutôt qu'à la chance. Dans cette méta-analyse, une telle hétérogénité pouvait être liée à l'utilisation d'instruments différents pour mesurer le job strain, aux différences dans la catégorisation de cette exposition et au fait que les variables de confusion différaient de manière importante d'une étude à l'autre.

7.4.2 Études sur la pression artérielle et la détresse psychologique

Les études sur la pression artérielle et la détresse psychologique comportent également des limites. D'abord, les analyses réalisées aux suivis à 3 et à 5 ans impliquaient que les femmes aient participé à deux temps de collecte des données (au recrutement et à 3 ans ou au recrutement et à 5 ans). Ainsi, bien que nous ayons obtenu d'excellents taux de participation de 80,9%-85% à chaque collecte, l'attrition et la sélection ultérieure des participantes (Figures 1 des chapitres 4 et 5) pourraient avoir mené à un biais de 'bonne santé du travailleur' (Healthy worker effect) (109). Pour que ce biais de sélection soit présent, la 'non-participation' doit être associée à l'expostion et à l'issue, c'est-à-dire que les non-participants doivent être plus exposés et plus *malades* que les participants. Un biais de bonne santé du travailleur contribue généralement à sous-estimer les mesures d'effets (109). Afin d'évaluer la présence et la force de ce biais potentiel dans notre étude, les femmes i) perdues aux suivis et ii) exclues en raison de données manquantes ont été comparées aux participantes incluses dans les analyses, en regard des expositions principales et des issues de santé (109). Compte tenu de la nature potentiellement différente de ces deux groupes (pertes aux suivis versus exclusions liées à des limites méthodologiques), ceux-ci ont fait l'objet d'analyses indépendantes.

Pour la pression artérielle, les femmes **perdues aux suivis** à 3 ans (N=78) et à 5 ans (N=123) avaient tendance à être moins exposées aux responsabilités familiales (à 3 ans et 5 ans) et aux doubles expositions au job strain (à 3 ans et 5 ans) ou au déséquilibre efforts-reconnaissance (à 3 ans) et à des responsabilités familiales élevées que les participantes (comparaison des valeurs obtenues au recrutement, tableaux 10 et 12 de l'annexe 6). Le niveau de pression artérielle des femmes perdues aux suivis était par ailleurs similaire à celui des participantes (tableaux 10 et 12 de l'annexe 6). Cela suggère une potentielle surestimation de la proportion de femmes ayant des responsabilités familiales élevées et ayant une double exposition dans notre population, ce qui ne supporte pas un biais de bonne santé du travailleur.

Pour leur part, les femmes exclues des analyses **en raison de données manquantes** au suivi à 3 ans avaient des proportions d'expositions au job strain et aux responsabilités familiales comparables à celles des femmes incluses dans les analyses. Par ailleurs, les femmes exclues avaient tendance à être davantage exposées au déséquilibre efforts-reconnaissance aux suivi à 3 (N=94) et à 5 ans (N=119), même si cette tendance n'était pas statistiquement significative (34% comparés à 27,6% p=0.18 et 31,9% comparés à 24,5%, p=0.31, tableaux 11 et 13 de l'annexe 6). De plus, les femmes exclues au suivi à 5 ans avaient tendance à être davantage exposées au job strain que les femmes incluses dans les analyses (32,8% comparés à 22,6%, tableau 13 de l'annexe 6). Les femmes exclues avaient aussi une moyenne de PA systolique plus élevée que les femmes incluses dans les analyses, et ce, aux suivis à 3 ans et à 5 ans (+7.1 mm Hg et +16.5 mm Hg, respectivement) (Tableaux 11 et 13 de l'annexe 6). Un biais de bonne santé du travailleur est ainsi envisageable, particulièrement au suivi à 5 ans. Ce biais sous-estimerait les mesures d'effets des analyses liées au job strain et, possiblement, au déséquilibre efforts-reconnaissance.

Pour la détresse psychologique, les femmes **perdues aux suivis** à 3 ans (N=109) et à 5 ans (N=164) avaient tendance à être moins exposées aux contraintes psychosociales, aux responsabilités familiales et aux doubles expositions contraintes psychosociales et à des responsabilités familiales que les participantes (tableaux 9 et 11 de l'annexe 7). Par ailleurs, leur prévalence de détresse psychologique était similaire à celle des participantes (tableaux 9 et 11 de l'annexe 7). Tel qu'observé pour la pression artérielle, cela suggère une potentielle surestimation de la proportion de femmes ayant des responsabilités familiales élevées et ayant une double exposition dans notre population et ne supporte pas un biais de bonne santé du travailleur.

Pour ce qui est des femmes exclues des analyses **en raison de données manquantes** aux suivis à 3 ans (N=31), seule leur proportion d'exposition à des responsabilités familiales était plus élevée comparées à celle des femmes incluses dans les analyses (33.2% versus 38,7%, tableau 12 de l'annexe 7). Cette tendance se basait toutefois sur un petit nombre de femmes exclues et n'était pas répliquée au suivi à 5 ans (N=56 exclusions). De plus, aucune différence n'a été observée pour les proportions d'expositions aux contraintes psychosociales, aux doubles expositions et pour la prévalence de la détresse psychologique (Tableaux 10 et 12 de l'annexe 7). Un biais de sélection chez ces femmes exclues est donc improbable.

Un autre biais ayant pu être introduit est celui de la méthode commune (surestimation des mesures d'effet). L'utilisation de données auto-rapportées pour les expositions et pour la détresse psychologique pourrait avoir entraîné un tel biais d'information différentiel (183). Il est toutefois important de noter que les intervalles de 3 et 5 ans entre les mesures des expositions et de la détresse psychologique ont contribué à minimiser l'importance de ce biais potentiel (109). Le biais de la méthode commune a été évalué dans une étude antérieure portant sur les symptômes dépressifs et anxieux (auto-rapportés). Dans cette étude antérieure, la latitude décisionnelle au travail a été mesurée de manière auto-rapportée et *objectivée* par titre d'emploi (78). La variance des symptômes dépressifs et anxieux expliquée par une latitude décisionnelle faible était aussi élevée lorsque cette contrainte était mesurée de manière *objectivée* (32% pour les symptômes dépressifs et 27% pour les symptômes anxieux) que lorsqu'elle était auto-rapportée (32% pour les symptômes dépressifs et 24% pour les symptômes anxieux) (78). Ainsi, dans cette étude antérieure, le biais de la méthode commune n'était pas présent pour la latitude décisionnelle.

Seules les expositions aux contraintes psychosociales et aux responsabilités familiales mesurées au recrutement ont été prises en compte. Le recours à une seule mesure de l'exposition a pu introduire un biais d'information non-différentiel (sous-estimation potentielle) lié aux changements d'exposition non pris en compte. En effet, plus la période de suivi d'une étude est longue, plus les expositions aux contraintes psychosociales et aux responsabilités familiales sont susceptibles de se modifier (enrichissement des tâches, resserrement de personnel, nouveau chef d'équipe plus ou moins *reconnaissant*, enfants qui deviennent plus autonomes ou qui quittent la maison, etc.). Dans notre étude, une analyse complémentaire a révélé que la plupart des femmes ayant une double exposition i) au job strain ou ii) au DER et aux responsabilités familiales élevées au recrutement n'avaient plus la double exposition au suivi à 5 ans. En effet, seules 22% (job strain) et 23% (DER) des femmes qui avaient une double exposition au recrutement sont demeurées doublement exposées à 5 ans. Ne pas avoir pris en compte les changements d'exposition a probablement contribué à introduire un important biais d'information non-différentiel. Bien que l'information quant aux expositions était disponible aux suivis à 3 et 5 ans, nous ne disposions pas de la puissance statistique nécessaire pour évaluer la double exposition cumulée à plus d'un temps de mesure.

De plus, l'exposition aux responsabilités familiales a été mesurée par des questions sur le nombre d'enfants, leur âge, les tâches ménagères et les soins prodigués aux enfants. Bien que ces questions donnent un aperçu global des responsabilités familiales, elles ne permettent pas de saisir toute la complexité de celles-ci. Une mesure plus complète aurait par exemple pu inclure des questions portant sur les tâches ménagères extérieures (ex. tonte du gazon, déneigement) (101) ou sur le fait de s'occuper d'une personne en perte d'autonomie (108) ainsi que sur les conflits entre le travail et la vie personnelle (111). Le fait que notre mesure des responsabilités familiales soit 'incomplète' a pu contribuer à introduire un biais d'information non-différentiel ayant mené à une sous-estimation des effets.

Bien que de nombreux facteurs de confusion potentiels aient été pris en compte, une confusion résiduelle peut tout de même avoir résulté de facteurs non mesurés. Par exemple, aucun facteur lié aux habitudes alimentaires n'ont été pris en compte alors que des évidences montrent que celles-ci peuvent incluencer la santé cardiovasculaire (199) et mentale (200). D'autres facteurs de risque individuels non mesurés auraient été pertinents pour maximiser le contrôle de la confusion, tel le sentiment d'efficacité et la satisfaction qu'éprouve un individu envers son travail ainsi que les comportements de type malade (*sick role* en anglais) et le trait de personnalité de type A (individu pressé par le temps, impatient et exigeant envers lui-même). Un contrôle pour la cohésion maritale aurait également été pertinent compte tenu que deux études antérieures ont observé qu'une faible cohésion maritale amplifiait l'effet délétère des contraintes psychosociales au travail sur la pression artérielle (58, 184). Ne pas avoir tenu compte des ces facteurs a pu contribuer à sous-estimer ou à surestimer les mesures d'effet.

Enfin, il est important de mentionner que certaines variables d'ajustement incluses dans les analyses principales avaient possiblement un rôle intermédiaire dans l'effet de la double exposition sur la PA (133, 176) et la détresse psychologique (12). Ces variables sont : la consommation d'alcool, le tabagisme, la pratique d'activités physiques de loisir et l'indice de masse corporelle. Des analyses de sensibilité retirant ces variables des modèles statistiques ont été réalisées. Les résultats obtenus pour cette analyse étaient très similaires aux résultats des analyses principales sur la PA (tableaux 6 et 7 de l'annexe 6) et la détresse psychologique (tableaux 5 et 6 de l'annexe 7). *L'effet indépendant* de la double exposition sur les issues de santé (modèle incluant toutes les variables confondantes potentielles) et *l'effet global* (modèle excluant les variables intermédiaires potentielles) étaient ainsi pratiquement identiques dans la présente étude.

7.5 Conclusions

La présente thèse de doctorat a d'abord montré, par une revue systématique de la littérature, que les effets des contraintes psychosociales au travail sur la pression artérielle étaient plus consistants au sein des études de qualité méthodologique supérieure et chez les hommes comparés aux femmes. Cette thèse a ensuite montré que l'effet moins consistant observé chez les femmes dans les études antérieures pouvait notamment être lié au fait de ne pas avoir évalué ces contraintes conjointement avec les responsabilités familiales. Dans la présente thèse, les femmes ayant une double exposition au déséquilibre efforts-reconnaissance et à des responsabilités familiales élevées avaient une moyenne de pression artérielle plus élevée que les femmes non exposées à ces contraintes. Ces différences ont été observées aux trois temps de mesure de l'étude, soit au recrutement et aux suivis à 3 ans et à 5 ans. Par ailleurs, les femmes ayant une double exposition au job strain et à des responsabilités familiales élevées avaient une moyenne de PA similaire à celle des femmes non-exposées.

La présente thèse a également montré que les femmes ayant une double exposition au job strain ou au déséquilibre efforts-reconnaissance et à des responsabilités familiales élevées avaient une prévalence de détresse psychologique plus élevée que les femmes non-exposés. Globalement, ces effets délétères persistaient sur l'ensemble du suivi de 5 ans.

7.6 Contributions et retombées

La présente thèse de doctorat contribue à l'avancement des connaissances relatives à l'étiologie psychosociale des maladies cardiovasculaires et des problèmes de santé mentale en intégrant: i) la première revue systématique de la littérature sur les effets des contraintes psychosociales au travail des modèles DL et DER sur la PA moyenne et sur l'hypertension des femmes et des hommes, ii) la première évaluation des effets de la double exposition à des contraintes psychosociales au travail et à des responsabilités familiales élevées sur la pression artérielle et la détresse psychologique sur la base d'un devis longitudinal et d'une utilisation simultanée des deux mesures les plus validées des contraintes psychosociales au travail (modèles DL et DER) et iii) la première exploration de la persistance des effets délétères de cette double exposition dans le temps.

La présente thèse fournit des données probantes rigoureuses pour la prévention primaire des maladies cardiovasculaires. Au niveau populationnel, une réduction persistante de seulement 2 mm Hg de la PA systolique est associée à une réduction de la mortalité attribuable aux maladies coronariennes et aux AVC de respectivement 7 et 10% (3, 185). Les différences de moyennes de PA observées dans la présente étude variaient entre 2,22 mm Hg et 3,10 mm Hg, comportant ainsi un potentiel majeur pour la santé publique. D'importantes retombées pour la prévention des problèmes de santé mentale peuvent également être escomptées. En effet, les femmes de la présente étude qui avaient une double exposition au job strain ou au déséquilibre efforts-reconnaissance et à des responsabilités familiales élevées avaient un rapport de prévalences de détresse psychologique de 1,43 à 2,04 fois plus élevé que les femmes non-exposées. Réduire la détresse psychologique revêt une grande importance populationnelle, particulièrement compte tenu que cette atteinte précoce à la santé mentale constitue un facteur de risque important de la dépression majeure (5, 6). L'Organisation Mondiale de la Santé (OMS) prévoit que la dépression majeure constituera la deuxième principale cause d'incapacité mondiale d'ici 2020 (186).

Les contraintes psychosociales au travail évaluées dans la présente étude sont précises, fréquentes (13) et modifiables (187). La réduction de ces contraintes, de même que l'amélioration de la conciliation entre le travail et la vie personnelle, peuvent être ciblées à chacun des trois niveaux de prévention en santé publique : 1) au niveau de l'individu, par le biais des programmes d'aide aux employés (PAE) (188), 2) au niveau du milieu de travail, à l'aide d'actions précises visant à améliorer l'organisation du travail et les pratiques de gestion; 3) au niveau des politiques publiques, en précisant, par exemple, le contenu de la norme québécoise *Prévention, promotion et pratiques organisationnelles favorables à la santé (BNQ 9700-800)* et le contenu de la norme canadienne *Santé et sécurité psychologiques en milieu de travail (BNQ 9700-803)*. Les résultats de cette thèse comportent donc un potentiel important pour la prévention primaire des maladies cardiovasculaires et des problèmes de santé mentale.

Annexe 1 – Tableau synthèse des études prospectives sur les contraintes psychosociales au travail et la pression artérielle

Author, year (reference)	N participants (N men / women) Participation rate (PR)	Age at baseline, Population type[1], Country	Study design	D C S indicator, assessment[2] and prevalence	Outcome[3-4]	Covariates[5]	Main results / Comments	
							Results for men	Results for women
DEMAND-CONTROL MODEL, N=14 studies								
Office BP measures, N=9 studies								
Reed, 1989 (189)	7,750 men PR: not mentioned	45-68 years old, men of the general working population, Honolulu *Hypertension workers at baseline not excluded	Prospective18-year follow-up	JCQ, English version	Office mean BP	Age, BMI, oral contraceptive use	Adjusted differences in mean BP **D** (high) Syst. BP: + 0 mm Hg Diast. BP: + 0 mmHg **C** (high): Syst. BP: +-2 mm Hg Diast. BP: + 0 mmHg *No significant results	

Chapman, 1990 (190)	2,634 participants (2100 men and 534 women), PR:57%	Mean age 34.4 in men and 31.9 in women, Government workers, Australia *Workers under medication for hypertension at baseline were excluded	Prospectiv e 5-year follow-up	Questionnaire not mentioned	Office mean BP	Age, education, weight, weight change, physical activity, family history of stroke or hypertension, skinfold thickness, alcohol consumption and change in consumption	Partial regression coefficients	
							no significant association (not shown)	< 35 years old: **D**: Quantitative demands: Diast. BP: 0.08 (p value <0.001) **S:** Diast. BP: 0.11(p value <0.01) WOMEN ≥50 years old: **C:** -0.25 (p value <0.01) *No significant association for systolic BP (not shown

Greenlund, 1995 (191)	2,665 participants, PR: 57% at baseline and 90% at 7–year follow-up	18-30 years old, black and white workers, USA *Hypertensive workers at baseline were not excluded	Prospective5 and 7-year follow-ups	JCQ English version	Office mean BP	Age, education, physical activity, BMI Framingham A/B personality score, smoking and alcohol	Correlation coefficients	
							WHITE MEN **D:** Syst. BP: -0.019 Diast BP: -0.050 **C:** Syst. BP: -0.031 Diast BP: 0.022 BLACK MEN **D:** Syst. BP: 0.072 Diast BP: -0.113 **C:** Syst. BP: 0.067 Diast BP: 0.004	WHITE WOMEN **D:** Syst. BP: -0.093 Diast BP: -0.060 **C:** Syst. BP: 0.118* Diast BP: 0.100* BLACK WOMEN **D**: Syst. BP: 0.026 Diast BP: -0.007 **C:** Syst. BP: -0.027 Diast BP: 0.017 *p value <0.05

Eaker, 2004 (48)	3,039 participants (1711 men and 1328 women) PR: 75%	18-77 years-old, general working population, USA *Hypertensive workers at baseline were not excluded	Prospective, 10 year follow-up	JCQ original English version, Quadrant	Office systolic mean BP	Age, the ratio of total cholesterol to high density lipoprotein cholesterol, BMI, smoking, and diabetes * Crude results presented.	Crude difference mean systolic BP: **Job strain**: +1.2* mm Hg p=0.02 **D** (higher median): +1.5 mm Hg (p=0.05) **C** (lowest median): +1.9* mm Hg (p=0.01)	Crude difference mean systolic BP: **Job strain**: +2.5* mm Hg p=0.05 **D** (higher median): -1.00 mm Hg (NS) **C** (lowest median): +2.9* mm Hg (p<0.01)
Markovitz, 2004 (49)	3,200 participants (1443 men and 1757 women) PR: not mentioned	20-32 years old Workers of a normotensive cohort, USA *Hypertensive workers at baseline were excluded based on BP measure and medication	Longitudinal study (8-year follow-up),	JCQ completed at baseline and at follow-up (change in score for longitudinal analysis), Dichotomous Cumulative exposure	Office hypertension (160 / 95 mmHg)	Age, baseline BP, education, BMI, change in BMI, alcohol intake, smoking, family history of high BP	**Both genders** Odds ratio of hypertension: **Job strain at baseline :** 1.27 (0.47-3.44) **D or C at baseline** : NS **Change in D**: 1.05 (1.01-1.09) **Change in job strain:** 2.06 (1.01-4.26)	

Guimont, 2006 (50)	6,719 participants (3483 men and 3236 women), PR: 75% at baseline, 89% at follow-up	18-65 years old (mean 41.0±8.2 in men and 38±7.2), employees of 22 public organizations in Quebec City, Canada *Workers under medication for hypertension at baseline were excluded	Prospectiv e7.5-year follow-up,	JCQ French version, Quadrant	Office mean BP	Age, BMI, social support at work, living with a child, number of years working for the organization, and baseline systolic or diastolic blood pressure values (controlled but not retained: physical activity, alcohol consumption, smoking, marital status)	Adjusted differences in mean BP **Job strain at both times**: Syst. BP: +1.8 mm Hg (0.1-3.5) Diast. BP:+0.8 mm Hg (-0.5-2.0) **Risk ratios for BP increase in highest quintile** MEN: Syst. BP: 1.33 (1.01-1.76), Diast. BP: 1.07 (0.84-1.36)	Adjusted differences in mean BP **Job strain at both times:** Syst. BP:+0.5 mm Hg (-0.8-1.8), Diast. BP: +0.5 mm Hg (-0.5-1.4) **Risk ratios for BP increase in highest quintile** WOMEN: Syst. BP: 1.15 (0.93-1.41), Diast. BP: 1.06 (0.85-1.31)
Kivimaki, 2007 (51)	8,086 participants (5630 men and 2456 women), PR: 73% at baseline	35-55 years old at baseline (mean 44.3), London-based civil servants, England *Hypertensive workers at baseline were not excluded	Prospectiv e 12-year follow-up,	JCQ English version, Quadrant	Office hypertension (≥140/90 mm Hg or medication)	Age, gender, ethnicity, and employment grade	**Both genders:** **Job strain** Prevalence of hypertension: -1.2% Difference in mean BP: Syst. BP: -1.0 mm Hg Diast. BP: 0.0 mm Hg *No significant results. *Baseline results are also given. The was no significant differences.	

Ohlin, 2007 (52)	448 participants (197 men and 251 women) PR not mentioned	Under 63 years old (mean: 55 years old), employed with reading and writing skills, Sweden *Hypertensive workers at baseline were not excluded	Prospective study followed for a mean of 6.5 years,	JCQ Swedish version , Quadrant	Office mean BP	Age, time to follow-up, baseline BP, hypertensive medication at baseline and education	Adjusted differences in mean BP: Job strain at baseline: Syst. BP + 7.7 mm Hg (p=0.02), Diast. +5.6 mm Hg (p=0.003) **D**: significant increase in crude syst BP (p=0.02), but when adjusted p=0.095. Diast BP: p=0.075 **C**: no significant increases (not shown)	Adjusted differences in mean BP: **Job strain:** No associations (not shown). **D:** No association (not shown) **C** (high): significant increase in crude syst BP (p=0.035), but when adjusted p=0.23.
Chandola, 2008 (192)	10,308 participants at baseline, PR: 67% participation at follow-up (N=6484) (follow-up PR not mentioned)	35-55 years old, 20 civil service departments, London *Hypertensive workers at baseline were not excluded	Prospective12-year follow-up	JCQ English version (items not mentioned), Dichotomous	Office hypertension (≥140/85 mm Hg or medication)	Age, gender, employment grade, health behaviors (alcohol consumption, smoking, physical activity, diet)	**Both genders** Adjusted odds ratios: **One report of job strain**: 0.88 (0.67–1.14) **Two reports of job strain**: 1.13 (0.91-1.40)	

Ambulatory BP measures, N= 5 studies								
Melamed, 1998 (193)	145 men from industrial plants PR : 93%	27 to 60 years old (mean 44.1), employed in industrial plants Israel *Hypertensive workers at baseline were excluded based on BP measure and medication	Longitudinal (variations within the same day),	C: 6 items. Work load: 1 item. Not the original JQC instrument. Ratio demand/control	Ambulatory mean BP[38]	Age BMI, baseline (office) BP.	Adjusted differences in mean BP: **Job strain:** Syst. BP: +4.2mmHg (p=0.001 Work load X control interaction) Diast. BP: +0.1 mmHg (ns) Systolic BP Main effect of **workload**: p =0.023 Main effect of **C**: p =0.046 Diastolic BP: NS (not mentioned)	None

[38] Office measures were also taken.

Schnall, 1998 (194)	195 men, PR: PR: 75% at baseline and 77% follow-up rate	30-60 y-old mean, general working population, USA *Hypertensive workers at baseline were not excluded	Longitudinal (3 years follow-up),	JCQ English version, Dichotomous Cumulative exposure	Ambulatory mean BP	Age, BMI, race/ethnic group, alcohol use, 24-hour urine sodium excretion, Type A behavior, education, current smoking status, physical activity of the job and work site	Adjusted differences in mean BP **Job strain at both times**: Syst. BP + 11 mm Hg, Diast. BP +7 mm Hg	None
Fauvel, 2003 (56)	303 participants (278 men and 25 women), PR: 78%	18-55 years old (mean 38.1), normotensive (<140/90 mm Hg) workers in a chemical company, France *Hypertensive workers at baseline were excluded, based on BP measure and medication	Prospective 5-year	JCQ French version, Dichotomous Cumulative exposure	Ambulatory hypertension (≥140/90 mmHg) Ambulatory mean BP	Age, gender, BMI, alcohol consumption, occupation and sodium intake	**Both genders** Cumulative incidence of hypertension **Job strain:** No significant difference among the incidence curves. Difference mean BP: **Job strain at both times:** 24h syst BP: -2.0 mmHg 24h diast BP: -1.0 mm Hg Worksite syst. BP: 0.0 mm Hg Worksite diast. BP: 0.0 mm Hg * No significant results.	

Riese, 2004 (195)	159 women PR = 60%	Mean age 35.9 (SD 8.5) years, nurses Netherlands *Workers under medication for hypertension at baseline were excluded	Longitudinal study 12.2 month average	JCQ Dutch version, ratio demand/control Cumulative exposure	Ambulatory mean BP	Social support at follow-up, age, oral contraceptive use Waist-hip ratio	None	Adjusted beta coefficients **D/C**: B=0.19 for the interaction term, p=0.02 **D:** B = 0.17 p =0.04 **C:** not significant (not shown)
Tobe, 2007 (196)	229 participants (106 men and 123 women) PR:69.7%	Mean age: 50.8 (SD 6.5) years, respondents to local advertisement and seminars Toronto, Canada *Workers under medication for hypertension at baseline were excluded	Prospective 1-year follow-up	JCQ English version, Dichotomous	Ambulatory mean BP	Age gender ethnic background premature CVD education, BMI, smoking, alcohol consumption, participation in a stress management program, income, and physical activity	**Both genders** P-value for adjusted mean change over the last year **Job strain**: Syst. BP change over 1 year: (p=0.011).	

EFFORT-REWARD IMBALANCE MODEL, N=1 study							
Gilbert-Ouimet, 2011 (59)	1,595 participants (62 men and 96 women), PR: 79.5%	44.0±8.1 years old (men) and 42.8±6.9 years old (women) White-collar workers, Quebec City (Canada) *Hypertensive workers at baseline were excluded (based on BP measure and medication) (for analysis on cumulative incidence of hypertension)	ERI and OC, Siegrist's questionnaire, French version Cumulative exposure	Ambulatory mean BP Cumulative incidence of hypertension (135/85 mm Hg or medication)	Age, gender, education, income, marital status, BMI, waist circumference, family history of CVD, medication, diabetes, smoking, alcohol consumption, physical activity, situations that may affect BP during measurement	**ERI:** **Adjusted mean BP:** Syst. BP: +0.17 (p-value 0.84) and Diast. BP: +0.42 (p-value 0.83) **Adjusted cumulative incidence ratios of hypertension:** 1.04 (0.56-1.95) **OC**: **Adjusted BP means in men in highest tertile:** Syst BP: +1.66 (p value 0.02) Diast. BP: +0.89 (p value 0.10)	**ERI:** **Adjusted mean BP in women exposed at both times :** <45 years old: Syst. BP: +1.86 (p-value 0.05) and Diast. BP: +1.48 (p-value 0.02). ≥45 years old: Syst. BP: +0.06 (p-value 0.95) and Diast. BP: -0.26 (p-value 0.70). **Adjusted cumulative incidence ratios of hypertension in women exposed at both times**: < 45 years old: 1.20 (0.53-2.75) ≥45 years old: 2.78 (1.26-6.10) **OC**: Adjusted BP means in women in highest tertile: Syst BP= +1.28 (p value 0.03) Diast. BP= +1.02 (p value 0.01)

Annexe 2 – Tableau synthèse des études prospectives sur les contraintes psychosociales au travail et la détresse psychologique

First author, year	N participant, Participation rate (PR), Length of follow-up	Age, Population type[1], Country	Psychosocial work factors[2]	Outcome	Covariates[3]	Main results: MEN	Main results: WOMEN
DEMAND-CONTROL MODEL, N= 14 studies							
Niedhammer, 1998 (197)	11 552 participants (8422 men and 3130 women) PR at baseline: 74% PR at follow-up: 92% 1-year follow-up	41-56 years-old, workers of an electricity company, Belgium	JCQ French version PD: 5 items DL: 6 items SS: 5 items	Depressive symptoms (CES-D), 20 items	Age, marital status, number of children, educational level, occupation, previous absenteeism for mental disorders, and stressful personal and occupational events	**Odds ratios PD: 1.77 (1.57-1.99) DL: 1.38 (1.22-1.56) SS: 1.58 (1.41-1.78)**	**Odds ratios PD: 1.37 (1.13-1.67) DL: 1.41 (1.15-1.73) SS: 1.29 (1.06-1.57)**
Stansfeld, 1999 (83)	10 308 participants (6895 men and 3413 women) PR at baseline: 73%	35-55 years-old, civil servants (Whitehall II), UK	JCQ PD: NM items DL: NM items SS: NM items	Psychiatric disorders (GHQ), 30 items	Age, employment grade and baseline GHQ score	**Odds ratios PD: 1.33 (1.1 to 1.6) DL: Decision authority (low): 1.29 (1.1 to 1.5)** Skills	**Odds ratios PD: 1.24 (1.0-1.6) DL: Decision authority: 1.37 (1.1 to 1.8)** Skills

First author, year	N participant, Participation rate (PR), Length of follow-up	Age, Population type[1], Country	Psychosocial work factors[2]	Outcome	Covariates[3]	Main results	
						MEN	WOMEN
	PR at phase 2: 79% PR at phase 3: 83% 5.3-year follow-up					discretion (low): 1.11 (0.9 to 1.3)	discretion: 1.09 (0.8 to 1.4)
Cheng, 2000 (148)	16 287 women PR at baseline: 69% PR at follow-up: 41% 4-year follow-up	30-55 years-old, nurses, USA	JCQ PD: 5 items DL: 6 items SS from supervisors: 4 items SS from co-workers: 5 items Assessed at baseline and follow-up.	Mental health status (SF-36) Assessed at baseline and follow-up.	Age, BMI, smoking, alcohol, diabetes, hypertension, hypercholesterolaemia, employment status, presence of a confidant, marital status, educational status, educational attainment, exercise level.		**Multivariate regression coefficients** for **improvement in mental health**: **DL (high vs low): 5.16 (4.66 – 5.67)** **PD: (low vs high): 4.4 (3.87 – 4.93)** **SS: (high vs low): 4.46 (4.00-4.91)**
Bültmann, 2002 (140)	12 161 participants (8840	18-65 years-old, employees	JCQ PD: 5 items DL: NM items	Psychological distress (GHQ)	Education, age, sex, income, living alone, employment status,	**Odds ratios**: **PD:1.63 (1.33-2.00)**	**Odds ratios:** PD=**1.59 (1.15-2.19)**

First author, year	N participant, Participation rate (PR), Length of follow-up	Age, Population type[1], Country	Psychosocial work factors[2]	Outcome	Covariates[3]	Main results	
						MEN	WOMEN
	men and 3255 women) PR at baseline: 45% PR at follow-up: 80% 1-year follow-up	from 45 companies, Netherlands	SS: 8 items		presence of disease, baseline value of GHQ-12	**DL:1.43 (1.15-1.78)** **Supervisor SS: 1.39 (1.17-1.65)** **Co-worker SS: 1.38 (1.15 – 1.65)**	DL=1.01 (0.73-1.41) Supervisor SS: **1.30 (1.00-1.70)** **Co-worker SS:1.40 (1.05 – 1.89)**
Bildt, 2002 (87)	420 participants (198 men and 222 women) PR at baseline: 62% PR at follow-up: 87% 4-year follow-up	18-65 years-old, general population sample (REBUS study), Swedish	Questionnaire used not mentioned PD: NM items DL: NM items SS: NM items	Reduced psychological well-being (developing psychological distress, GHQ)	Age, working hours, physical load, marital status, frequency of social contacts, demanding life events, smoking habits, physical activity and perceived load outside work	**Risk ratios :** SS : 1.7 (0.8-3.3) Job strain : 1.5 (0.5-4.6)	**Risk ratios :** SS:1.2 (0.7-2.2) Job strain : 1.3 (0.7-2.5)
Paterniti, 2002	10 519 participan	35-50 years-old, workers	JCQ PD: 5 items	Depressive symptoms in	Age, gender, marital status, stressful	**Pearson correlation**	**Pearson correlation**

First author, year	N participant, Participation rate (PR), Length of follow-up	Age, Population type[1], Country	Psychosocial work factors[2]	Outcome	Covariates[3]	Main results	
						MEN	WOMEN
(75)	ts (7729 men and 2790 women) PR at baseline: 79% PR at follow-up: 73% 3-year follow-up	of an electricity company (GAZEL cohort), Belgium	DL: 6 items SS: 5 items	past week (CES-D)	personal events during the previous year, and the presence of one or more chronic diseases (asthma, infarction, angina, hypertension, diabetes, osteoarthritis, hypercholesterolaemia or cancer	**coefficients** **Depressive symptoms at baseline:** **PD: 0.12** **DL: -0.15** **SS: 0.14** **Deterioration in depressive symptoms score:** **PD: 0.14** **DL: -0.07** **SS: 0.11** *All coefficients were statistically significant (p<0.05)	**coefficients** **Depressive symptoms at baseline:** **PD: 0.11** **DL:-0.17** **SS: 0.12** **Deterioration in depressive symptoms score:** **PD: 0.10** **DL: -0.05** **SS: 0.08** *All coefficients were statistically significant (p<0.05)
Griffin, 2002 (81)	7473 participants (5156 men and 2317 women) PR at	35-55 years-old, civil servants, (Whitehall cohort), UK	JCQ DL:15 items	**Recent feelings of psychological morbidity** Depression: 4 items GHQ Anxiety 5	Age, occupation, home control, number of children, marital status	**Odds ratios:** **DEPRESSION** **DL: 1.53 (1.31-1.80)** **ANXIETY** **DL: 1.43(1.20-**	**Odds ratios:** **DEPRESSION** **DL: 1.48 (1.15-1.89)** **ANXIETY** **DL: 1.29 (1.03-1.62)**

First author, year	N participant, Participation rate (PR), Length of follow-up	Age, Population type[1], Country	Psychosocial work factors[2]	Outcome	Covariates[3]	Main results	
						MEN	WOMEN
	baseline: 73% PR at follow-up: 71% 5-year follow-up			items GHQ		**1.70)**	
Godin, 2004 (77)	3804 workers (2056 men and 1740 women) PR at baseline: 40% PR at follow-up: NM 4-year follow-up	18-66 years-old, workers from a hospital, two insurance companies, one telecommunication organization (Somstress study), Belgium	JCQ PD: NM items DL: NM items SS: NM items	Depression and anxiety symptoms (SCL-90)	Age, gender, education	**Both gender** **Odds ratios:** **DEPRESSION** PD: 1.0 (0.9–1.2) **DL: 1.9 (1.6-2.3)** **SS: 1.4 (1.2-1.7)** **ANXIETY** **PD: 1.2 (1.0–1.4)** **DL: 1.7 (1.4–2.0)** **SS: 1.3 (1.1–1.5)**	
De Lange, 2004 (80)	1074 participants (men and women)	18-65 years-old, workers of 34 different companies,	**JCQ** PD: 5 items DL: 8 items SS from supervisors: 4	Depressive symptoms during the last two weeks (CES-	Age, gender, education, years of experience in the present job	**Both genders** **Chi-square obtained by structural equation modeling** **PD, DL et SS** were introduced	

First author, year	N participant, Participation rate (PR), Length of follow-up	Age, Population type[1], Country	Psychosocial work factors[2]	Outcome	Covariates[3]	Main results	
						MEN	WOMEN
	PR at baseline: 84% PR at follow-up: 85% 3-year follow-up	Germany	items	D)		simultaneously: **253.88 (126 degrees of freedom)**, statistically significant	
Virtanen, 2007 (88)	3366 participants (1662 men and 1704 women) PR at baseline: 87,8% PR at follow-up: NM 1-year follow-up	30-64 years-old, general population (the Health 2000 Study), Finland	JCQ PD: 5 items, DL: 9 items	Depression or anxiety disorders (CIDI)	Age, gender, marital status, occupational grade, household income	Odds ratios: PD: **1.30 (1.07-1.57**) DL (high): **0.60 (0.47-0.75)** Job strain (dichotomous) : **1.62 (1.33-1.98)** Job strain (quadrants) Active: 1.50 (0.82-2.74) Passive: **2.13 (1.14-3.98)** High strain: **2.54 (1.43-4.51)**	Odds ratios: PD: **1.31 (1.15-1.49**) DL (high): **0.85(0.73-1.00)** Job strain (dichotomous): **1.33 (1.18-1.49)** Job strain (quadrants) Active: 1.14 (0.74-1.76) Passive: 0.93 (0.59 – 1.47) High strain: **1.68 (1.07 – 2.61)**

First author, year	N participant, Participation rate (PR), Length of follow-up	Age, Population type[1], Country	Psychosocial work factors[2]	Outcome	Covariates[3]	Main results	
						MEN	WOMEN
Ahola, 2007 (76)	3255 participants (672 men and 1883 women) PR at baseline: 71% PR at follow-up: 84% 3-year follow-up	26-73 years-old, dentist members of the national association, Finland	**JCQ** PD: 3 items DL: 9 items	Depression symptoms (BDI)	Age, gender, marital status	**Both genders** Odd ratio: Job strain: **3.39 (2.03 to 5.66)**	
Clays, 2007 (79)	2821 workers (1950 men and 871 women) PR at baseline: 67,2% PR at follow-up: NM 6.6-year	35-59 years-old, workers of 9 companies or public administrations (executive, white collar, blue collar), Belgium	JCQ PD: 5 items DL: 9 items SS: 8 items Assessed at both baseline and follow-up	Depressive symptoms during the last two weeks (CES-D)	Age, educational level, social netwwok,, satisfaction with private life, locus of control	Odds ratios: PD:1.31 (0.87-1.99) DL:1.07 (0.71– 1.62) SS: 1.03(0.69 – 1.54) Job strain: 1.58 (0.98-2.54) Job strain and low social support (iso-	Odds ratios: PD:1.18 (0.72-1.94) DL:**1.90 (1.08 -3.33)** SS:1.35(0.82-2.23) Job strain: 1.74 (1.00-3.01) Job strain and low social support (iso-

First author, year	N participant, Participation rate (PR), Length of follow-up	Age, Population type[1], Country	Psychosocial work factors[2]	Outcome	Covariates[3]	Main results	
						MEN	WOMEN
	follow-up					strain): 1.52 (0.86-2.67) Repeated high strain Yes-No: 1.25 (0.67-2.34) No-Yes: **2.13 (1.16 – 3.93)** Yes-Yes: **3.31 (1.67-6.56)** Repeated isostrain Yes-No: 1.07 (0.52-2.20) No-Yes: **3.14 (1.67 – 5.90)** Yes-Yes: **5.80 (2.12-15.85)**	strain): **2.53 (1.32-4.86)** Repeated high strain Yes-No: 1.50 (0.73-3.07) No-Yes: **2.14 (1.07 – 4.31)** Yes-Yes: **3.40 (1.45 – 7.94)** Repeated isostrain Yes-No: **3.16 (1.47 – 6.78)** No-Yes: **3.04 (1.35 – 6.82)** Yes-Yes: 2.12 (0.54 – 8.31)
Stoetzer, 2009 (82)	4040 participants (2265 female and 1755 men) PR: 53%	20-64 years-old, general population (PART-project), Sweden	JCQ PD: 5 items DL: 4 items SS: 2 items	**Depressive and anxiety symptoms (MDI)**	Age, severe conflict in family, education, financial situation, lacking a close friend or partner, severe life events, job demands, skill discretion, decision authority and depression at T1	**Both genders** **Odds ratio:** **PD: 1.4 (1.1-1.8)** DL:1.2 (0.9-1.5) **Odds ratio:** **SS: 2.2 (1.3 – 3.9)**	**Odds ratio:** **SS: 1.3 (1.0-1.8)**

First author, year	N participant, Participation rate (PR), Length of follow-up	Age, Population type[1], Country	Psychosocial work factors[2]	Outcome	Covariates[3]	Main results: MEN	Main results: WOMEN
	PR at follow-up: 84% 3-year follow-up						
Marchand, 2010 (70)	5270 participants (3004 men and 2266 women) PR: 80,6% PR at follow-up: 93,6%	Years-old, general population, Canada	JCQ PD: 2 items DL: 5 items SS: 3 items	Psychological distress (K6)	Age, gender, occupation, marital status, smoking, alcohol consumption, income, social network, physical health status, cohesion, stressful child events, number of children, couple-related strain	**Both genders** **Odds ratios:** PD: 1.00 (0.94-1.06) DL, Skill discretion: 0.96 (0.96-1.01) **DL, Decision authority: 1.05 (1.00-1.11)** **SS: 0.93 (0.88-0.98)** *No gender interaction.	
EFFORT-REWARD MODEL, N=4 studies							
Stansfeld, 1999 (83)	10 308 participants (6895 men and 3413 women) PR at	35-55 years-old, civil servants (Whitehall II), UK	ERI (NM items)	Depressive and anxiety symptoms (GHQ), 30 items	Age, employment grade and baseline GHQ score	Odds ratio **ERI: 2.57 (1.8 to 3.6)**	Odds ratio **ERI: 1.67 (1.0 to 2.9)**

First author, year	N participant, Participation rate (PR), Length of follow-up	Age, Population type[1], Country	Psychosocial work factors[2]	Outcome	Covariates[3]	Main results	
						MEN	WOMEN
	baseline: 73% PR at phase 2: 79% 5.3-year follow-up						
Kuper, 2002 (89)	10308 participants (6906 men and 3402 women) PR at baseline: 73% PR at phase 3: 83% 11-year follow-up	35-55 years-old, civil servants (Whitehall cohort), UK	ERI Effort: 5 items Reward : 10 items Overcommitment: 1 item	Mental health status (SF-36)	Age, gender, and grade	Both genders **Odd ratio :** **ERI: 2.24 (1.89-2.65)**	
Godin, 2004 (77)	3804 workers (2056	18-66 years-old, workers from a	ERI Efforts: NM items	Depression and anxiety symptoms	Age, gender, education	**Both genders** Odds ratios: **DEPRESSION**	

First author, year	N participant, Participation rate (PR), Length of follow-up	Age, Population type[1], Country	Psychosocial work factors[2]	Outcome	Covariates[3]	Main results MEN	Main results WOMEN
	men and 1740 women) PR at baseline: 40% PR at follow-up: NM 4-year follow-up	hospital, two insurance companies, one telecommunication organization (Somstress study), Belgium	Reward: NM items Overcommitment: NM items	(SCL-90)		ERI: **2.1 (1.7–2.5)** Overcommitment: 3**.5 (2.9–4.1)** **ANXIETY** ERI: **1.8 (1.5–2.2)** Overcommitment: **3.8 (3.2–4.5)**	
Godin, 2005 (84)	1986 participants (1067 men and 919 women) PR at baseline: 40% PR at follow-up: 40% 1-year follow-up	18-65 years-old, workers from 4 enterprises in private and public sector with a majority of white collar, Belgium	ERI Effort: 6 items Rewards: 11 items Assessed at baseline and follow-up	Depression and anxiety symptoms (SCL-90)	Age, job satisfaction and threat from global economy	Odds ratios: **DEPRESSION** Repeated ERI Yes-No:1.2 (0.5-2.9) No-yes: 4.6 (2.3-9.2) Yes-yes: 2.8 (1.3-5.7) ANXIETY: Repeated ERI Yes-No:0.8 (0.3-2.1) No-yes: 3.7(1.7-7.8) Yes-yes: 2.3	Odds ratios: **DEPRESSION** Repeated ERI Yes-No:1.3 (0.5-3.2) No-yes: 3.2 (1.6-6.4) Yes-yes: 4.6 (2.3-9.0) ANXIETY: Repeated ERI Yes-No:1.1 (0.4-3.1) No-yes: 2.3(1.1-4.8) Yes-yes: 4.5

First author, year	N participant, Participation rate (PR), Length of follow-up	Age, Population type[1], Country	Psychosocial work factors[2]	Outcome	Covariates[3]	Main results	
						MEN	WOMEN
						(1.1-4.8)	(2.1-9.8)

1 For example, the population could be composed of working participants or participants from the general population.
2 PD: Psychological demands, DL: Decision latitude, SS: social support, ERI: effort-reward imbalance. OC: overcommitment.
3 Listing of all covariates considered for adjustment.

Annexe 3 – Tableau synthèse des études sur les responsabilités familiales et la pression artérielle, N=6 études

First author, year	N (N men / women), Participation rate at baseline (PR), Length of follow-up	Age, Population type, Country	Family responsibilities	Outcome	Covariates	Main results	
						MEN	**WOMEN**
Robitaille, 2008 (24)	N=2003 (819 men and 1184 women) Cross-sectional PR: 76,5%	18-65 years-old, white-collar workers, Quebec City	Children load (number of children and their age) Domestic load (meal planning and house cleaning)	Ambulatory BP	Age, education, alcohol consumption, physical activity, oral contraceptive, income, BMI, social support at work, social support outside work, stressful event during the last 12 months	**Difference in mean BP (mm Hg):** **Having children**: Systolic: -0.6 (-1.0-2.1) Diastolic: 0.1 (-1.1-1.2) **Number of children (≥2):** Systolic: 0.9 (-0.7-2.6) Diastolic: 0.0 (-1.2-1.3) **Children load**: Systolic:-0.4 (-2.2-1.4) Diastolic: -0.6 (-2.0-0.7) **Domestic load**: Systolic: 0.7 (-2.0-3.5) Diastolic: 1.4 (-0.7-3.5) **Total family**	**Difference in mean BP (mm Hg):** **Having children**: Systolic: 0.4 (-0.8-1.7) Diastolic: 0.7 (-0.3-1.6) **Number of children(≥2):** Systolic: 0.6 (-0.7-2.0) Diastolic: 0.6 (-0.4-1.6) **Children load**: Systolic: -0.7 (-2.2-0.7) Diastolic: 0.1 (-1.0-1.2) **Domestic load**: Systolic: -0.8 (-2.7-1.1) Diastolic: -0.3 (-1.7-1.1) **Total family load:** Systolic: -0.9 (-2.4-0.6) Diastolic: -0.2 (-1.3-1.0)

First author, year	N (N men / women), Participation rate at baseline (PR), Length of follow-up	Age, Population type, Country	Family responsibilities	Outcome	Covariates	Main results	
						MEN	WOMEN
						load: Systolic: -1.3 (-3.3-0.7) Diastolic: -0.8 (-2.3-0.7)	
Xu, 2004 (25)	421 women, Cross-sectional PR: 93,5%	18-59 years-old, 4 worksites, Bejing	Family stress (relationship with spouse and household workload, sexual relationship, childcare and education, job and family role conflict)	Office BP mean (3 mesurements at 10-min intervals)	BMI, physical activity, smoking, alcohol consumption, contraceptive use	NA	**Difference in systolic mean BP:** **High family stress:** +3,4 mm Hg, *p*-value <0.05
Brisson, 1999 (101)	199 women, PR: 76%, Cross-sectional	18-64 years-old, White-collar workers, Quebec City	Children load (number of children and age of children) Domestic work (meal preparation, grocery shopping, laundry, ironing, fixing things inside the house,	Office BP	Age, smoking, oral contraceptives, BMI, alcohol consumption, smoking, physical efforts at work, education, social support outside work, physical activity	NA	Among women holding a university degree, mean BP was higher (systolic: +2.7 to +5.7 mm Hg and diastolic: +1.8 to +4.0 mm Hg) in women having high family responsibilities than among non-exposed women for: having children, number of children, children load and total family load.

First author, year	N (N men / women), Participation rate at baseline (PR), Length of follow-up	Age, Population type, Country	Family responsibilities	Outcome	Covariates	Main results	
						MEN	WOMEN
			cleaning inside the house, working outside or around the house, paying the bills, taking care of car problems, planning family life) Total family load				
Steptoe, 2000 (151)	N=102 women and 60 men, cross-sectional design PR: not mentioned	22-58 years-old, High school teachers, London	Having children	Ambulatory BP	Age, BMI	A greater difference in systolic BP between day and night was observed among adults having children (-4.46 mm Hg, <0.05), followed by married adults (-1.76 mm Hg, <0.05) and single adults (+0.22 mm Hg, not significant). It was thus more beneficial to have children than not having them. **MEAN BP LEVEL DURING DAY LIFE:** **MEN:** **Among parents:** Systolic= 136.2 mm Hg Diastolic= 84.7 mm Hg **Among married adults:** Systolic= 133.7 mm Hg Diastolic= 86.1 mm Hg **Among single adults:** Systolic= 126.0 mm Hg	

First author, year	N (N men / women), Participation rate at baseline (PR), Length of follow-up	Age, Population type, Country	Family responsibilities	Outcome	Covariates	Main results	
						MEN	WOMEN
						Diastolic= 83.6 mm Hg **WOMEN** **Among parents:** Systolic= 123.2 mm Hg Diastolic= 80.2 mm Hg **Among married adults:** Systolic= 127.1 mm Hg Diastolic= 82.6 mm Hg **Among single adults:** Systolic= 123.9 mm Hg Diastolic= 81.0 mm Hg	
James, 1989 (96)	N=50 women, cross-sectional design PR: NM	Average age: 30,2 years-old, Normotensive women	Home stress (child care and marital stress) Number of children			NA	Home stress (p<0.05) and number of children (p<0.05) had a deleterious effect on difference in diastolic BP between day and night (from stepwise regression). No point estimates provided.
Zimmerman, 1982 (103)	1169 women, cross-sectional design PR: NM	Workers of 4 organizations, Midwest USA	2 items: having children and number of children	Office hypertension		NA	*p*-values Having children: p<0.05 Number of children: p<0.01 No point estimates provided.

Annexe 4 – Tableau synthèse des études sur les responsabilités familiales et la détresse psychologique, N= 6 études

First author, year	N (N men / women), Participation rate at baseline (PR), Length of follow-up	Age, Population type, Country	Family Responsibilities	Outcome	Covariates	Main results: MEN	Main results: WOMEN
Ozer, 1995 (104)	42 women, cross-sectional, PR: NM	20-44 years-old, Full-time professional women, San Fransisco	Childcare responsibilities one month after the return to work from maternity leave	Psychological distress Psychological well-being	Number of hours to work, age, education, length of time married, hours of sleep per night, time returned to work	NA	**Bêta coefficients from linear regression** **Psychological distress** Childcare responsibilities: β=0.28, p<0.05 **Psychological well-being** Childcare responsibilities: β=-0.46, p<0.05
Artazcoz, 2001 (105)	2148 men and 1185 women, cross-sectional, PR: NM	25-64 years-old, general population, Spain	- Having a child <15 years-old - Household size	- Mental health well-being	Age	**Odds ratios:** **Household size** (>4) Manual workers: 0.92 (0.40-2.11) Non-manual workers: 0.70 (0.32-1.55) **Number of children < 15 years-old**: Manual workers: 1.47 (0.89-2.43) Non-manual workers: 1.02 (0.61-1.70)	**Odds ratios:** **Household size** (≥4 versus 2): Among manual workers: 1.35 (0.59-1.62) Among non-manual workers: 1.64 (0.68-3.97) **Having at least one child < 15 years-old** (versus none) Among manual workers: 0.95 (0.56-1.62) Among non-manual workers: 1.03 (0.57-1.87)
Walters,	356 women,	≥21 years-	Having	Anxiety and	Age, language,	NA	**PARENTING:**

First author, year	N (N men / women), Participation rate at baseline (PR), Length of follow-up	Age, Population type, Country	Family Responsibilities	Outcome	Covariates	Main results	
						MEN	WOMEN
1993 (106)	PR: 55%, Cross-sectional	old, Random sample of households, Hamilton	children Combination of having children and work	depressive symptoms	education, household size, household type, marital status, employment paid, occupation status, family income		*Prevalence of anxiety* : 63,4% among parents and 41,9% among adults without children (p<0,05) *Prevalence of depression*: 51,2% among parents and 33,3% among adults without children (p<0,05) **COMBINING WORK AND PARENTING:** *Prevalence of anxiety* : 59,3% among parents and 41,0 % among adults without children (p<0,05) *Prevalence of depression*: 42,4% among parents and 33,4% among adults without children (p<0,05)
Lennon, 1992 (94)	- New-York community survey: N=429 (114 included in analyses) PR: 57% - National survey of New-York: N=2264 (541 included in analysis), PR:71%	- New-York community survey: 19-59 years-old - National survey of New-York: ≥21 years-old	- Number of children ≤18 years-old - Domestic responsibilities and childcare	Psychological distress	Family income, age, education, race	NA	**Bêta coefficients from linear regression** - *New-York community survey:* - Number of children ≤18 years-old: no effect - Domestic responsibilities and childcare: no effect - *National survey of New-York:* - Number of children ≤18 years-old: no effect - Domestic responsibilities

First author, year	N (N men / women), Participation rate at baseline (PR), Length of follow-up	Age, Population type, Country	Family Responsibilities	Outcome	Covariates	Main results	
						MEN	WOMEN
	Both surveys were cross-sectional						and childcare: 0,32, p<0,05 When no effect, bêtas were of 0,00.
Tierney, 1990 (95)	539 women, PR: 58% Cross-sectional	Mean age 33.3 years-old, workers in 17 hospitals, Quebec	Domestic load (cleaning, meal preparation, laundry, age, number of children)	Insomnia, exhaustion	Age, education	NA	**Prevalence of insomnia >1 time a week**: 37,3% among women realizing ≥21 hours of domestic hours/week compared to 16,7% among those realizing 0-10 hours/week. p<0,05
Ross, 1983 (107)	680 couple, PR: 76,5% Cross-sectinoal	Sample of US households	- Husband helps at home - Number of children <12 years-old	Depressive symptoms	Race, religion, education, family income, husband's earning,	Not mentioned	**Bêta coefficients from linear regression** - Husband helps at home: β=-0.075, p<0,05 - Number of children <12 years-old: β=-0,049, NS

Annexe 5 - Items utilisés pour mesurer les contraintes psychosociales au travail et les responsabitlités familiales

1- Items du modèle demande-latitude de Karasek

Demande psychologique (9 items):

Mon travail exige d'aller très vite
1. |___| Fortement en désaccord
2. |___| En désaccord
3. |___| D'accord
4. |___| Fortement d'accord

Mon travail exige de travailler très fort mentalement
1. |___| Fortement en désaccord
2. |___| En désaccord
3. |___| D'accord
4. |___| Fortement d'accord

On ne me demande pas de faire une quantité excessive de travail
1. |___| Fortement en désaccord
2. |___| En désaccord
3. |___| D'accord
4. |___| Fortement d'accord

J'ai suffisamment de temps pour faire mon travail
1. |___| Fortement en désaccord
2. |___| En désaccord
3. |___| D'accord
4. |___| Fortement d'accord

Je reçois des demandes contradictoires de la part des autres
1. |___| Fortement en désaccord

2. |___| En désaccord
3. |___| D'accord
4. |___| Fortement d'accord

Ma tâche est souvent interrompue avant que je l'aie terminée. Je dois alors y revenir plus tard
1. |___| Fortement en désaccord
2. |___| En désaccord
3. |___| D'accord
4. |___| Fortement d'accord

Mon travail est très mouvementé
1. |___| Fortement en désaccord
2. |___| En désaccord
3. |___| D'accord
4. |___| Fortement d'accord

Je suis souvent ralenti dans mon travail parce que je dois attendre que les autres aient terminé le leur
1. |___| Fortement en désaccord
2. |___| En désaccord
3. |___| D'accord
4. |___| Fortement d'accord

<u>Latitude décisionnelle (9 items):</u>

Mon travail exige que j'apprenne des choses nouvelles
1. |___| Fortement en désaccord
2. |___| En désaccord
3. |___| D'accord
4. |___| Fortement d'accord

Mon travail exige un niveau élevé de qualifications
1. |___| Fortement en désaccord

2. |___| En désaccord
3. |___| D'accord
4. |___| Fortement d'accord

Dans mon travail, je dois faire preuve de créativité
1. |___| Fortement en désaccord
2. |___| En désaccord
3. |___| D'accord
4. |___| Fortement d'accord

Mon travail consiste à refaire toujours les mêmes choses
1. |___| Fortement en désaccord
2. |___| En désaccord
3. |___| D'accord
4. |___| Fortement d'accord

J'ai la liberté de décider comment je fais mon travail
1. |___| Fortement en désaccord
2. |___| En désaccord
3. |___| D'accord
4. |___| Fortement d'accord

Mon travail me permet de prendre des décisions de façon autonome
1. |___| Fortement en désaccord
2. |___| En désaccord
3. |___| D'accord
4. |___| Fortement d'accord

Au travail, j'ai l'opportunité de faire plusieurs choses différentes
1. |___| Fortement en désaccord
2. |___| En désaccord
3. |___| D'accord
4. |___| Fortement d'accord

J’ai passablement d’influence sur la façon dont les choses se passent à mon travail
1. |___| Fortement en désaccord
2. |___| En désaccord
3. |___| D’accord
4. |___| Fortement d’accord

Au travail, j’ai la possibilité de développer mes habiletés personnelles
1. |___| Fortement en désaccord
2. |___| En désaccord
3. |___| D’accord
4. |___| Fortement d’accord

<u>Soutien social des collègues au travail (8 items):</u>

Il y a des tensions entre moi et au moins un de mes collègues
1. |___| Fortement en désaccord
2. |___| En désaccord
3. |___| D’accord
4. |___| Fortement d’accord

Les gens avec qui je travaille sont amicaux
1. |___| Fortement en désaccord
2. |___| En désaccord
3. |___| D’accord
4. |___| Fortement d’accord

Les personnes avec qui je travaille s’intéressent à moi personnellement
1. |___| Fortement en désaccord
2. |___| En désaccord
3. |___| D’accord
4. |___| Fortement d’accord

Je peux consulter mes collègues si j’ai besoin d’un conseil à propos d’un problème

1. |___| Fortement en désaccord
2. |___| En désaccord
3. |___| D'accord
4. |___| Fortement d'accord

Les gens avec qui je travaille sont qualifiés pour les tâches qu'ils accomplissent

1. |___| Fortement en désaccord
2. |___| En désaccord
3. |___| D'accord
4. |___| Fortement d'accord

Les gens avec qui je travaille ont des attitudes hostiles ou conflictuelles envers moi

1. |___| Fortement en désaccord
2. |___| En désaccord
3. |___| D'accord
4. |___| Fortement d'accord

Les gens avec qui je travaille s'encouragent mutuellement à travailler ensemble

1. |___| Fortement en désaccord
2. |___| En désaccord
3. |___| D'accord
4. |___| Fortement d'accord

Les gens avec qui je travaille facilitent la réalisation du travail

1. |___| Fortement en désaccord
2. |___| En désaccord
3. |___| D'accord
4. |___| Fortement d'accord

Soutien social du supérieur immédiat au travail (8 items):

Mon supérieur immédiat me donne confiance dans ma capacité à faire le travail

1. |___| Fortement en désaccord
2. |___| En désaccord
3. |___| D'accord
4. |___| Fortement d'accord

Mon supérieur immédiat critique souvent à propos de choses peu importantes

1. |___| Fortement en désaccord
2. |___| En désaccord
3. |___| D'accord
4. |___| Fortement d'accord

Mon supérieur immédiat réussit à faire travailler les gens ensemble

1. |___| Fortement en désaccord
2. |___| En désaccord
3. |___| D'accord
4. |___| Fortement d'accord

Mon supérieur immédiat ne traite pas les gens d'une manière juste

1. |___| Fortement en désaccord
2. |___| En désaccord
3. |___| D'accord
4. |___| Fortement d'accord

Mon supérieur immédiat se soucie du bien-être des personnes qui sont sous sa supervision

1. |___| Fortement en désaccord
2. |___| En désaccord
3. |___| D'accord
4. |___| Fortement d'accord

Mon supérieur immédiat prête attention à ce que je dis
1. |___| Fortement en désaccord
2. |___| En désaccord
3. |___| D'accord
4. |___| Fortement d'accord

Mon supérieur immédiat a une attitude hostile ou conflictuelle envers moi
1. |___| Fortement en désaccord
2. |___| En désaccord
3. |___| D'accord
4. |___| Fortement d'accord

Mon supérieur immédiat facilite la réalisation du travail
1. |___| Fortement en désaccord
2. |___| En désaccord
3. |___| D'accord
4. |___| Fortement d'accord

2- Items du modèle déséquilibre efforts-reconnaissance de Siegrist

<u>Efforts (4 items):</u>

J'ai suffisamment de temps pour faire mon travail

1. |___| Fortement en désaccord
2. |___| En désaccord
3. |___| D'accord
4. |___| Fortement d'accord

Ma tâche est souvent interrompue avant que je l'aie terminée. Je dois alors y revenir plus tard

1. |___| Fortement en désaccord
2. |___| En désaccord
3. |___| D'accord
4. |___| Fortement d'accord

Je suis souvent contraint à faire des heures supplémentaires

1. |___| Fortement en désaccord
2. |___| En désaccord
3. |___| D'accord
4. |___| Fortement d'accord

Au cours des dernières années, mon travail est devenu de plus en plus exigeant

1. |___| Fortement en désaccord
2. |___| En désaccord
3. |___| D'accord
4. |___| Fortement d'accord

<u>Reconnaissance (11 items):</u>

Dimension "respect et estime":

Je reçois le respect que je mérite de mes supérieurs

1. |___| Fortement en désaccord
2. |___| En désaccord
3. |___| D'accord

4. |___| Fortement d’accord

Je reçois le respect que je mérite de mes collègues

1. |___| Fortement en désaccord
2. |___| En désaccord
3. |___| D’accord
4. |___| Fortement d’accord

Au travail, je bénéficie d’un soutien satisfaisant dans les situations difficiles

1. |___| Fortement en désaccord
2. |___| En désaccord
3. |___| D’accord
4. |___| Fortement d’accord

On me traite injustement à mon travail

1. |___| Fortement en désaccord
2. |___| En désaccord
3. |___| D’accord
4. |___| Fortement d’accord

Vu tous mes efforts, je reçois le respect et l’estime que je mérite à mon travail

1. |___| Fortement en désaccord
2. |___| En désaccord
3. |___| D’accord
4. |___| Fortement d’accord

Dimension " sécurité d'emploi":

Je suis en train de vivre ou je m’attends à vivre un changement indésirable dans ma situation de travail

1. |___| Fortement en désaccord
2. |___| En désaccord
3. |___| D’accord
4. |___| Fortement d’accord

Ma sécurité d’emploi est menacée

1. |___| Fortement en désaccord
2. |___| En désaccord
3. |___| D’accord
4. |___| Fortement d’accord

Dimension " promotion et rémunération":

Mes perspectives de promotion sont faibles

1. |___| Fortement en désaccord
2. |___| En désaccord
3. |___| D’accord
4. |___| Fortement d’accord

Ma position professionnelle actuelle correspond bien à ma formation

1. |___| Fortement en désaccord
2. |___| En désaccord
3. |___| D’accord
4. |___| Fortement d’accord

Vu tous mes efforts, mes perspectives de promotion sont satisfaisantes

1. |___| Fortement en désaccord
2. |___| En désaccord
3. |___| D’accord
4. |___| Fortement d’accord

Vu tous mes efforts, mon salaire est satisfaisant

1. |___| Fortement en désaccord
2. |___| En désaccord
3. |___| D’accord
4. |___| Fortement d’accord

<u>Surinvestissement (6 items):</u>

Au travail, il m'arrive fréquemment d'être pressé par le temps

1. |___| Fortement en désaccord
2. |___| En désaccord
3. |___| D’accord
4. |___| Fortement d’accord

Je commence à penser à des problèmes au travail dès que je me lève le matin

1. |___| Fortement en désaccord
2. |___| En désaccord
3. |___| D’accord
4. |___| Fortement d’accord

Quand je rentre à la maison, j'arrive facilement à me décontracter et à oublier tout ce qui concerne mon travail

1. |___| Fortement en désaccord
2. |___| En désaccord
3. |___| D'accord
4. |___| Fortement d'accord

Mes proches disent que je me sacrifie trop pour mon travail

1. |___| Fortement en désaccord
2. |___| En désaccord
3. |___| D'accord
4. |___| Fortement d'accord

Le travail me trotte encore dans la tête quand je vais au lit

1. |___| Fortement en désaccord
2. |___| En désaccord
3. |___| D'accord
4. |___| Fortement d'accord

Quand je remets à plus tard quelque chose que je devais faire le jour, j'ai du mal à dormir le soir

1. |___| Fortement en désaccord
2. |___| En désaccord
3. |___| D'accord
4. |___| Fortement d'accord

3- Items des responsabilités familiales

<u>Nombre d'enfants et leur âge:</u>

Avez-vous des enfants ?

1. |___| Oui
2. |___| Non ➔ ***Passez à la question 12***

Combien avez-vous d'enfants ? __________ enfants

Indiquez l'âge de chacun d'eux : (***<u>Note</u> : Vous pouvez ajouter des lignes au besoin)***

1er enfant ______

2^{e} enfant ______

3^{e} enfant ______

4^{e} enfant ______

5^{e} enfant ______

<u>Responsabilités domestiques, incluant les soins prodigués aux enfants:</u>

En général, qui s'occupe des soins aux enfants à la maison ?

1. |___| Moi-même
2. |___| Quelqu'un d'autre et moi
3. |___| Quelqu'un d'autre

En général, qui s'occupe des soins ou des activités en lien avec les enfants en dehors de la maison (médecin, dentiste, école, loisirs, etc.)?

1. |___| Moi-même
2. |___| Quelqu'un d'autre et moi
3. |___| Quelqu'un d'autre

En général, qui planifie et prépare les repas à la maison ?

1. |___| Moi-même
2. |___| Quelqu'un d'autre et moi
3. |___| Quelqu'un d'autre

En général, qui fait le ménage à l'intérieur de la maison ?

1. |___| Moi-même
2. |___| Quelqu'un d'autre et moi
3. |___| Quelqu'un d'autre

Annexe 6 : Analyses complémentaires de l’article sur la pression artérielle (Chapitre 4)

Table 1. Adjusted[39] systolic and diastolic mean blood pressure (95% confidence interval) according to the double exposure to job strain and high family responsibilities[40] and age

	At baseline			At 3-year follow-up			At 5-year follow-up		
	N	SBP (mm Hg)	DBP (mm Hg)	N	SBP (mm Hg)	DBP (mm Hg)	N	SBP (mm Hg)	DBP (mm Hg)
< 45 YEARS-OLD									
No (no)	296	121.2	77.8	247	121.8	77.8	233	122.5	77.5
No (yes)	238	-0.12 (-1.88-1.64)	0.46 (-0.84-1.76)	214	-0.55 (-2.52-1.42)	-0.17 (-1.59-1.25)	206	-0.31 (-2.31-1.68)	0.11 (-1.36-1.58)
Yes (no)	93	1.27 (-1.10-3.64)	1.25 (-0.51-3.00)	81	1.57 (-1.07-4.21)	1.43 (-0.47-3.33)	75	1.59 (-1.15-4.33)	1.48 (-0.54-3.50)
Yes (yes)	86	-0.17 (-2.67-2.32)	1.01 (-0.83-2.86)	74	-0.56 (-3.38-2.27)	0.57 (-1.46-2.61)	69	-1.02 (-3.88-1.83)	-0.45 (-2.55-1.65)
≥ 45 YEARS-OLD									
No (no)	341	123.5	78.1	289	121.9	77.1	266	121.3	75.9
No (yes)	62	-0.76 (-3.51-2.00)	0.45 (-1.59-2.49)	54	0.38 (-2.72-3.48)	1.48 (-0.75-3.71)	48	**4.69 (1.46-7.92)**	**3.67 (1.29-6.06)**
Yes (no)	88	-1.95 (-4.40-0.49)	-0.51 (-2.31-1.30)	74	-0.22 (-3.03-2.59)	0.23 (-1.79-2.25)	67	0.20 (-2.72-3.13)	0.77 (-1.39-2.92)
Yes (yes)	11	-1.58 (-8.25-5.10)	1.50 (-3.44-6.43)	10	**9.59 (2.20-16.98)**	**7.02 (1.70-12.33)**	9	**5.07 (-2.73-12.87)**	**3.11 (-2.64-8.86)**

[39] Adjusted for all covariates, namely: education, age, marital status, body mass index, alcohol consumption, smoking, leisure physical activity, stressful events, social support outside work, diabetes, known family history of cardiovascular diseases, and at 3-year and 5-year follow-ups menopause and menopausal hormone therapy. Categorizations used are provided in the "covariates" subsection of the methodology.

[40] Exposed categories are compared with the reference category (first category of each variable). Statistical significance of the differences is estimated by a Student's t test. Results in bold: $p<0.05$. Results in italic: $0.05\leq p<0.10$.

Table 2. Adjusted[41] systolic and diastolic mean blood pressure (95% confidence interval) according to the double exposure to effort-reward imbalance and high family responsibilities[42] and age

	At baseline			At 3-year follow-up			At 5-year follow-up		
	N	SBP (mm Hg)	DBP (mm Hg)	N	SBP (mm Hg)	DBP (mm Hg)	N	SBP (mm Hg)	DBP (mm Hg)
< 45 YEARS-OLD									
No (no)	273	120.8	77.4	226	121.6	77.7	211	122.0	77.3
No (Yes)	241	-0.43 (-2.22-1.36)	0.24 (-1.09-1.56)	214	-1.39 (-3.40-0.63)	-0.68 (-2.13-0.76)	208	-0.76 (-2.79-1.26)	-0.38 (-1.88-1.11)
Yes (no)	116	2.41 (-0.19-4.64)	1.82 (-0.18-3.46)	102	1.61 (-0.87-4.10)	1.19 (-0.60-2.97)	97	**2.67 (0.14-5.20)**	1.67 (-0.20-3.53)
Yes (yes)	83	2.37 (-0.17-4.90)	**2.62 (0.75-4.49)**	74	2.40 (-0.42-5.21)	**2.21 (0.19-4.23)**	67	2.21 (-0.69-5.10)	1.74 (-0.40-3.88)
≥ 45 YEARS-OLD									
No (no)	305	123.1	77.9	262	122.0	77.5	239	121.2	76.1
No (Yes)	59	-0.78 (-3.62-2.06)	0.28 (-1.81-2.38)	53	1.03 (-2.12-4.18)	1.43 (-0.84-3.69)	47	**4.58 (1.28-7.88)**	**2.81 (0.37-5.24)**
Yes (no)	124	0.52 (-1.67-2.70)	0.86 (-0.75-2.48)	101	-0.66 (-3.16-1.83)	-1.21 (-3.00-0.58)	94	0.86 (-1.72-3.44)	-0.10 (-2.00-1.81)
Yes (yes)	14	1.49 (-4.10-7.08)	3.60 (-0.53-7.72)	11	3.75 (-2.88-10.38)	4.10 (-0.66-8.87)	10	*6.86 (-0.07-13.79)*	**6.72(1.61-11.84)**

[41] Adjusted for all covariates, namely: education, age, marital status, body mass index, alcohol consumption, smoking, leisure physical activity, stressful events, social support outside work, diabetes, known family history of cardiovascular diseases, and at 3-year and 5-year follow-ups menopause and menopausal hormone therapy. Categorizations used are provided in the "covariates" subsection of the methodology.

[42] Exposed categories are compared with the reference category (first category of each variable). Statistical significance of the differences is estimated by a Student's t test. Results in bold: $p<0.05$. Results in italic: $0.05 \leq p < 0.10$.

Table 3. Adjusted[43] systolic and diastolic mean blood pressure (95% confidence interval) according to the double exposure to job strain and high family responsibilities[44] and social support at work

	At baseline			At 3-year follow-up			At 5-year follow-up		
	N	SBP (mm Hg)	DBP (mm Hg)	N	SBP (mm Hg)	DBP (mm Hg)	N	SBP (mm Hg)	DBP (mm Hg)
LOW SOCIAL SUPPORT									
No (no)	292	121.1	77.6	246	122.1	77.6	229	122.0	76.6
No (Yes)	147	-1.00 (-3.02-1.03)	0.19 (-1.30-1.69)	133	-0.87 (-3.13-1.39)	-0.22 (-1.84-1.41)	130	0.99 (-1.31-3.28)	1.41 (-0.29-3.10)
Yes (no)	57	-1.11 (-4.03-1.81)	0.87 (-1.29-3.03)	51	-0.12 (-3.32-3.08)	0.62 (-1.67-2.92)	45	-0.41 (-3.85-3.02)	1.54 (-0.99-4.07)
Yes (yes)	32	-0.83 (-4.64-2.98)	0.77 (-2.04-3.58)	30	-2.15 (-6.28-1.98)	-1.39 (-4.36-1.57)	29	-0.29 (-4.47-3.88)	-0.65(-3.73-2.42)
HIGH SOCIAL SUPPORT									
No (no)	345	122.6	78.2	290	121.5	77.3	270	121.8	76.9
No (Yes)	153	-0.55 (-2.51-1.41)	0.52 (-0.93-1.96)	135	0.20 (-2.03-2.42)	0.86 (-0.74-2.46)	124	0.94 (-1.36-3.23)	0.87 (-0.82-2.57)
Yes (no)	124	-0.05 (-2.17-2.07)	0.05 (-1.52-1.62)	104	1.28 (-1.15-3.70)	1.07 (-0.68-2.81)	97	1.76 (-0.75-4.26)	0.99 (-0.86-2.83)
Yes (yes)	65	-1.06 (-3.91-1.78)	0.85 (-1.26-2.95)	54	2.16 (-1.11-5.43)	**3.08 (0.73-5.42)**	49	0.10 (-3.25-3.45)	0.78 (-1.69-3.25)

[43] Adjusted for all covariates, namely: education, age, marital status, body mass index, alcohol consumption, smoking, leisure physical activity, stressful events, social support outside work, diabetes, known family history of cardiovascular diseases, and at 3-year and 5-year follow-ups menopause and menopausal hormone therapy. Categorizations used are provided in the "covariates" subsection of the methodology.
[44] Exposed categories are compared with the reference category (first category of each variable). Statistical significance of the differences is estimated by a Student's t test. Results in bold: $p<0.05$. Results in italic: $0.05\leq p<0.10$.

Table 4. Adjusted[45] systolic and diastolic mean blood pressure (95% confidence interval) according to the double exposure to effort-reward imbalance and high family responsibilities[46] and overcommitment

	At baseline			**At 3-year follow-up**			**At 5-year follow-up**		
	N	SBP (mm Hg)	DBP (mm Hg)	N	SBP (mm Hg)	DBP (mm Hg)	N	SBP (mm Hg)	DBP (mm Hg)
NON-OVERCOMMITED									
No (no)	415	121.9	77.4	345	121.4	77.0	312	121.5	76.4
No (Yes)	226	-1.07 (-2.74-0.60)	0.37 (-1.12-1.87)	201	-0.27 (-2.15-1.61)	0.54 (-0.81-1.89)	192	0.43 (-1.50-2.36)	0.87 (-0.56-2.29)
Yes (no)	72	1.94 (-0.64-4.53)	1.61 (-0.44-3.65)	58	2.05 (-0.92-5.02)	-0.28 (-2.41-1.85)	55	2.76 (-0.30-5.82)	0.64 (-1.61-2.90)
Yes (yes)	33	1.37 (-2.22-4.95)	1.78 (-2.05-3.61)	29	2.94 (-1.06-6.94)	2.13 (-0.74-5.00)	25	**5.83 (1.59-10.07)**	**4.57 (1.44-7.70)**
OVERCOMMITED									
No (no)	163	121.8	77.8	143	122.8	79.1	138	121.7	77.5
No (Yes)	74	-0.80 (-3.62-2.02)	-0.07 (-1.56-1.43)	66	-2.97 (-6.11-0.16)	**-2.30(-4.54--0.05)**	63	0.43 (-2.73-3.59)	-0.62 (-2.95-1.71)
Yes (no)	168	1.12(-1.10-3.34)	1.09 (-0.34-2.51)	145	-0.98 (-3.95-1.49)	-1.02(-2.80-0.75)	136	1.39 (-1.14-3.91)	0.40 (-1.46-2.26)
Yes (yes)	64	1.84 (-1.17-4.85)	**3.36 (1.34-5.39)**	56	1.37 (-2.00-4.74)	1.50 (-0.92-3.91)	52	1.50 (-1.96-4.95)	1.04 (-1.51-3.59)

[45] Adjusted for all covariates, namely: education, age, marital status, body mass index, alcohol consumption, smoking, leisure physical activity, stressful events, social support outside work, diabetes, known family history of cardiovascular diseases, and at 3-year and 5-year follow-ups menopause and menopausal hormone therapy. Categorizations used are provided in the "covariates" subsection of the methodology.

[46] Exposed categories are compared with the reference category (first category of each variable). Statistical significance of the differences is estimated by a Student's t test. Results in bold: $p<0.05$. Results in italic: $0.05\leq p<0.10$.

Table 5. Adjusted systolic and diastolic mean blood pressure[47-48] (95% confidence interval) according to the double exposure to job strain or effort-reward imbalance and high family responsibilities additionally adjusted for baseline blood pressure values

	At 3-year follow-up			At 5-year follow-up		
	N	SBP (mm Hg)	DBP (mm Hg)	N	SBP (mm Hg)	DBP (mm Hg)
Job strain (High family responsibilities)						
No (no)	464	121.0	77.3	413	121.4	76.9
No (Yes)	253	0.44 (-0.70-1.58)	0.35 (-0.78-1.48)	225	1.13 (-0.21-2.47)	0.76 (-0.48-2.00)
Yes (no)	139	-0.05 (-1.44-1.34)	0.31 (-1.08-1.71)	124	0.40 (-1.26-2.06)	0.13 (-1.40-1.66)
Yes (yes)	77	1.13 (-0.73-2.99)	0.77 (-1.01-2.54)	69	0.15 (-1.98-2.29)	0.27 (-1.67-2.21)
Effort-reward imbalance (High family responsibilities)						
No (no)	433	121.2	77.7	381	121.3	77.1
No (Yes)	253	0.06 (-1.10-1.22)	-0.26 (-1.05-0.52)	232	0.92 (-0.43-2.27)	0.14 (-0.79-1.06)
Yes (no)	170	-0.82 (-2.12-0.49)	-0.62 (-1.58-1.02)	156	0.82 (-0.71-2.25)	-0.06 (-1.10-0.99)
Yes (yes)	77	1.47 (-035-3.29)	0.35 (-0.88-1.58)	62	1.59 (-0.63-3.80)	0.81 (-0.70-2.32)

[47] Adjusted for: systolic and diastolic BP at baseline education, age, marital status, stressful events, social support outside work, diabetes, known family history of cardiovascular diseases, and at 3-year and 5-year follow-ups menopause and menopausal hormone therapy. Categorizations used are provided in the "covariates" subsection of the methodology.

[48] Exposed categories are compared with the reference category (first category of each variable). Statistical significance of the differences is estimated by a Student's t test. Results in bold: $p<0.05$. Results in italic: $0.05 \leq p<0.10$.

Table 6. Systolic and diastolic mean blood pressure (95% confidence interval) according to the double exposure to job strain and high family responsibilities[49] adjusted for all covariates[50] except for potentially intermediate covariates (physical inactivity, overweight, alcohol consumption, smoking) [51]

	At baseline			At 3-year follow-up			At 5-year follow-up		
	N	SBP (mm Hg)	DBP (mm Hg)	N	SBP (mm Hg)	DBP (mm Hg)	N	SBP (mm Hg)	DBP (mm Hg)
Job strain (High family responsibilities)									
No (no)	637	122.4	77.9	536	121.9	77.5	499	121.9	76.7
No(Yes)	300	-0.90 (-2.34-0.54)	0.34 (-0.71-1.39)	268	-0.51 (-2.14-1.12)	0.25 (-0.91-1.41)	254	0.95 (-0.71-2.60)	1.21 (0.00-2.42)
Yes (no)	181	-0.45 (-2.18-1.27)	0.32 (-0.94-1.59)	155	0.47 (-1.48-2.41)	0.70 (-0.69-2.08)	142	0.81 (-1.20-2.83)	1.02 (-0.46-2.50)
Yes(yes)	97	-0.75 (-3.05-1.56)	1.09 (-0.59-2.78)	84	0.51 (-2.09-3.11)	1.31 (-0.54-3.16)	78	0.29 (-2.33-2.91)	0.53 (-1.39-2.45)

[49] Exposed categories are compared with the reference category (first category of each variable). Statistical significance of the differences is estimated by a Student's t test. Results in bold: $p<0.05$. Results in italic: $0.05 \le p<0.10$.

[50] Adjusted for: education, age, marital status, stressful events, social support outside work, diabetes, known family history of cardiovascular diseases, and at 3-year and 5-year follow-ups menopause and menopausal hormone therapy. Categorizations used are provided in the “covariates” subsection of the methodology.

[51] Exposed categories are compared with the reference category (first category of each variable). Statistical significance of the differences is estimated by a Student's t test. Results in bold: $p<0.05$. Results in italic: $0.05 \le p<0.10$.

Table 7. Systolic and diastolic mean blood pressure (95% confidence interval) according to the double exposure to effort-reward imbalance and high family responsibilities[52] adjusted for all covariates[53] except for potentially intermediate covariates (physical inactivity, overweight, alcohol consumption, smoking) [54]

	At baseline			At 3-year follow-up			At 5-year follow-up		
	N	SBP (mm Hg)	DBP (mm Hg)	N	SBP (mm Hg)	DBP (mm Hg)	N	SBP (mm Hg)	DBP (mm Hg)
Effort-reward imbalance (High family responsibilities)									
No (no)	578	121.9	77.6	488	121.8	77.6	450	121.5	76.7
No (Yes)	300	-1.09 (-2.55-0.37)	0.17 (-0.89-1.24)	267	-1.06 (-2.71-0.59)	-0.30 (-1.48-0.87)	255	0.51 (-1.16-2.18)	0.54 (-0.68-1.77)
Yes (no)	240	1.31 (-0.27-2.89)	**1.29 (0.14-2.44)**	203	0.58 (-1.20-2.37)	0.04 (-1.24-1.31)	191	1.88 (0.06-3.70)	0.87 (-0.47-2.21)
Yes(yes)	97	1.76 (-0.46-4.02)	**2.76 (1.11-4.41)**	85	**2.52 (-0.02-5.06)**	**2.44 (0.63-4.25)**	77	**3.37 (0.75-5.98)**	**2.89 (0.97-4.82)**

[52] Exposed categories are compared with the reference category (first category of each variable). Statistical significance of the differences is estimated by a Student's t test. Results in bold: $p<0.05$. Results in italic: $0.05 \leq p<0.10$.

[53] Adjusted for: education, age, marital status, stressful events, social support outside work, diabetes, known family history of cardiovascular diseases, and at 3-year and 5-year follow-ups menopause and menopausal hormone therapy. Categorizations used are provided in the "covariates" subsection of the methodology.

[54] Exposed categories are compared with the reference category (first category of each variable). Statistical significance of the differences is estimated by a Student's t test. Results in bold: $p<0.05$. Results in italic: $0.05 \leq p<0.10$.

Table 8. Modifying effect of family responsibilities on adjusted[55] differences in systolic and diastolic mean blood pressure (95% confidence interval) according to job strain or effort-reward imbalance[56]

	At baseline		**At 3-year follow-up**		**At 5-year follow-up**	
	SBP (mm Hg)	DBP (mm Hg)	SBP (mm Hg)	DBP (mm Hg)	SBP (mm Hg)	DBP (mm Hg)
High family responsibilities						
Job strain						
No	121.6	78.3	121.5	77.8	122.9	77.9
Yes	-0.13 (-2.52-2.26)	0.57 (-1.19-2.34)	0.85 (-1.83-3.53)	1.08 (-0.84-3.01)	-1.04 (-3.76-1.68)	-0.87 (2.88-1.13)
Effort-reward imbalance						
No	120.9	77.8	120.8	77.4	122.0	77.2
Yes	**2.65 (0.31-4.99)**	**2.49 (0.76-4.22)**	**3.42 (0.82-6.01)**	**2.69 (0.82-4.56)**	*2.59 (-0.11-5.29)*	**2.17 (0.18-4.16)**
Low family responsibilities						
Job strain						
No	122.3	77.9	121.8	77.4	121.9	76.8
Yes	-0.33 (-2.03-1.38)	0.40 (-0.86-1.66)	0.75 (-1.17-2.67)	0.91 (-0.47-2.29)	1.03 (-0.97-3.04)	1.21 (-0.27-2.69)
Effort-reward imbalance						
No	121.9	77.6	121.8	77.6	121.6	76.8
Yes	1.34 (-0.22-2.89)	1.32 (0.17-2.46)	0.49 (-1.27-2.25)	0.05 (-1.22-1.31)	**1.84 (0.03-3.65)**	0.88 (-0.45-2.22)

[55] Adjusted for all covariates, namely: education, age, marital status, body mass index, alcohol consumption, smoking, leisure physical activity, stressful events, social support outside work, diabetes, known family history of cardiovascular diseases, and at 3-year and 5-year follow-ups menopause and menopausal hormone therapy. Categorizations used are provided in the "covariates" subsection of the methodology.

[56] Exposed categories are compared with the reference category (first category of each variable). Statistical significance of the differences is estimated by a Student's t test. Results in bold: p<0.05. Results in italic: 0.05≤p<0.10.

Table 9. Comparison between participant having completed the self-administered questionnaire at baseline (N=1391) and women who refused to participate (N=324)

	Participants at baseline N = 1391	Refusal to participate N=239*	*p*
Job title**			
Office worker	551 (39.6)	114 (47.7)	0.19
Technician	408 (29.3)	64 (26.8)	
Professionnal	383 (27.5)	55 (23.0)	
Manager	47 (3.4)	6 (2.5)	
Other	2(0.1)	0 (0)	

*Missing data for 85 women.

**The job title was the only variable available for women who refused to participate at baseline.

Table 10. Comparison between participants included in the analysis at the 3-year follow-up (N=1043) and participants excluded due to refusals or lost at follow-up (N=78)

	Included in the analysis N = 1043	Excluded due to methodological limitations N=78	*p*
Job strain			
Yes	239 (22.9)	15 (19.2)	p=0.55
No	804 (77.1)	63 (80.8)	
Effort-reward imbalance			
Yes	288 (27.8)	17 (21.8)	p=0.27
No	755 (73.4)	61 (78.2)	
Family responsibilities			
Low	246 (23.6)	26 (33.3)	p=0.03
Medium	445 (42.7)	36 (46.2)	
High	352 (33.7)	16 (20.5)	
Double exposure to job strain and high family responsibilities			
Non-exposed	536 (51.4)	50 (64.1)	p=0.10
Exposed only to responsibilities	268 (25.7)	13 (16.7)	
Exposed only to psychosocial work factors	155 (14.9)	12 (15.4)	
Exposed to both	84 (8.1)	3 (3.9)	
Double exposure to effort-reward imbalance and high family responsibilities			
Non-exposed	488 (46.8)	48 (61.5)	p=0.6
Exposed only to responsibilities	267 (25.6)	13 (16.7)	
Exposed only to psychosocial work factors	203 (19.5)	14 (18.0)	
Exposed to both	85 (8.2)	3 (3.8)	
BP mean (SD) at baseline			
Systolic	121.8 (10.8)	122.4** (8.2)	p=0.55
Diastolic	78.1 (7.4)	77.7** (7.0)	p=0.48

Table 11. Comparison between participants included in the analysis at the 3-year follow-up (N=1043) and participants excluded due to methodological limitations or pregnancy (N=94)

	Included in the analysis N = 1043	Excluded due to methodological limitations N=94	*p*
Job strain			
Yes	239 (22.9)	24 (25.5)	p=0.56
No	804 (77.1)	70 (74.5)	
Effort-reward imbalance			
Yes	288 (27.6)	32 (34)	p=0.18
No	755 (72.4)	62 (66)	
Family responsibilities			
Low	246 (23.6)	18 (19.1)	p=0.36
Medium	445 (42.7)	47 (50)	
High	352 (33.8)	29 (30.9)	
Double exposure to job strain and high family responsibilities			
Non-exposed	536 (51.4)	51 (54.3)	p=0.60
Exposed only to responsibilities	268 (25.7)	19 (20.2)	
Exposed only to psychosocial work factors	155 (14.9)	14 (14.9)	
Exposed to both	84 (8.0)	10 (10.5)	
Double exposure to effort-reward imbalance and high family responsibilities			
Non-exposed	488 (46.8)	42 (44.7)	p=0.57
Exposed only to responsibilities	267 (25.5)	20 (21.3)	
Exposed only to psychosocial work factors	203 (19.5)	23 (24.5)	
Exposed to both	85 (8.2)	9 (9.6)	
BP mean (SD)			
Systolic	121.8 (10.5)	128.9 (10.9)	p<0.01
Diastolic	77.8 (7.5)	80.4 (7.1)	p=0.16

Table 12. Comparison between participants included in the analysis at the 5-year follow-up (N=973) and participants excluded due to refusals or lost at follow-up (N=123)

	Included in the analysis N = 973	Excluded due to methodological limitations N=123	*p*
Job strain			
Yes	220 (22.6)	19 (15.5)	p=0.06
No	753 (77.4)	104 (84.6)	
Effort-reward imbalance			
Yes	268 (27.5)	31 (25.2)	p=0.58
No	705 (72.5)	92 (74.8)	
Family responsibilities			
Low	219 (22.5)	39 (31.7)	p=0.07
Medium	422 (43.4)	49 (39.8)	
High	332 (34.1)	35 (28.5)	
Double exposure to job strain and high family responsibilities			
Non-exposed	499 (51.3)	75 (61.0)	p=-0.18
Exposed only to responsibilities	254 (26.1)	29 (23.6)	
Exposed only to psychosocial work factors	142 (14.6)	13 (10.6)	
Exposed to both	78 (8.0)	6 (4.9)	
Double exposure to effort-reward imbalance and high family responsibilities			
Non-exposed	450 (46.3)	67 (54.5)	p=0.33
Exposed only to responsibilities	255 (26.1)	25 (20.3)	
Exposed only to psychosocial work factors	191 (19.6)	21 (17.1)	
Exposed to both	77 (7.9)	10 (8.1)	
BP mean (SD)			
Systolic	121.7 (10.2)	121.8 (8.9)	p=0.96
Diastolic	78.1 (7.6)	77.4 (0.9)	p=0.97

Table 13. Comparison between participants included in the analysis at the 5-year follow-up (N=973) and participants excluded due to methodological limitations or pregnancy (N=119)

	Included in the analysis N = 973	**Excluded due to methodological limitations N=119**	***p***
Job strain			
Yes	220 (22.6)	39 (32.8)	P<0.05
No	753 (77.4)	80 (67.2)	
Effort-reward imbalance			
Yes	268 (24.5)	38 (31.9)	p=0.31
No	705 (68.1)	81 (68.1)	
Family responsibilities			
Low	219 (22.5)	32 (26.9)	P=0.14
Medium	422 (43.4)	57 (47.9)	
High	332 (34.1))	30 (25.2)	
Double exposure to job strain and high family responsibilities			
Non-exposed	499 (51.3)	63 (52.9)	p<0.05
Exposed only to responsibilities	254 (26.1)	17 (14.3)	
Exposed only to psychosocial work factors	142 (14.6)	26 (21.9)	
Exposed to both	78 (8.0)	13 (10.9)	
Double exposure to effort-reward imbalance and high family responsibilities			
Non-exposed	450 (46.3)	61 (51.3)	P=0.16
Exposed only to responsibilities	255 (26.2)	20 (16.8)	
Exposed only to psychosocial work factors	191 (19.6)	28 (23.5)	
Exposed to both	77 (7.9)	10 (8.4)	
BP mean (SD)			
Systolic	122.3 (10.6)	138.8 (14.5)	p<0.05
Diastolic	77.2 (7.6)	84.9** (0.9)	p=0.19

Table 14. Adjusted[57] associations between job strain and high family responsibilities[58] assessed at baseline with systolic and diastolic mean blood pressure (95% confidence interval) assessed at baseline, 3- and 5-year follow-ups, with alternative formulation of family responsibilities

	At baseline		At 3-year follow-up		At 5-year follow-up	
	SBP (mm Hg)	DBP (mm Hg)	SBP (mm Hg)	DBP (mm Hg)	SBP (mm Hg)	DBP (mm Hg)
High job strain (high family responsibilities from the main analyses, multiplicative)[1]						
No (no)	122.3	77.9	121.8	77.4	121.9	76.8
No (Yes)	-0.8 (-2.2-0.7)	0.4 (-0.7-1.4)	-0.3 (-2.0-1.3)	0.3 (-0.8-1.5)	1.0 (-0.7-2.6)	1.1 (-0.1-2.4)
Yes (no)	-0.3 (-2.1-1.4)	0.4 (-0.9-1.7)	0.8 (-1.2-2.7)	0.9 (-0.5-2.3)	1.0 (-1.0-3.0)	1.2 (-0.3-2.7)
Yes (yes)	-0.9 (-3.2-1.4)	0.9 (-0.8-2.6)	0.5 (-2.1-3.1)	1.4 (-0.5-3.3)	-0.1 (-2.7-2.6)	0.3 (-1.7-2.2)
High job strain (high family responsibilities additive)[2]						
No (no)	122.0	77.9	121.3	77.3	121.6	76.9
No (Yes)	-0.8 (-2.2-0.6)	0.3 (-0.8-1.3)	-0.4 (-2.1-1.2)	0.3 (-0.9-1.4)	0.4 (-1.3-2.1)	0.8 (-0.5-2.1)
Yes (no)	-0.1 (-2.0-1.8)	0.4 (1.0-1.7)	-0.1 (-2.2-2.0)	0.4 (-1.0-2.0)	0.5 (-1.8-2.8)	0.5 (-1.3-2.2)
Yes (yes)	-1.0 (-3.3-1.2)	0.8 (-0.9-2.4)	0.3 (-2.3-2.9)	0.9 (-0.9-2.8)	-0.1 (-2.6-2.8)	0.5 (-1.5-2.5)

[57] Adjusted for all covariates, namely: education, age, marital status, body mass index, alcohol consumption, smoking, leisure physical activity, stressful events, social support outside work, diabetes, known family history of cardiovascular diseases, and at 3-year and 5-year follow-ups menopause and menopausal hormone therapy. Categorizations used are provided in the “covariates” subsection of the methodology.

[58] Exposed categories are compared with the reference category (first category of each variable). Statistical significance of the differences is estimated by a Student's t test. Results in bold: p<0.05.

High job strain (high family responsibilities alternative weighting, multiplicative)[3]						
No (no)	121.9	77.8	121.1	77.2	121.4	76.7
No (Yes)	-0.6 (-2.0-0.8)	0.6 (-0.5-1.6)	0.1 (-1.5-1.8)	0.7 (-0.5-1.9)	0.9 (-0.8-2.6)	1.4 (0.1-2.7)
Yes (no)	-0.2 (-2.0-1.7)	0.5 (-0.9-1.8)	0.0 (-2.2-2.1)	0.6 (-1.0-2.1)	1.0 (-1.3-3.3)	1.0 (-0.7-2.7)
Yes (yes)	-0.7 (-3.2-1.5)	0.9 (-0.7-2.5)	0.7 (-1.8-3.3)	1.2 (-0.6-3.0)	-0.1 (-2.7-2.7)	0.4 (-1.6-2.3)
High job strain (high family responsibilities alternative weighting, additive)[4]						
No (no)	122.1	77.9	121.2	77.3	121.5	76.8
No (Yes)	-0.9 (-2.3-0.5)	0.2 (-0.9-1.2)	-0.0 (-1.7-1.6)	0.3 (-0.8-1.5)	0.6 (-1.1-2.3)	1.0 (-0.3-2.2)
Yes (no)	-0.2 (-2.1-1.7)	0.4 (-1.0-1.8)	0.1 (-2.2-2.1)	0.4 (-1.1-2.0)	0.9 (-1.4-3.3)	0.8 (-0.9-2.5)
Yes (yes)	-0.9 (-3.1-1.2)	0.6 (-1.0-2.2)	0.6 (-2.0-3.1)	1.1 (-0.7-2.9)	-0.1 (-2.8-2.5)	0.3 (-1.7-2.2)

1. (number of children and their age + 1) x (housework and children care). Original variable number of children and their age: (nb_enf_0a5 * 3) + (nb_enf_6a11 * 2.5) + (nb_enf_12a17 * 2) + (nb_enf_18a20 * 1.5).
2 number of children and their age + housework and children care. Original variable number of children and their age: (nb_enf_0a5 * 3) + (nb_enf_6a11 * 2.5) + (nb_enf_12a17 * 2) + (nb_enf_18a20 * 1.5).
3. Number of children and their age x housework and children care. Alternative variable number of children and their age: 1 + (nb_enf_0a5 * 2) + (nb_enf_6a11 * 1.5) + (nb_enf_12a17 * 1) + (nb_enf_18a20 * 0.5).
4. Number of children and their age + housework and children care. Alternative variable number of children and their age: 1 + (nb_enf_0a5 * 2) + (nb_enf_6a11 * 1.5) + (nb_enf_12a17 * 1) + (nb_enf_18a20 * 0.5).

Table 15. Adjusted[59] associations between effort-reward imbalance and high family responsibilities[60] assessed at baseline with systolic and diastolic mean blood pressure (95% confidence interval) assessed at baseline, 3- and 5-year follow-ups, with alternative formulation of family responsibilities

	At baseline		**At 3-year follow-up**		**At 5-year follow-up**	
	SBP (mm Hg)	DBP (mm Hg)	SBP (mm Hg)	DBP (mm Hg)	SBP (mm Hg)	DBP (mm Hg)
Effort-reward imbalance (high family responsibilities from the main analyses, multiplicative)[1]						
No (no)	121.9	77.6	121.8	77.6	121.6	76.8
No (Yes)	-1.0 (-2.4-0.5)	0.2 (-0.9-1.2)	-1.0 (-2.6-0.6)	-0.3 (-1.4-0.9)	0.5 (-1.2-2.1)	0.5 (-0.8-1.7)
Yes (no)	1.3 (-0.2-2.9)	**1.3 (0.2-2.5)**	0.5 (-1.8-2.3)	0.1 (-1.2-1.3)	1.8 (0.0-3.7)	0.9 (-0.5-2.2)
Yes (yes)	1.7 (-0.6-3.9)	**2.6 (1.0-4.3)**	2.4 (-0.1-5.0)	**2.4 (0.6-4.2)**	**3.1 (0.5-5.7)**	**2.6 (0.6-4.5)**
Effort-reward imbalance (high family responsibilities additive)[2]						
No (no)	121.7	77.6	121.4	77.5	121.2	76.8
No (Yes)	-1.1 (-2.6-0.3)	0.2 (-0.9-1.3)	-1.2 (-2.9-0.4)	-0.3 (-1.5-0.8)	0.2 (-1.5-2.0)	0.6 (-0.7-1.9)
Yes (no)	1.3 (-0.5-3.0)	**1.4 (0.2-2.7)**	-0.3 (-2.3-1.7)	0.3 (-1.7-1.1)	1.9 (-0.2-4.1)	0.8 (-0.8-2.3)
Yes (yes)	1.3 (-0.8-3.5)	**2.2 (0.6-3.7)**	2.7 (0.2-5.2)	**2.0 (0.3-3.8)**	2.6 (-0.2-5.4)	1.9 (-0.1-3.9)

[59] Adjusted for all covariates, namely: education, age, marital status, body mass index, alcohol consumption, smoking, leisure physical activity, stressful events, social support outside work, diabetes, known family history of cardiovascular diseases, and at 3-year and 5-year follow-ups menopause and menopausal hormone therapy. Categorizations used are provided in the “covariates” subsection of the methodology.

[60] Exposed categories are compared with the reference category (first category of each variable). Statistical significance of the differences is estimated by a Student's t test. Results in bold: $p<0.05$.

Effort-reward imbalance (high family responsibilities alternative weighting, multiplicative)[3]						
No (no)	121.4	77.4	121.0	77.3	121.0	76.7
No (Yes)	-0.6 (-2.1-0.8)	0.5 (-0.5-1.6)	-0.4 (-2.1-1.2)	0.2 (-1.0-1.4)	0.7 (-1.1-2.5)	0.8 (-0.4-2.1)
Yes (no)	1.6 (-0.1-3.3)	**1.6 (0.3-2.8)**	0.2 (-1.8-2.2)	-0.1 (-1.5-1.3)	**2.3 (0.2-4.4)**	0.7 (-0.8-2.3)
Yes (yes)	1.3 (-0.8-3.5)	**2.3 (0.7-3.8)**	**2.7 (0.19-5.2)**	**2.2 (0.5-4.0)**	2.5 (-0.2-5.2)	**2.2 (0.2-4.2)**
Effort-reward imbalance (high family responsibilities alternative weighting, additive)[4]						
No (no)	121.6	77.6	121.1	77.4	121.0	76.8
No (Yes)	-0.9 (-2.4-0.4)	0.0 (-1.1-1.0)	-0.5 (-2.1-1.2)	-0.1 (-1.3-1.0)	0.5 (-1.2-2.1)	0.5 (-0.7-1.8)
Yes (no)	1.5 (-0.3-3.2)	**1.6 (0.3-2.8)**	0.3 (-1.8-2.3)	-0.2 (-1.6-1.3)	**2.4 (0.2-4.5)**	0.7 (-0.9-2.3)
Yes (yes)	1.1 (-1.0-3.2)	**2.0 (0.6-3.5)**	2.3 (-0.1-4.8)	**1.9 (0.2-3.7)**	2.2 (-0.4-4.8)	1.9 (-0.1-3.9)

1. (number of children and their age + 1) x (housework and children care). Original variable number of children and their age: (nb_enf_0a5 * 3) + (nb_enf_6a11 * 2.5) + (nb_enf_12a17 * 2) + (nb_enf_18a20 * 1.5).
2 number of children and their age + housework and children care. Original variable number of children and their age: (nb_enf_0a5 * 3) + (nb_enf_6a11 * 2.5) + (nb_enf_12a17 * 2) + (nb_enf_18a20 * 1.5).
3. Number of children and their age x housework and children care. Alternative variable number of children and their age: 1 + (nb_enf_0a5 * 2) + (nb_enf_6a11 * 1.5) + (nb_enf_12a17 * 1) + (nb_enf_18a20 * 0.5).
4. Number of children and their age + housework and children care. Alternative variable number of children and their age: 1 + (nb_enf_0a5 * 2) + (nb_enf_6a11 * 1.5) + (nb_enf_12a17 * 1) + (nb_enf_18a20 * 0.5).

Table 16. Adjusted[61] systolic and diastolic mean blood pressure (95% confidence interval) according to family responsibilities dimensions[62] assessed at baseline among women having at least one child

	At baseline		
	N	SBP (mm Hg)	DBP (mm Hg)
Children load			
Low	194	123.0	78.5
Intermed.	221	-1.05 (-3.36-1.26)	0.11 (-1.61-1.82)
High	467	-1.39 (-3.76-0.98)	-0.56 (-2.32-1.20)
Domestic load			
Low	140	122.2	77.8
Intermed.	204	0.37 (-2.00-2.74)	0.86 (-0.90-2.62)
High	538	-0.52 (-2.70-1.66)	0.36 (-1.25-1.98)
High family responsibilities			
Low	99	122.5	78.2
Intermed.	362	-0.44 (-3.05-2.16)	-0.04 (-1.98-1.89)
High	421	-0.74 (-3.60-2.11)	0.05 (-2.07-2.17)

[61] Adjusted for all covariates, namely: education, age, marital status, body mass index, alcohol consumption, smoking, leisure physical activity, stressful events, social support outside work, diabetes, known family history of cardiovascular diseases, and at 3-year and 5-year follow-ups menopause and menopausal hormone therapy. Categorizations used are provided in the "covariates" subsection of the methodology.

[62] Exposed categories are compared with the reference category (first category of each variable). Statistical significance of the differences is estimated by a Student's t test. Results in bold: $p<0.05$. Results in italic: $0.05 \leq p<0.10$.

Table 17. Adjusted[63] systolic and diastolic mean blood pressure (95% confidence interval) according to family responsibilities dimensions[64] and age

	At baseline			At 3-year follow-up			At 5-year follow-up		
	N	SBP (mm Hg)	DBP (mm Hg)	N	SBP (mm Hg)	DBP (mm Hg)	N	SBP (mm Hg)	DBP (mm Hg)
<45 years-old									
Children									
No	235	121.8	77.8	190	121.4	77.0	170	122.5	77.1
Yes	458	-1.27 (-2.97-0.42)	0.25 (-1.01-1.52)	386	-0.33 (-2.33-1.66)	0.72 (-0.56-2.00)	355	-0.91 (-3.00-1.17)	0.38 (-1.01-1.77)
Children load									
Low	246	120.8	77.4	199	121.3	77.2	176	122.5	77.6
Interm.	100	-0.62 (-2.94-1.70)	0.70 (-1.00-2.41)	81	0.32 (-2.52-3.16)	1.54 (-0.36-3.44)	76	-0.34 (-3.34-2.65)	0.39 (-1.83-2.61)
High	347	-0.56 (-2.19-1.07)	0.34 (-0.86-1.54)	296	-0.40 (-2.43-1.62)	0.18 (-1.14-1.51)	273	-0.97 (-3.10-1.16)	-0.18 (-1.75-1.40)
Domestic load									
Low	158	121.6	77.4	126	120.4	77.9	110	123.1	77.0
Interm.	191	-0.51 (-2.63-1.61)	0.03 (-1.52-1.58)	157	-0.87 (-3.32-1.57)	-0.23 (-2.02-1.56)	142	-1.36 (-4.08-1.34)	0.48 (-1.42-2.37)
High	344	-1.21 (-3.13-0.70)	0.54 (-0.84-1.93)	293	0.00 (-2.18-2.18)	-0.10 (-1.71-1.50)	273	-1.48 (-3.88-0.92)	0.53 (-1.16-2.21)
High family responsibilities									
Low	129	121.9	77.7	105	122.8	76.7	90	122.0	78.4
Interm.	245	-1.54 (-3.68-0.61)	-0.43(-2.00-1.13)	199	-1.95 (-4.49-0.58)	0.11 (-1.49-1.71)	188	-0.49 (-2.96-1.98)	-0.81 (-2.84-1.22)
High	319	-1.19 (-3.28-0.89)	0.46 (-1.04-1.96)	272	-1.73 (-4.18-0.71)	0.66 (-0.95-2.27)	247	-0.15 (-2.62-2.32)	-1.12 (-3.06-0.83)

[63] Adjusted for all covariates, namely: education, age, marital status, body mass index, alcohol consumption, smoking, leisure physical activity, stressful events, social support outside work, diabetes, known family history of cardiovascular diseases, and at 3-year and 5-year follow-ups menopause and menopausal hormone therapy. Categorizations used are provided in the "covariates" subsection of the methodology.

[64] Exposed categories are compared with the reference category (first category of each variable). Statistical significance of the differences is estimated by a Student's t test. Results in bold: $p<0.05$. Results in italic: $0.05 \leq p<0.10$.

≥ 45 years-old									
Children									
No	126	121.8	78.5	100	121.3	77.4	89	119.8	76.1
Yes	316	0.08 (-2.01-2.17)	-0.34 (-1.90-1.22)	257	-0.05 (-2.54-2.44)	0.24 (-1.46-1.94)	217	*2.54 (-0.14-5.21)*	1.04 (-0.84-2.91)
Children load									
Low	264	124.3	78.8	208	121.4	77.2	180	121.1	76.2
Interm.	96	-1.44 (-3.77-0.89)	-0.34 (-2.06-1.38)	78	-0.10 (-2.88-2.69)	0.93 (-0.98-2.84)	67	-0.01 (-3.04-3.02)	0.44 (-1.81-2.68)
High	82	*-2.45(-4.93-0.02)*	-0.59 (-2.41-1.23)	71	-0.31 (-3.21-2.59)	1.27 (-0.71-3.25)	59	2.02 (-1.16-5.21)	*2.26 (-0.10-4.62)*
Domestic load									
Low	142	123.5	78.7	109	122.8	76.4	93	120.5	75.6
Interm.	157	-0.39 (-2.74-1.96)	0.34 (-1.33-2.01)	127	-0.10 (-2.77-2.57)	1.00 (-1.04-3.03)	113	0.87 (-2.18-3.92)	1.53 (-0.55-3.62)
High	143	-1.08 (-3.43-1.27)	-0.56 (-2.27-1.14)	414	-0.02 (-2.72-2.68)	1.35 (-0.64-3.34)	100	1.90 (-1.13-4.93)	1.95 (-0.19-4.10)
High family responsibilities									
Low	133	123.7	78.9	102	121.3	78.9	87	122.3	75.9
Interm.	240	-0.93 (-3.10-1.24)	-0.33 (-1.89-1.23)	197	-0.59 (-3.19-2.02)	-0.97 (-2.90-0.97)	172	-0.39 (-3.33-2.54)	0.36 (-1.72-2.44)
High	69	-1.40 (-4.35-1.54)	-0.10 (-2.23-2.04)	58	1.03 (-2.44-4.51)	-0.35 (-2.45-1.74)	47	-1.02 (-4.26-2.21)	**3.27 (0.43-6.10)**

Table 18. Modifying effect of job strain on adjusted[65] systolic and diastolic mean blood pressure (95% confidence interval) according to family responsibilities dimensions[66]

	At baseline		**At 3-year follow-up**		**At 5-year follow-up**	
	SBP (mm Hg)	DBP (mm Hg)	SBP (mm Hg)	DBP (mm Hg)	SBP (mm Hg)	DBP (mm Hg)
High job strain						
Children						
No	121.3	78.3	121.6	78.1	122.3	77.8
Yes	0.78 (-1.82-3.38)	0.34 (-1.59-2.26)	1.31 (-1.64-4.26)	0.59 (-1.53-2.72)	0.24 (-2.85-3.32)	-0.31 (-2.58-1.96)
Children load						
Low	121.1	77.8	121.5	77.7	122.4	77.7
Intermed.	2.51 (-1.04-6.06)	**2.89 (0.27-5.52)**	3.39 (-0.65-7.43)	**3.95 (1.05-6.85)**	-0.34 (-4.56-3.88)	0.91 (-2.20-4.01)
High	0.66 (-2.08-3.39)	0.56 (-1.46-2.59)	1.14 (-1.97-4.26)	0.42 (-1.82-2.65)	0.40 (-2.82-3.62)	-0.52 (-2.88-1.85)
Domestic load						
Low	122.3	78.1	123.3	78.8	123.0	77.2
Intermed.	-0.72 (-4.06-2.62)	0.07 (-2.40-2.54)	-2.16 (-5.87-1.55)	-1.27 (-3.94-1.40)	-0.30 (-4.25-3.65)	1.18 (-1.73-4.09)
High	-0.41 (-3.70-2.88)	1.04 (-1.39-3.47)	-0.03 (-3.64-3.59)	0.52 (-2.08-3.12)	-0.93 (-0.79-2.93)	0.06 (-2.77-2.90)
High family responsibilities						
Low	122.1	78.1	123.9	79.2	123.6	77.7
Intermed.	-0.15 (-3.48-3.19)	0.37 (-2.09-2.84)	-2.00 (-5.68-1.69)	-1.25 (-3.90-1.41)	-0.92 (-4.85-3.00)	0.40 (-2.49-3.30)
High	-0.67 (-4.18-2.84)	0.78 (-1.81-3.37)	-1.59 (-5.46-2.29)	-0.35 (-3.13-2.44)	-1.76 (-5.88-2.37)	-0.65 (-3.69-2.39)

[65] Adjusted for all covariates, namely: education, age, marital status, body mass index, alcohol consumption, smoking, leisure physical activity, stressful events, social support outside work, diabetes, known family history of cardiovascular diseases, and at 3-year and 5-year follow-ups menopause and menopausal hormone therapy. Categorizations used are provided in the "covariates" subsection of the methodology.

[66] Exposed categories are compared with the reference category (first category of each variable). Statistical significance of the differences is estimated by a Student's t test. Results in bold: $p<0.05$. Results in italic: $0.05 \leq p < 0.10$.

Low job strain						
Children						
No	123.0	78.1	122.0	77.2	121.6	76.3
Yes	-1.41 (-2.88-0.07)	-0.12 (-1.21-0.97)	-0.49 (-2.18-1.19)	0.50 (-0.71-1.72)	*0.88 (-0.88-2.61)*	**1.29 (0.02-2.56)**
Children load						
Low	123.1	78.2	122.0	77.3	121.6	76.3
Intermed.	-1.94 (-3.78- -0.09)	-0.33 (-1.69-1.04)	-0.09 (-2.18-2.00)	0.79 (-0.71-2.29)	1.43 (-0-73-3.59)	**1.63 (0.05-3.22)**
High	*-1.93 (-3.43- -0.42)*	-0.20 (-1.32-0.91)	-0.94 (-2.66-0.77)	0.25 (-0.98-1.48)	0.83 (-0.92-2.58)	**1.52 (0.23-2.80)**
Domestic load						
Low	122.8	78.1	122.0	77.3	122.0	76.3
Intermed.	-0.27 (-2.03-1.50)	-0.03 (-1.33-1.27)	-0.09 (-2.12-1.94)	0.32 (-1.14-1.78)	-0.50 (-2.59-1.59)	0.44 (-1.09-1.98)
High	-1.42 (-3.02-0.18)	-0.18 (-1.33-1.27)	-0.73 (-2.55-1.09)	0.36 (-0.95-1.67)	0.84 (-1.02-2.69)	**1.56 (0.20-2.93)**
High family responsibilities						
Low	123.1	78.3	122.3	77.7	122.2	76.6
Intermed.	-1.14 (-2.82-0.53)	-0.66 (-1.89-0.58)	-0.85 (-2.76-1.06)	-0.34 (-1.71-1.04)	-0.49 (-2.46-1.48)	0.20 (-1.25-1.65)
High	-1.49 (-3.26-0.28)	-0.07 (-1.38-1.24)	-0.88 (-2.91-1.14)	0.10 (-1.36-1.56)	0.66 (-1.41-2.73)	1.27 (-0.26-2.79)

Table 19. Modifying effect of effort-reward imbalance on adjusted[67] systolic and diastolic mean blood pressure (95% confidence interval) according to family responsibilities dimensions[68]

	At baseline		At 3-year follow-up		At 5-year follow-up	
	SBP (mm Hg)	DBP (mm Hg)	SBP (mm Hg)	DBP (mm Hg)	SBP (mm Hg)	DBP (mm Hg)
ERI						
Children						
No	123.3	79.3	121.8	77.8	122.7	77.5
Yes	0.01 (-2.34-2.36)	0.09 (-1.64-1.82)	1.54 (-1.16-4.24)	0.88 (-1.06-2.83)	1.54 (-1.21-4.28)	0.91 (-1.12-2.94)
Children load						
Low	122.9	78.7	121.9	77.5	122.7	78.7
Intermed.	1.99 (-1.14-5.11)	**2.45 (0.14-4.76)**	1.53 (-1.98-5.03)	1.92 (-0.60-4.44)	2.02 (-1.67-5.71)	**2.45 (0.14-4.76)**
High	0.19 (-2.30-2.68)	0.55 (-1.29-2.38)	1.93 (-0.92-4.78)	1.58 (-0.47-3.64)	1.97 (-0.92-4.85)	0.55 (-1.29-2.38)
Domestic load						
Low	123.8	79.1	123.2	78.6	122.8	77.1
Intermed.	-1.07 (-3.99-2.48)	-0.59 (-2.74-1.56)	-1.08 (-4.42-2.27)	-1.70 (-4.10-0.71)	0.73 (-2.70-4.16)	0.62 (-1.91-3.15)
High	-0.27 (-3.03-2.48)	0.97 (-1.07-3.00)	0.05 (-3.03-3.12)	0.65 (-1.56-2.86)	1.75 (-1.42-4.91)	1.98 (-0.35-4.32)
High family responsibilities						
Low	123.7	79.1	123.3	78.8	122.4	77.2
Intermed.	-0.71 (-3.53-2.12)	-0.25 (-2.33-1.83)	-1.45 (-4.62-1.71)	-1.70 (-3.97-0.57)	1.42 (-1.81-4.66)	0.63 (-1.76-3.03)
High	-0.17 (-3.29-2.95)	1.15 (-1.16-3.45)	0.95 (-2.55-4.45)	1.23 (-1.29-3.74)	2.18 (-1.40-5.76)	2.16 (-0.49-4.80)

[67] Adjusted for all covariates, namely: education, age, marital status, body mass index, alcohol consumption, smoking, leisure physical activity, stressful events, social support outside work, diabetes, known family history of cardiovascular diseases, and at 3-year and 5-year follow-ups menopause and menopausal hormone therapy. Categorizations used are provided in the "covariates" subsection of the methodology.

[68] Exposed categories are compared with the reference category (first category of each variable). Statistical significance of the differences is estimated by a Student's t test. Results in bold: $p<0.05$. Results in italic: $0.05 \leq p<0.10$.

No ERI						
Children						
No	122.4	77.7	121.9	77.3	121.4	76.3
Yes	-1.26 (-2.77-0.26)	-0.05 (-1.17-1.07)	-0.69 (-2.41-1.04)	0.40 (-0.85-1.64)	*0.45 (-1.32-2.23)*	0.96 (-0.35-2.27)
Children load						
Low	122.6	77.9	121.9	77.4	121.5	76.3
Intermed.	-2.11 (-4.02- -0.19)	-0.43 (-1.84-0.98)	0.27 (-1.92-2.46)	1.24 (-0.34-2.82)	0.75 (-1.49-2.99)	1.32 (-0.34-2.97)
High	*-2.01 (-3.56- -0.46)*	-0.30 (-1.45-0.84)	-1.41 (-3.17-0.35)	-0.20 (-1.46-1.07)	0.31 (-1.50-2.12)	0.95 (-0.38-2.28)
Domestic load						
Low	122.3	77.7	121.9	77.2	121.9	76.2
Intermed.	-0.20 (-2.01-1.61)	0.21 (-1.12-1.55)	-0.32 (-2.40-1.76)	0.65 (-0.84-2.15)	-0.73 (-2.89-1.42)	0.77 (-0.82-2.36)
High	-1.60 (-3.27-0.07)	-0.27 (-1.50-0.97)	-0.82 (-2.73-1.08)	0.33 (-1.04-1.70)	0.06 (-1.90-2.03)	1.05 (-0.40-2.50)
High family responsibilities						
Low	122.6	78.0	122.4	77.6	122.4	76.7
Intermed.	-1.12 (-2.87-0.64)	-0.54 (-1.84-0.75)	-0.89 (-2.90-1.12)	0.02 (-1.42-1.46)	-1.36 (-3.44-0.73)	0.15 (-1.39-1.69)
High	-1.70 (-3.52-0.12)	-0.20 (-1.54-1.15)	-1.55 (-3.63-0.52)	-0.25 (-1.74-1.25)	-0.42 (-2.57-1.73)	0.55 (-1.04-2.13)

Table 20. Adjusted[69] systolic and diastolic mean blood pressure (95% confidence interval) according to double exposures to psychological demands, job control or reward and high family responsibilities[70]

	At baseline		**At 3-year follow-up**		**At 5-year follow-up**	
	SBP (mm Hg)	DBP (mm Hg)	SBP (mm Hg)	DBP (mm Hg)	SBP (mm Hg)	DBP (mm Hg)
High psychological demands and high family responsibilities						
No (no)	121.7	77.5	121.2	77.2	121.6	76.9
No (Yes)	-0.9 (-2.6-0.8)	0.2 (-1.1-1.4)	-0.9 (-2.9-1.0)	-0.3 (1.7-1.1)	0.5 (-1.6-2.6)	0.8 (-0.7-2.3)
Yes (no)	0.5 (-1.0-2.0)	0.9 (-0.2-2.0)	0.1 (-1.6-1.9)	0.5 (-0.7-1.7)	0.3 (-1.6-2.1)	0.3 (-1.1-1.6)
Yes (yes)	-0.1 (-2.0-1.7)	**1.5 (0.1-2.8)**	1.0 (-1.1-3.1)	1.5 (0.0-3.0)	0.1 (-2.2-2.4)	0.4 (-1.3-2.1)
Low decision latitude and high family responsibilities						
No (no)	122.4	78.5	122.1	78.0	122.6	76.9
No (Yes)	-1.0 (-3.2-1.1)	0.1 (-1.5-1.6)	-0.4 (-2.8-2.0)	0.2 (-1.4-1.9)	-1.5 (-4.1-1.0)	0.8 (-0.5-2.1)
Yes (no)	-0.7 (-2.3-0.8)	-0.8 (-1.9-0.3)	-1.3 (-3.1-0.5)	-0.8 (-2.1-0.4)	-1.4 (-3.4-0.5)	0.5 (-1.3-2.2)
Yes (yes)	-1.3 (-3.1-0.5)	-0.3 (-1.6-1.0)	-1.3 (-3.3-0.8)	-0.5 (-2.0-0.9)	-0.2 (-2.4-2.0)	0.5 (-1.5-2.5)
Low reward and high family responsibilities						
No (no)	122.0	78.0	121.5	77.7	121.6	77.1
No (Yes)	-0.7 (-2.3-0.8)	0.2 (-1.0-1.3)	-0.7 (-2.5-1.1)	-0.5 (-1.8-0.8)	0.2 (-1.7-2.1)	0.3 (-1.1-1.6)
Yes (no)	-0.1 (-1.6-1.4)	-0.1 (-1.2-1.0)	-0.6 (-2.3-1.2)	-0.7 (-1.9-0.6)	0.3 (-1.6-2.1)	-0.3 (-1.6-1.0)
Yes (yes)	1.0 (-3.1-1.1)	0.6 (-0.9-2.2)	0.3 (-2.0-2.7)	1.2 (-0.5-2.8)	0.5 (-2.1-3.0)	1.1 (-0.7-2.9)

[69] Adjusted for all covariates, namely: education, age, marital status, body mass index, alcohol consumption, smoking, leisure physical activity, stressful events, social support outside work, and at 3-year and 5-year follow-ups menopause and menopausal hormone therapy. Categorizations used are provided in the "covariates" subsection of the methodology.

[70] Exposed categories are compared with the reference category (first category of each variable). Statistical significance of the differences is estimated by a Student's t test. Results in bold: $p<0.05$. Results in italic: $0.05 \le p < 0.10$.

Annexe 7 : Analyses complémentaires de l'article sur la détresse psychologique (Chapitre 5)

Table 1. Adjusted[71] prevalence ratios of psychological distress (95% confidence interval) according the double exposure to job strain and subscales of family responsibilities[72]

	N	At baseline PR (95% CI)	N	At 3-year PR (95% CI)	N	At 5-year PR (95% CI)
Job strain and having ≥1 child						
No (no)	335	1.00	290	1.00	267	1.00
No (Yes)	683	**1.33 (1.10-1.62)**	624	**1.30 (1.05-1.60)**	580	*1.21 (0.96-1.53)*
Yes (no)	96	**1.44 (1.09-1.91)**	88	**1.51 (1.14-2.00)**	79	**1.49 (1.06-2.08)**
Yes (yes)	195	**1.75 (1.41-2.17)**	180	**1.35 (1.05-1.72)**	171	**1.50 (1.15-1.97)**
Job strain and the index "number of children and their age"						
No (no)	667	1.00	585	1.00	534	1.00
No (Yes)	351	1.14 (0.95-1.36)	329	1.15 (0.95-1.40)	313	1.19 (0.95-1.47)
Yes (no)	179	**1.43 (1.20-1.71)**	163	**1.28 (1.05-1.57)**	151	**1.36 (1.08-1.72)**
Yes (yes)	112	**1.39 (1.10-1.74)**	105	1.16 (0.88-1.55)	99	**1.48 (1.10-1.98)**
Job strain and the index "housework and children care"						
No (no)	601	1.00	525	1.00	486	1.00
No (Yes)	417	**1.20 (1.01-1.41)**	389	**1.28 (1.07-1.53)**	361	0.96 (0.78-1.18)
Yes (no)	172	**1.40 (1.15-1.70)**	159	**1.32 (1.06-1.64)**	144	**1.32 (1.04-1.68)**
Yes (yes)	119	**1.56 (1.26-1.93)**	109	*1.29 (1.00-1.68)*	106	1.26 (0.94-1.68)

[71] Adjusted for all covariates, namely: education, age, marital status, body mass index, alcohol consumption, smoking, leisure physical activity, stressful events, social support outside work, and at 3-year and 5-year follow-ups menopause and menopausal hormone therapy. Categorizations used are provided in the "covariates" subsection of the methodology.

[72] Exposed categories are compared with the reference category (first category of each variable). Statistical significance of the differences is estimated by a Student's t test. Results in bold: $p<0.05$. Results in italic: $0.05 \leq p<0.10$.

Table 2. Adjusted[73] prevalence ratios of psychological distress (95% confidence interval) according to the double exposure to effort-reward and subscales of family responsibilities[74]

	At baseline N	At baseline PR (95% CI)	At 3-year N	At 3-year PR (95% CI)	At 5-year N	At 5-year PR (95% CI)
Effort-reward imbalance and having ≥1 child						
No (no)	309	1.00	270	1.00	244	1.00
No (Yes)	644	**1.32 (1.06-1.64)**	585	1.13 (0.90-1.41)	552	1.24 (0.96-1.59)
Yes (no)	122	**1.72 (1.32-2.24)**	108	**1.54 (1.17-2.02)**	102	**1.67 (1.22-2.29)**
Yes (yes)	234	**2.21 (1.78-2.75)**	219	**1.93 (1.54-2.42)**	199	**1.80 (1.37-2.36)**
Effort-reward imbalance and the index "number of children and their age"						
No (no)	616	1.00	540	1.00	496	1.00
No (Yes)	337	1.08 (0.88-1.31)	315	1.07 (0.86-1.33)	300	1.16 (0.92-1.47)
Yes (no)	230	**1.68 (1.42-1.98)**	208	**1.65 (1.37-1.98)**	189	**1.52 (1.22-1.90)**
Yes (yes)	126	**1.81 (1.50-2.19)**	119	**1.78 (1.43-2.23)**	112	**1.74 (1.34-2.28)**
Effort-reward imbalance and the index "housework and children care"						
No (no)	559	1.00	491	1.00	453	1.00
No (Yes)	394	1.20 (1.00-1.44)	364	1.18 (0.96-1.45)	343	1.03 (0.82-1.29)
Yes (no)	214	**1.73 (1.44-2.08)**	193	**1.63 (1.34-2.00)**	177	**1.63 (1.30-2.04)**
Yes (yes)	142	**1.95 (1.61-2.36)**	134	**1.99 (1.62-2.45)**	124	**1.40 (1.07-1.83)**

[73] Adjusted for all covariates, namely: education, age, marital status, body mass index, alcohol consumption, smoking, leisure physical activity, stressful events, social support outside work, and at 3-year and 5-year follow-ups menopause and menopausal hormone therapy. Categorizations used are provided in the "covariates" subsection of the methodology.

[74] Exposed categories are compared with the reference category (first category of each variable). Statistical significance of the differences is estimated by a Student's t test. Results in bold: p<0.05. Results in italic: 0.05≤p<0.10.

Table 3. Adjusted[75] prevalence ratios of psychological distress (95% confidence interval) according to the double exposure to job strain and high family responsibilities[76] and age

	N	At baseline PR (95% CI)	N	At 3-year PR (95% CI)	N	At 5-year PR (95% CI)
< 45 YEARS-OLD						
No (no)	319	1.00	283	1.00	260	1.00
No (Yes)	251	1.15 (0.92-1.42)	236	1.02 (0.80-1.29)	221	0.97 (0.74-1.28)
Yes (no)	97	1.19 (0.90-1.58)	90	1.19 (0.89-1.58)	83	1.18 (0.83-1.66)
Yes (yes)	87	**1.48 (1.16-1.90)**	83	1.13 (0.83-1.53)	77	**1.41 (1.03-1.92)**
≥ 45 YEARS-OLD						
No (no)	380	1.00	334	1.00	307	1.00
No (Yes)	68	1.33 (0.98-1.80)	61	1.39 (1.00-1.94)	59	1.23 (0.85-1.78)
Yes (no)	94	**1.64 (1.30-2.07)**	84	1.32 (0.99-1.74)	79	**1.42 (1.03-1.95)**
Yes (yes)	13	1.22 (0.57-2.62)	11	1.17 (0.51-2.68)	11	1.16 (0.40-3.35)

[75] Adjusted for all covariates, namely: education, age, marital status, body mass index, alcohol consumption, smoking, leisure physical activity, stressful events, social support outside work, and at 3-year and 5-year follow-ups menopause and menopausal hormone therapy. Categorizations used are provided in the "covariates" subsection of the methodology.

[76] Exposed categories are compared with the reference category (first category of each variable). Statistical significance of the differences is estimated by a Student's t test. Results in bold: $p<0.05$. Results in italic: $0.05 \leq p<0.10$.

Table 4. Adjusted[77] prevalence ratios of psychological distress (95% confidence interval) according to the double exposure to effort-reward imbalance and high family responsibilities[78] and age

	N	**At baseline** RP (95% CI)	N	**At 3-year follow-up** RP (95% CI)	N	**At 5-year follow-up** RP (95% CI)
< 45 YEARS-OLD						
No (no)	292	1.00	259	1.00	238	1.00
No (Yes)	252	1.20 (0.94-1.54)	236	0.92 (0.70-1.21)	223	1.10 (0.82-1.47)
Yes (no)	124	**1.67 (1.30-2.14)**	114	**1.45 (1.11-1.88)**	105	**1.53 (1.13-2.09)**
Yes (yes)	86	**2.03 (1.59-2.59)**	83	**1.73 (1.33-2.25)**	75	**1.57 (1.12-2.21)**
≥ 45 YEARS-OLD						
No (no)	344	1.00	301	1.00	278	1.00
No (Yes)	65	1.30 (0.93-1.83)	59	1.39 (0.96-2.01)	57	1.35 (0.91-2.01)
Yes (no)	130	**1.76 (1.40-2.21)**	117	**1.74 (1.36-2.24)**	108	**1.72 (1.28-2.30)**
Yes (yes)	16	**1.84 (1.15-2.94)**	13	**2.20 (1.33-3.64)**	13	1.28 (0.55-2.96)

[77] Adjusted for all covariates, namely: education, age, marital status, body mass index, alcohol consumption, smoking, leisure physical activity, stressful events, social support outside work, and at 3-year and 5-year follow-ups menopause and menopausal hormone therapy. Categorizations used are provided in the "covariates" subsection of the methodology.

[78] Exposed categories are compared with the reference category (first category of each variable). Statistical significance of the differences is estimated by a Student's t test. Results in bold: $p<0.05$. Results in italic: $0.05 \leq p<0.10$.

Table 5. Prevalence ratios of psychological distress (95% confidence interval) according to the double exposure to job strain and family responsibilities adjusted for all covariates[79] except for potentially intermediate covariates (i.e. physical inactivity, overweight, alcohol consumption, smoking) [80]

	At baseline		3-year follow-up		5-year follow-up	
	N	RP (95% CI)	N	RP (95% CI)	N	RP (95% CI)
High job strain						
No	1018	1.00	914	1.00	847	1.00
Yes	291	**1.36 (1.17-1.57)**	268	1.17 (0.99-1.38)	250	**1.33 (1.10-1.60)**
Job strain quadrants						
Unexposed	176	1.00	160	1.00	153	1.00
Passive	552	**1.64 (1.20-2.23)**	**486**	**1.37 (1.02-1.83)**	448	1.04 (0.76-1.43)
Active	290	**2.05 (1.49-2.82)**	**268**	**1.54 (1.13-.08)**	246	**1.42 (1.03-1.97)**
High strain	291	**2.23 (1.63-3.06)**	**268**	**1.58 (1.17-2.13)**	250	**1.52 (1.11-2.09)**
Job strain (family load)						
No (no)	699	1.00	617	1.00	567	1.00
No (Yes)	319	**1.25 (1.05-1.49)**	297	1.14 (0.94-1.39)	280	1.06 (0.85-1.33)
Yes (no)	191	**1.39 (1.16-1.67)**	174	*1.23 (1.00-1.49)*	162	**1.29 (1.02-1.62)**
Yes (yes)	100	**1.62 (1.29-2.03)**	94	1.21 (0.92-1.59)	88	**1.50 (1.13-2.00)**
Job strain (having ≥1 child)						
No (no)	335	1.00	290	1.00	267	1.00
No (Yes)	683	**1.35 (1.11-1.64)**	624	**1.30 (1.06-1.60)**	580	*1.22 (0.96-1.54)*
Yes (no)	96	**1.41 (1.07-1.87)**	88	**1.48 (1.12-1.96)**	79	**1.43 (1.03-1.99)**
Yes (yes)	195	**1.80 (1.45-2.24)**	180	**1.34 (1.05-1.72)**	171	**1.56 (1.19-2.04)**
Job strain (index "number of children and their age")						
No (no)	667	1.00	585	1.00	534	1.00
No (Yes)	351	1.13 (0.95-1.35)	329	1.15 (0.95-1.39)	313	1.18 (0.95-1.47)
Yes (no)	179	**1.42 (1.19-1.70)**	163	**1.26 (1.04-1.54)**	151	**1.36 (1.08-1.72)**
Yes (yes)	112	**1.42 (1.12-1.79)**	105	1.16 (0.88-1.54)	99	**1.51 (1.12-2.02)**
Job strain (index "housework and children care")						
No (no)	601	1.00	525	1.00	486	1.00
No (Yes)	417	**1.12 (1.03-1.43)**	389	**1.27 (1.07-1.52)**	361	0.98 (0.80-1.21)
Yes (no)	172	**1.37 (1.13-1.66)**	159	**1.29 (1.04-1.60)**	144	**1.30 (1.03-1.65)**
Yes (yes)	119	**1.64 (1.33-2.03)**	109	**1.30 (1.01-1.69)**	106	**1.35 (1.01-1.79)**

[79] Adjusted for: education, age, marital status, stressful events, social support outside work, and at 3-year and 5-year follow-ups menopause and menopausal hormone therapy. Categorizations used are provided in the "covariates" subsection of the methodology.

[80] Exposed categories are compared with the reference category (first category of each variable). Statistical significance of the differences is estimated by a Student's t test. Results in bold: $p<0.05$. Results in italic: $0.05 \le p < 0.10$.

Table 6. Prevalence ratios of psychological distress (95% confidence interval) according to the double exposure to effort-reward imbalance and family responsibilities adjusted for all covariates[81] except for potentially intermediate covariates (i.e. physical inactivity, overweight, alcohol consumption, smoking) [82]

	At baseline		At 3-year		At 5-year	
	N	RP (95% CI)	N	RP (95% CI)	N	RP (95% CI)
Effort-reward imbalance						
No	953	1.00	855	1.00	796	1.00
Yes	356	**1.68 (1.47-1.92)**	327	**1.65 (1.43-1.91)**	301	**1.51 (1.27-1.79)**
Effort-reward imbalance and family load						
No (no)	636	1.00	560	1.00	516	1.00
No (Yes)	317	**1.26 (1.04-1.53)**	295	1.07 (0.886-1.33)	280	1.19 (0.95-1.50)
Yes (no)	254	**1.71 (1.44-2.02)**	231	**1.59 (1.33-1.91)**	213	**1.62 (1.31-2.00)**
Yes (yes)	102	**2.11 (1.72-2.57)**	96	**1.93 (1.55-2.41)**	88	**1.58 (1.18-2.12)**
Effort-reward imbalance and having ≥1 child						
No (no)	309	1.00	270	1.00	244	1.00
No (Yes)	644	**1.35 (1.08-1.67)**	585	1.12 (0.90-1.41)	552	1.25 (0.97-1.62)
Yes (no)	122	**1.70 (1.31-2.21)**	108	**1.52 (1.16-1.99)**	102	**1.64 (1.20-2.24)**
Yes (yes)	234	**2.25 (1.81-2.80)**	219	**1.93 (1.54-2.42)**	199	**1.84 (1.40-2.42)**
Effort-reward imbalance and index “number of children and their age”						
No (no)	616	1.00	540	1.00	496	1.00
No (Yes)	337	1.07 (0.88-1.31)	315	1.08 (0.87-1.34)	300	1.17 (0.92-1.47)
Yes (no)	230	**1.66 (1.41-1.96)**	208	**1.64 (1.37-1.97)**	189	**1.53 (1.22-1.90)**
Yes (yes)	126	**1.82 (1.50-2.22)**	119	**1.79 (1.44-2.23)**	112	**1.73 (1.33-2.25)**
Effort-reward imbalance and index “housework and children care”						
No (no)	559	1.00	491	1.00	453	1.00
No (Yes)	394	1.22 (1.01-1.47)	364	1.18 (0.97-1.45)	343	1.07 (0.86-1.34)
Yes (no)	214	**1.70 (1.42-2.04)**	193	**1.62 (1.33-1.98)**	177	**1.63 (1.31-2.04)**
Yes (yes)	142	**2.02 (1.67-2.44)**	134	**2.01 (1.63-2.47)**	124	**1.44 (1.10-1.88)**

[81] Adjusted for: education, age, marital status, stressful events, social support outside work, and at 3-year and 5-year follow-ups menopause and menopausal hormone therapy. Categorizations used are provided in the “covariates” subsection of the methodology.

[82] Exposed categories are compared with the reference category (first category of each variable). Statistical significance of the differences is estimated by a Student's t test. Results in bold: p<0.05. Results in italic: 0.05≤p<0.10.

Table 7. Adjusted[83] prevalence ratios of psychological distress (95% confidence interval) according to double exposures to psychological demands, job control or reward and high family responsibilities[84]

	N	At baseline PR (95% CI)	N	At 3-year PR (95% CI)	N	At 5-year PR (95% CI)
Psychological demands and high family responsibilities						
No (no)	502	1.00	430	1.00	394	1.00
No (Yes)	224	1.19 (0.96-1.48)	209	1.11 (0.87-1.40)	198	*1.13 (0.86-1.48)*
Yes (no)	387	**1.43 (1.20-1.70)**	350	**1.25 (1.04-1.50)**	326	**1.49 (1.20-1.85)**
Yes (yes)	194	**1.73 (1.42-2.11)**	178	**1.32 (1.05-1.67)**	169	**1.55 (1.19-2.01)**
Job control and high family responsibilities						
No (no)	321	1.00	287	1.00	270	1.00
No (Yes)	145	1.25 (0.97-1.62)	134	1.11 (0.83-1.48)	129	0.93 (0.68-1.28)
Yes (no)	568	1.12 (0.93-1.35)	493	1.09 (0.90-1.32)	450	0.89 (0.71-1.11)
Yes (yes)	273	**1.31 (1.07-1.62)**	253	1.16 (0.92-1.46)	238	1.02 (0.80-1.32)
Reward and high family responsibilities						
No (no)	556	1.00	482	1.00	437	1.00
No (Yes)	274	**1.17 (0.96-1.41)**	254	**1.04 (0.84-1.30)**	243	1.07 (0.84-1.36)
Yes (no)	333	**1.31 (1.10-1.55)**	298	**1.24 (1.04-1.49)**	283	**1.27 (1.02-1.57)**
Yes (yes)	144	**1.67 (1.37-2.04)**	133	**1.46 (1.16-1.83)**	124	**1.41 (1.08-1.84)**

[83] Adjusted for all covariates, namely: education, age, marital status, body mass index, alcohol consumption, smoking, leisure physical activity, stressful events, social support outside work, and at 3-year and 5-year follow-ups menopause and menopausal hormone therapy. Categorizations used are provided in the "covariates" subsection of the methodology.

[84] Exposed categories are compared with the reference category (first category of each variable). Statistical significance of the differences is estimated by a Student's t test. Results in bold: p<0.05. Results in italic: 0.05≤p<0.10.

Table 8. Comparison between participants having completed the self-administered questionnaire at baseline and women who refused to participate

	Participants at baseline N = 1,391 (%)	Refusal to participate N=239 (%)	*p*
Job title**			
Office worker	551 (39.6)	114 (47.7)	0.19
Technician	408 (29.3)	64 (26.8)	
Professionnal	383 (27.5)	55 (23.0)	
Manager	47 (3.4)	6 (2.5)	
Other	2 (0.1)	0 (0)	

*The job title was the only variable available for women who refused to participate at baseline.

Table 9. Comparison between participants included in the analysis at the 3-year follow-up (1167) and participants excluded due to refusals or lost at follow-up (N=109)

	Included in the analysis N = 1,167	Excluded due to methodological limitations N=109	*p*
Job strain			
Yes	264 (22.6)	19 (17.4)	p=0.21
No	903 (77.4)	90 (82.6)	
Effort-reward imbalance			
Yes	322 (27.6)	25 (22.9)	p=0.29
No	845 (72.4)	84 (77.1)	
Family responsibilities			
Low	278 (23.8)	36 (33.0)	p=0.03
Medium	502 (43.0)	54 (49.5)	
High	387 (33.2)	19 (17.4)	
Double exposure to job strain and high family responsibilities			
Non-exposed	608 (52.1)	75 (68.8)	p<0.01
Exposed only to responsibilities	295 (25.3)	15 (13.8)	
Exposed only to psychosocial work factors	172 (14.7)	15 (13.8)	
Exposed to both	92 (7.9)	4 (3.7)	
Double exposure to effort-reward imbalance and high family responsibilities			
Non-exposed	553 (47.4)	69 (63.3)	p<0.01
Exposed only to responsibilities	292 (25.0)	15 (13.8)	
Exposed only to psychosocial work factors	227 (19.5)	21 (19.3)	
Exposed to both	95 (8.1)	4 (3.7)	
High psychological distress			
Yes	446 (38.2)	40 (36.7)	p=0.75
No	721 (61.8)	69 (63.3)	

Table 10. Comparison between participants included in the analysis at the 3-year follow-up (N=1167) and participants excluded due to methodological limitations (N=31)

	Included in the analysis N = 1,167	Excluded due to methodological limitations N=31	*p*
Job strain			
Yes	264 (22.6)	8 (0.67)	0.21
No	903 (77.4)	23 (74.2)	
Effort-reward imbalance			
Yes	322 (27.6)	8 (25.8)	0.43
No	845 (72.4)	23 (74.2)	
Family responsibilities			
Low	278 (23.8)	6 (19.4)	<0.01
Medium	502 (43.0)	13 (41.9)	
High	387 (33.2)	12 (38.7)	
Double exposure to job strain and high family responsibilities			
Non-exposed	608 (52.1)	15 (48.4)	p=0.56
Exposed only to responsibilities	295 (25.3)	8 (25.8)	
Exposed only to psychosocial work factors	172 (14.7)	4 (12.9)	
Exposed to both	92 (7.9)	4 (12.9)	
Double exposure to effort-reward imbalance and high family responsibilities			
Non-exposed	553 (47.4)	14 (45.2)	p=0.92
Exposed only to responsibilities	292 (25.0)	9 (29.0)	
Exposed only to psychosocial work factors	227 (19.5)	5 (16.1)	
Exposed to both	95 (8.1)	3 (3.1)	
High psychological distress			
Yes	446 (38.2)	10 (32.3)	p=0.50
No	721 (61.8)	21 (67.7)	

Table 11. Comparison between participants included in the analysis at the 5-year follow-up (N=1087) and participants excluded due to refusals or lost at follow-up (N=164)

	Included in the analysis N = 1,087	Excluded due to methodological limitations N=164	*p*
Job strain			
Yes	249 (22.9)	26 (15.9)	p=0.04
No	838 (77.1)	138 (84.2)	
Effort-reward imbalance			
Yes	300 (27.6)	39 (23.8)	p=0.31
No	787 (72.4)	125 (76.2)	
Family responsibilities			
Low	252 (23.2)	52 (31.7)	p=0.01
Medium	468 (43.1)	72 (43.9)	
High	367 (33.8)	40 (24.4)	
Double exposure to job strain and high family responsibilities			
Non-exposed	559 (51.4)	105 (64.0)	p=0.02
Exposed only to responsibilities	279 (25.7)	33 (20.1)	
Exposed only to psychosocial work factors	161 (14.8)	19 (11.6)	
Exposed to both	88 (8.1)	7 (4.3)	
Double exposure to effort-reward imbalance and high family responsibilities			
Non-exposed	508 (46.7)	96 (58.5)	p=0.03
Exposed only to responsibilities	279 (25.7)	29 (17.7)	
Exposed only to psychosocial work factors	212 (19.5)	28 (17.1)	
Exposed to both	88 (8.1)	11 (6.7)	
High psychological distress			
Yes	411 (37.8)	62 (37.8)	p=0.99
No	676 (62.2)	102 (62.2)	

Table 12. Comparison between participants included in the analysis at the 5-year follow-up (N=1067) and participants excluded due to methodological limitations (N=56)

	Included in the analysis N = 1,087	Excluded due to methodological limitations N=56	*p*
Job strain			
Yes	249 (22.9)	16 (28.6)	p=0.33
No	838 (77.1)	40 (71.4)	
Effort-reward imbalance			
Yes	300 (27.6)	16 (28.6)	p=0.87
No	787 (72.4)	40 (71.4)	
Family responsibilities			
Low	252 (23.2)	16 (28.6)	p=0.09
Medium	468 (43.1)	29 (51.8)	
High	367 (33.8)	11(19.6)	
Double exposure to job strain and high family responsibilities			
Non-exposed	559 (51.4)	34 (60.7)	p=0.09
Exposed only to responsibilities	279 (25.7)	6 (10.7)	
Exposed only to psychosocial work factors	161 (14.8)	11 (19.6)	
Exposed to both	88 (8.1)	5 (8.9)	
Double exposure to effort-reward imbalance and high family responsibilities			
Non-exposed	508 (46.7)	32 (57.1)	p=0.18
Exposed only to responsibilities	279 (25.7)	8 (14.3)	
Exposed only to psychosocial work factors	212 (19.5)	13 (23.2)	
Exposed to both	88 (8.1)	3 (5.4)	
High psychological distress			
Yes	411 (37.8)	23 (41.1)	0.62
No	676 (62.2)	33 (58.9)	

Table 13. Adjusted[85] prevalence ratios of psychological distress (95% confidence interval) assessed at baseline, 3- and 5-year follow-ups according to the double exposure to high job strain or effort-reward imbalance and high family responsibilities[86] assessed at baseline, with alternative formulations of the family responsibilities scale

	At baseline PR (95% CI)	**At 3-year** PR (95% CI)	**At 5-year** PR (95% CI)
High job strain and high family responsibilities from the main analyses, multiplicative			
No (no)	1.00	1.00	1.00
No (Yes)	**1.24 (1.05-1.48)**	1.14 (0.94-1.38)	1.05 (0.85-1.31)
Yes (no)	**1.41 (1.18-1.69)**	**1.25 (1.03-1.53)**	**1.31 (1.04-1.65)**
Yes (yes)	**1.53 (1.22-1.92)**	1.17 (0.88-1.54)	**1.44 (1.07-1.92)**
High job strain and high family responsibilities, additive			
No (no)	1.00	1.00	1.00
No (Yes)	1.16 (0.98-1.38)	1.09 (0.90-1.32)	1.08 (0.87-1.34)
Yes (no)	**1.44 (1.19-1.74)**	1.23 (1.00-1.51)	**1.33 (1.05-1.69)**
Yes (yes)	**1.47 (1.18-1.83)**	1.18 (0.91-1.54)	**1.43 (1.08-1.90)**
High job strain and high family responsibilities alternative weighting, multiplicative			
No (no)	1.00	1.00	1.00
No (Yes)	**1.27 (1.07-1.51)**	**1.32 (1.10-1.60)**	1.15 (0.93-1.43)
Yes (no)	**1.52 (1.27-1.83)**	**1.38 (1.12-1.69)**	**1.45 (1.15-1.84)**
Yes (yes)	**1.40 (1.11-1.77)**	1.19 (0.90-1.57)	1.32 (0.98-1.78)

[85] Adjusted for all covariates, namely: education, age, marital status, body mass index, alcohol consumption, smoking, leisure physical activity, stressful events, social support outside work, and at 3-year and 5-year follow-ups menopause and menopausal hormone therapy. Categorizations used are provided in the "covariates" subsection of the methodology.

[86] Results in bold: $p<0.05$.

High job strain and high family responsibilities alternative weighting, additive			
No (no)	1.00	1.00	1.00
No (Yes)	**1.23 (1.04-1.45)**	**1.28 (1.07-1.54)**	1.10 (0.89-1.35)
Yes (no)	**1.50 (1.24-1.80)**	**1.35 (1.10-1.66)**	**1.40 (1.10-1.77)**
Yes (yes)	**1.42 (1.13-1.78)**	1.22 (0.93-1.60)	**1.35 (1.01-1.81)**
Effort-reward imbalance and high family responsibilities from the main analyses, multiplicative			
No (no)	1.00	1.00	1.00
No (Yes)	**1.25 (1.03-1.51)**	1.06 (0.85-1.32)	1.17 (0.93-1.47)
Yes (no)	**1.73 (1.46-2.05)**	**1.60 (1.34-1.92)**	**1.62 (1.31-2.01)**
Yes (yes)	**2.04 (1.68-2.49)**	**1.87 (1.49-2.34)**	**1.56 (1.15-2.10)**
Effort-reward imbalance and high family responsibilities, additive			
No (no)	1.00	1.00	1.00
No (Yes)	1.20 (0.99-1.45)	1.01 (0.81-1.25)	1.15 (0.91-1.44)
Yes (no)	**1.74 (1.46-2.06)**	**1.57 (1.30-1.89)**	**1.59 (1.28-1.99)**
Yes (yes)	**1.93 (1.59-2.35)**	**1.80 (1.45-2.24)**	**1.61 (1.22-2.13)**
Effort-reward imbalance and high family responsibilities alternative weighting, multiplicative			
No (no)	1.00	1.00	1.00
No (Yes)	**1.22 (1.01-1.48)**	1.21 (0.98-1.49)	1.23 (0.98-1.55)
Yes (no)	**1.75 (1.47-2.08)**	**1.66 (1.37-2.01)**	**1.71 (1.37-2.13)**
Yes (yes)	**1.95 (1.60-2.38)**	**1.98 (1.58-2.47)**	**1.54 (1.15-2.06)**

Effort-reward imbalance and high family responsibilities alternative weighting, additive			
No (no)	1.00	1.00	1.00
No (Yes)	**1.19 (0.98-1.43)**	1.17 (0.95-1.44)	1.19 (0.95-1.50)
Yes (no)	**1.73 (1.45-2.06)**	**1.61 (1.33-1.96)**	**1.69 (1.35-2.12)**
Yes (yes)	**1.95 (1.61-2.37)**	**2.00 (1.62-2.48)**	**1.54 (1.15-2.05)**

Table 14. Adjusted[87] prevalence ratios of psychological distress (95% confidence interval) according to the double exposure to effort-reward imbalance and high family responsibilities[88] and overcommitment

	At baseline		At 3-year		At 5-year	
	N	RP (95% CI)	N	RP (95% CI)	N	RP (95% CI)
NON-OVERCOMMITED						
No (no)	459	1.00	402	1.00	368	1.00
No (Yes)	241	1.19 (0.93-1.53)	224	1.02 (0.78-.33)	214	1.26 (0.96-1.66)
Yes (no)	80	**1.41 (1.03-1.94)**	73	**1.64 (1.23-2.19)**	64	**1.59 (1.11-2.27)**
Yes (yes)	35	**1.86 (1.28-2.70)**	32	1.38 (0.88-2.18)	30	**0.84 (0.40-1.72)***
OVERCOMMITED						
No (no)	177	1.00	158	1.00	148	1.00
No (Yes)	76	**1.43 (1.08-1.89)**	71	*1.23 (0.87-1.75)*	66	1.00 (0.65-1.54)
Yes (no)	174	**1.49 (1.19-1.86)**	158	**1.41 (1.10-1.82)**	149	**1.45 (1.07-1.95)**
Yes (yes)	67	**1.75 (1.36-2.24)**	64	**1.92 (1.44-2.55)**	58	**1.72 (1.20-2.47)**

87 Adjusted for all covariates, namely: education, age, marital status, body mass index, alcohol consumption, smoking, leisure physical activity, stressful events, social support outside work, and at 3-year and 5-year follow-ups menopause and menopausal hormone therapy. Categorizations used are provided in the “covariates” subsection of the methodology.

88 Exposed categories are compared with the reference category (first category of each variable). Statistical significance of the differences is estimated by a Student's t test. Results in bold: p<0.05. Results in italic: 0.05≤p<0.10.

Table 15. Adjusted[89] prevalence ratios of psychological distress (95% confidence interval) according to the double exposure to job strain and high family responsibilities[90] and social support at work

	At baseline		At 3-year follow-up		At 5-year follow-up	
	N	RP (95% CI)	N	RP (95% CI)	N	RP (95% CI)
Low social support						
No (no)	323	1.00	287	1.00	266	1.00
No (Yes)	155	1.19 (0.89-1.59)	145	1.15 (0.84-1.56)	140	1.12 (0.81-1.56)
Yes (no)	59	1.27 (0.87-1.86)	57	1.29 (0.89-1.88)	47	1.19 (0.76-1.86)
Yes (yes)	33	1.51 (0.95-2.40)	32	1.03 (0.60-1.77)	32	1.50 (0.92-2.43)
High social support						
No (no)	376	1.00	330	1.00	301	1.00
No (Yes)	164	**1.27 (1.03-1.57)**	152	1.13 (0.89-1.44)	140	1.00 (0.75-1.34)
Yes (no)	132	**1.40 (1.14-1.72)**	117	1.16 (0.92-1.47)	115	1.28 (0.97-1.69)
Yes (yes)	67	**1.45 (1.12-1.87)**	62	1.17 (0.84-1.62)	56	1.34 (0.94-1.90)

[89] Adjusted for all covariates, namely: education, age, marital status, body mass index, alcohol consumption, smoking, leisure physical activity, stressful events, social support outside work, and at 3-year and 5-year follow-ups menopause and menopausal hormone therapy. Categorizations used are provided in the "covariates" subsection of the methodology.

[90] Exposed categories are compared with the reference category (first category of each variable). Statistical significance of the differences is estimated by a Student's t test. Results in bold: $p<0.05$. Results in italic: $0.05 \leq p<0.10$.

Table 16. Adjusted prevalence ratios of psychological distress (95% confidence interval) according to job strain or effort-reward imbalance and family responsibilities[91] (without retired women)

	At baseline		At 3-year		At 5-year	
	N	RP (95% CI)	N	RP (95% CI)	N	RP (95% CI)
Job strain (family load)						
No (no)	699	1.00	617	1.00	567	1.00
No (Yes)	319	**1.25 (1.05-1.49)**	297	1.13 (0.94-1.37)	280	1.06 (0.85-1.33)
Yes (no)	191	**1.43 (1.19-1.72)**	174	1.15 (0.94-1.41)	162	1.22 (0.96-1.55)
Yes (yes)	100	**1.54 (1.22-1.95)**	94	1.19 (0.90-1.58)	88	**1.40 (1.06-1.86)**
Effort-reward imbalance (family load)						
No (no)	636	1.00	560	1.00	516	1.00
No (Yes)	317	**1.25 (1.03-1.52)**	295	1.06 (0.86-1.31)	280	1.18 (0.94-1.49)
Yes (no)	254	**1.74 (1.47-2.05)**	231	**1.54 (1.29-1.84)**	213	**1.60 (1.29-1.98)**
Yes (yes)	102	**2.03 (1.66-2.48)**	96	**1.93 (1.54-2.42)**	88	**1.58 (1.18-2.12)**

[91] Adjusted for: education, age, marital status, stressful events, social support outside work, and at 3-year and 5-year follow-ups menopause and menopausal hormone therapy. Categorizations used are provided in the "covariates" subsection of the methodology.

Table 17. Modifying effect of job strain on adjusted[92] prevalence ratios of psychological distress (95% confidence interval) according to family responsibilities dimensions[93]

	N	At baseline RP (95% CI)	N	At 3-year follow-up RP (95% CI)	N	At 5-year follow-up RP (95% CI)
High job strain						
Children						
No	96	1.00	88	1.00	79	1.00
Yes	195	1.21 (0.93-1.59)	180	0.89 (0.67-1.20)	171	1.01 (0.72-1.41)
Children load						
Low	135	1.00	124	1.00	113	1.00
Intermed.	44	1.11 (0.79-1.56)	39	1.00 (0.67-1.49)	38	0.91 (0.67-1.22)
High	112	1.00 (0.77-1.31)	105	0.92 (0.66-1.27)	99	1.15 (0.92-1.45)
Domestic load						
Low	64	1.00	61	1.00	53	1.00
Intermed.	108	0.83 (0.60-1.15)	98	1.07 (0.73-1.57)	91	0.81 (0.54-1.22)
High	119	1.00 (0.74-1.34)	109	1.02 (0.70-1.49)	106	0.83 (0.55-1.25)
Family load						
Low	58	1.00	55	1.00	48	1.00
Intermed.	133	0.94 (0.68-1.28)	119	1.21 (0.83-1.77)	114	0.79 (0.52-1.19)

[92] Adjusted for all covariates, namely: education, age, marital status, body mass index, alcohol consumption, smoking, leisure physical activity, stressful events, social support outside work, and at 3-year and 5-year follow-ups menopause and menopausal hormone therapy. Categorizations used are provided in the "covariates" subsection of the methodology.

[93] Exposed categories are compared with the reference category (first category of each variable). Statistical significance of the differences is estimated by a Student's t test. Results in bold: $p<0.05$. Results in italic: $0.05 \le p<0.10$.

High	100	1.03 (0.75-1.43)	94	1.18 (0.77-1.79)	88	0.93 (0.61-1.43)
No job strain						
Children						
No	335	1.00	290	1.00	267	1.00
Yes	683	1.33 (1.10-1.62)	624	1.30 (1.05-1.60)	580	1.21 (0.96-1.53)
Children load						
Low	490	1.00	424	1.00	388	1.00
Intermed.	177	1.35 (1.09-1.67)	161	1.32 (1.04-1.67)	146	0.90 (0.54-1.47)
High	351	1.25 (1.03-1.53)	329	1.25 (1.02-1.54)	313	*1.05 (0.75-1.49)*
Domestic load						
Low	298	1.00	259	1.00	237	1.00
Intermed.	303	1.17 (0.92-1.48)	266	1.18 (0.91-1.51)	249	1.02 (0.78-1.34)
High	417	1.30 (1.05-1.61)	389	1.39 (1.11-1.75)	361	0.97 (0.75-1.26)
Family load						
Low	263	1.00	226	1.00	207	1.00
Intermed.	436	1.27 (1.01-1.61)	391	1.36 (1.08-1.72)	360	1.03 (0.78-1.35)
High	319	**1.46 (1.15-1.85)**	297	**1.39 (1.08-1.79)**	280	1.07 (0.80-1.43)

Table 18. Modifying effect of effort-reward imbalance on adjusted[94] prevalence ratios of psychological distress (95% confidence interval) according to family responsibilities dimensions[95]

	At baseline		At 3-year follow-up		At 5-year follow-up	
	N	RP (95% CI)	N	RP (95% CI)	N	RP (95% CI)
ERI						
Children						
No	122	1.00	108	1.00	102	1.00
Yes	234	1.29 (1.03-1.60)	219	1.25 (0.99-1.59)	199	1.06 (0.80-1.41)
Children load						
Low	173	1.00	154	1.00	142	1.00
Intermed.	57	1.17 (0.89-1.52)	54	1.37 (1.04-1.81)	47	0.81 (0.50-1.23)
High	126	1.13 (0.92-1.40)	119	1.19 (0.93-1.53)	112	1.09 (0.81-1.47)
Domestic load						
Low	96	1.00	88	1.00	81	1.00
Intermed.	118	0.96 (0.74-1.25)	105	1.01 (0.75-1.36)	96	0.91 (0.65-1.27)
High	142	1.10 (0.87-1.39)	134	1.22 (0.93-1.60)	124	0.81 (0.58-1.14)
Family load						
Low	84	1.00	76	1.00	71	1.00
Intermed.	170	0.99 (0.77-1.27)	155	1.13 (0.77-1.67)	142	0.91 (0.65-1.28)
High	102	1.17 (0.91-1.51)	96	1.03 (0.68-1.57)	88	0.90 (0.62-1.32)

[94] Adjusted for all covariates, namely: education, age, marital status, body mass index, alcohol consumption, smoking, leisure physical activity, stressful events, social support outside work, and at 3-year and 5-year follow-ups menopause and menopausal hormone therapy. Categorizations used are provided in the "covariates" subsection of the methodology.

[95] Exposed categories are compared with the reference category (first category of each variable). Statistical significance of the differences is estimated by a Student's t test. Results in bold: $p<0.05$. Results in italic: $0.05 \le p < 0.10$.

No ERI						
Children						
No	309	1.00	270	1.00	244	1.00
Yes	644	1.32 (1.06-1.64)	585	1.13 (0.90-1.41)	552	1.22 (0.95-1.58)
Children load						
Low	452	1.00	394	1.00	359	1.00
Intermed.	164	1.36 (1.07-1.72)	146	1.16 (0.88-1.53)	137	0.96 (0.70-1.33)
High	337	1.18 (0.95-1.47)	315	1.12 (0.90-1.41)	300	1.15 (0.89-1.47)
Domestic load						
Low	266	1.00	232	1.00	209	1.00
Intermed.	293	1.19 (0.92-1.55)	259	1.31 (0.99-1.75)	244	1.08 (0.79-1.48)
High	394	1.32 (1.04-1.69)	364	1.38 (1.05-1.81)	343	1.08 (0.80-1.46)
Family load						
Low	237	1.00	205	1.00	184	1.00
Intermed.	399	1.33 (1.02-1.73)	355	1.31 (1.03-1.67)	332	1.02 (0.75-1.40)
High	317	**1.50 (1.15-1.97)**	295	**1.36 (1.05-1.76)**	280	1.19 (0.86-1.63)

Table 19. Modifying effect of family responsibilities on adjusted[96] prevalence ratios of psychological distress (95% confidence interval) according to job strain and effort-reward imbalance[97]

	At baseline RP (95% CI)	**At 3-year follow-up** RP (95% CI)	**At 5-year follow-up** RP (95% CI)
High family responsibilities			
Job strain			
No	1.00	1.00	1.00
Yes	1.24 (0.98-1.56)	1.04 (0.78-1.40)	**1.36 (1.02-1.64)**
Effort-reward imbalance			
No	1.00	1.00	1.00
Yes	**1.64 (1.33-2.02)**	**1.79 (1.40-2.30)**	1.33 (0.98-1.81)
Low family responsibilities			
Job strain			
No	1.00	1.00	1.00
Yes	**1.42 (1.18-1.70)**	**1.25 (1.02-1.53)**	**1.29 (1.02-1.64)**
Effort-reward imbalance			
No	1.00	1.00	1.00
Yes	**1.72 (1.46-2.04)**	**1.60 (1.34-1.92)**	**1.62 (1.31-2.01)**

[96] Adjusted for all covariates, namely: education, age, marital status, body mass index, alcohol consumption, smoking, leisure physical activity, stressful events, social support outside work, and at 3-year and 5-year follow-ups menopause and menopausal hormone therapy. Categorizations used are provided in the "covariates" subsection of the methodology.

[97] Exposed categories are compared with the reference category (first category of each variable). Statistical significance of the differences is estimated by a Student's t test. Results in bold: $p<0.05$. Results in italic: $0.05\leq p<0.10$.

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