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Work-related psychosocial factors and onset of metabolic syndrome among workers: a systematic review and meta-analysis protocol

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Abstract

Introduction: Metabolic syndrome is an important public health target because of its high prevalence worldwide. Work-related psychosocial factors have been identified as determinants of metabolic syndrome components. However, there have been no systematic reviews or meta-analyses conducted to evaluate the relationship between work-related psychosocial factors and metabolic syndrome as an aggregated cluster. The aim of this study is to examine this association from published prospective studies.

Methods and analysis: The systematic review and meta-analysis will be conducted using published studies that will be identified from electronic databases (i.e., PubMed, EMABASE, PsycINFO, PsycARTICLES, and Japan Medical Abstracts Society). Studies that (1) examined the association between work-related psychosocial factors and the onset of metabolic syndrome, (2) had a longitudinal or prospective cohort design, (3) were conducted among workers, (4) provided sufficient data for calculating odds ratios or relative risk with a 95% confidence interval, (5) were published as original articles written in English or Japanese, and (6) having been published until May 2016 will be included. Study selection, data collection, quality assessment, and statistical syntheses will be conducted based on discussions among investigators.

Ethics and Dissemination: Ethics approval was not required for this study because it was based on published studies. The results and findings of this study will be submitted and published in a scientific peer-reviewed journal. The findings from this study could be useful for assessing metabolic syndrome risk factors in the workplace, and determining approaches for prevention of metabolic syndrome in the future.

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42016039096)

Article summary

Strengths and limitations of this study

－This systematic review and meta-analysis will offer comprehensive understanding regarding the association between work-related psychosocial factors and metabolic syndrome.

－This study included a wide range of work-related psychosocial factors, and focused on metabolic syndrome as an aggregated cluster.

－This study included only prospective studies for stronger evidence.

－The findings from the study will be useful for assessing metabolic syndrome risk factors in the workplace, and determining approaches for prevention of metabolic syndrome in the future.

－Depending on the results, confounding factors that were not adjusted for in the selected studies, and low generalizability can be limitations.

Introduction

Metabolic syndrome is a cluster of medical conditions that has multiple risk factors for cardiovascular disease and type 2 diabetes, characterized by comorbidity of abdominal obesity, high blood glucose or insulin resistance, hypertension, dyslipidemia (high triglyceride and low high density lipoprotein [HDL] cholesterol), and microalbuminuria[1-5]. Although there are variations by demographic variables (e.g., sex and age) and countries, the prevalence of metabolic syndrome remains high worldwide[6-10]. In addition to elevating the risks for the incidence of cardiovascular disease and diabetes, metabolic syndrome has influence on cancer risks[11], a low health-related quality of life[12], and all-cause mortality[13,14]. Therefore, metabolic syndrome is an important public health target.

Work-related psychosocial factors among workers have been identified as a determinant of health[15-18]. For example, long working hours has been well-known to be correlated with workers' health[19-23]. Relationships between other work conditions, task and organizational characteristics, and workplace interaction and health status have also been discussed, such as shift work[24,25], job demands and controls[26], effort-reward imbalance[27], organizational justice[28], and social support from supervisors and colleagues[29]. Although the biological mechanisms by which these work-related psychosocial factors influence the health of workers are not currently clear, they could be partially explained by a poor metabolism[16]. In many systematic reviews and meta-analyses, it has been suggested that these work-related psychosocial factors are significant risk factors for metabolic syndrome components, including blood pressure and hypertension[30,31], weight gain and obesity[32,33], and blood glucose and impaired glucose tolerance[34], but insignificant for blood lipids and dyslipidemia[34,35].

There have been a few systematic reviews and/or meta-analyses conducted regarding the relationship between work-related psychosocial factors and metabolic syndrome as an aggregated cluster, defined by the international clinical criteria[1-5]. In a previous systematic review conducted by Bergmann et al.,[36] a positive relationship between chronic psychosocial stress and the incident of metabolic syndrome was suggested based on 39 prospective studies. However, they did not statistically synthesize the relationship. In addition, they included studies that targeted both the working and non-working population, and adopted general stressors as exposures and each metabolic syndrome component as an outcome. In another systematic review and meta-analysis by Wang et al.,[37] a positive association was observed between night shift work and metabolic syndrome among the working population based on 13 studies. However, the researchers only focused on shift work as the exposure and included both prospective, retrospective, and cross-sectional studies in the review. Additional systematic reviews and meta-analyses are necessary to obtain a more comprehensive understanding and stronger evidence regarding the association between work-related psychosocial factors and the onset of metabolic syndrome among workers.

The objective of this study is to evaluate published prospective studies in order to investigate this association. To the best of our knowledge, this will be the first systematic review and meta-analysis conducted specifically to analyze this association among the working population. We hypothesized that adverse work-related psychosocial factors would elevated the onset probability of metabolic syndrome among workers.

Methods and analysis

Study design

This is a systematic review and meta-analysis protocol of prospective cohort studies. The systematic review and meta-analysis will be reported according to the Preferred Reporting Items for Systematic Reviews and Meta-analyses (PRISMA) guidelines[38]. This protocol manuscript was reported according to the Preferred Reporting Items for Systematic reviews and Meta-Analysis protocols (PRISMA-P) guideline[39]. The study protocol was registered at PROSPERO (CRD42016039096).

Eligibility criteria

The participants, exposures, comparisons, and outcomes (PECO) of the studies in this systematic review and meta-analysis were defined as follows: (P) inclusion of all workers, (E) presence of adverse work-related psychosocial factors, (C) absence of adverse work-related psychosocial factors, and (O) the onset of metabolic syndrome. We targeted all employed workers as participants. There will be no exclusion criteria for workers according to employment status, job-type, and shift-type. The adverse work-related psychosocial factors (i.e., study exposures) included a wide range of task and organizational characteristics, work conditions, and workplace interaction[40], such as job strain, effort-reward imbalance, working hours, shift-work, low social support, and other organizational-level factors. The comparisons will be defined as preferable conditions for these psychosocial factors. The diagnostic standards for metabolic syndrome (i.e., study outcome) that were used in this study were defined by several international institutions, such as the World Health Organization[1,2], National Cholesterol Education Program[3], American Heart Association/National Heart, Lung, and Blood Institute[4], and International Diabetes Foundation[5].

Studies that (1) were conducted to evaluate the association between work-related

psychosocial factors and the onset of metabolic syndrome, (2) used a longitudinal or prospective cohort design, (3) were conducted among workers, (4) provided sufficient data for calculating the odds ratios (ORs) or relative risks (RRs) with 95% confidence intervals, (5) were published as original articles written in English or Japanese, and (6) have been published until May 2016 will be included in this systematic review and meta-analysis.

Information source, search strategy, and data management

Published studies will be searched using the following electronic databases: PubMed, EMABASE, PsycINFO, PsycARTICLES, and Japan Medical Abstracts Society. The search terms will include words related to the PECO of the studies. The search strategy that will be conducted is shown in Appendix 1. All identified studies will be managed within a Microsoft® Excel (Washington, the US) file. Prior to screening the studies, deduplication within this excel file will be conducted by KI. Decisions on all studies will be recorded.

Study selection process

Nine investigators (ASakuraya, KW, KI, EA, YA, HE, YK, NN, and HA) will independently conduct the screening of studies according to the eligibility criteria. Duplicated citations will be excluded. The titles and abstracts will be screened according to the eligibility criteria created earlier in the sifting phase, and the full texts of all eligible studies will be obtained. In the full text review phase, the full texts will be reviewed using a standardized form for assessing eligibility for this study. When resolution cannot be accomplished, the disagreements will be settled by consensus with discussion amongst all authors. Corresponding authors will be contacted directly if (1) the publication is unclear and may be related to multiple interpretations, or (2) the

collected data from the publication did not show data relevant to our study analysis. The reasons for excluding studies will be recorded. A flow chart will be provided to show the entire review process.

Data collection

Data will be extracted independently from the included studies by nine investigators (ASakuraya, KW, KI, EA, YA, HE, YK, NN, and HA), using a standardized data extraction form. Any disagreement or inconsistencies will be solved by consultation and consensus amongst all authors.

Data will include the number of participants included in the analysis, country where the study was conducted, length of follow-up, year of publication, number of participants who were excluded or lost to follow-up, demographic characteristics of participants (i.e., mean age, sex proportions, and employment status), sample size, exposure variables (i.e., adverse psychosocial factors at work), diagnostic criteria for metabolic syndrome, number and proportion with metabolic syndrome, and sufficient data for calculating ORs or RRs with 95% confidence intervals for the association between adverse work-related psychosocial factors and the onset of metabolic syndrome. This extraction form will be piloted and modified as required. When multiple ORs or RRs were reported in the included studies, we preferentially selected ORs or RRs adjusted by demographic variables (e.g., age, sex, educational status, and marital status) and lifestyle variables (e.g., smoking, physical activity, and sleep). ORs or RRs adjusted by other adverse work-related psychosocial factors and/or metabolic syndrome components will not be adopted in the systematic review and meta-analysis because of over-adjustment. Sex-stratified ORs or RRs were selected for our study if those were the only reported measures of association. Relevant research teams will be contacted about

the possibility of obtaining any missing data from the studies.

Assessment of study quality

Nine investigators (ASakuraya, KW, KI, EA, YA, HE, YK, NN, and HA) will independently assess each selected study for study quality using the Newcastle-Ottawa Quality Assessment Scale (NOS)[41]. The NOS evaluates cohort studies based on eight items categorized into the following three groups: (1) selection of the study cases, (2) comparability of the population, and (3) ascertainment of whether the exposure or outcome includes any risk of bias (i.e., selection bias or bias from lost to follow-up). The NOS is scored ranging from 0 to 9, and studies with scores ≥7 are considered as high quality[42]. Discrepancy of quality assessment among the investigators will be solved by discussion and consensus amongst all authors.

Data synthesis and statistical methods

The included studies will be statistically synthesized by a meta-analysis to estimate the pooled risk of work-related psychosocial factors related to metabolic syndrome. We will calculate ORs or RRs transformed to a natural logarithm, and standard errors of these association measures. We will use a random effect model to sum the results of the studies[43] using Stata version 12 (LightStone®, Tokyo, Japan). The results will be summed in a narrative format if conducting a meta-analysis is not appropriate or possible. Heterogeneity will be assessed by the χ^2 test on Cochrane's Q statistic, which is calculated into I^2 values[44] assuming that I^2 values of 25%, 50% and 75% indicate low, medium, and high heterogeneity, respectively. Publication bias will be examined by conducting a funnel plot and the Egger's test.

Subgroup and sensitivity analyses will also be conducted to compare the results across subgroups or under specific conditions when sufficient heterogeneity is detected.

Major grouping characteristics will include sex, age, employment status, and study quality. Any subgroup differences will be reported, and our findings will be explained by considering these differences. A possible sensitivity analysis will be conducted for included studies that only scored as high quality according to the NOS (≥ 7).

All the collected data and analyzed results will be deposited by the corresponding author and available upon requests by external reviewers and readers.

Ethics and dissemination

This systematic review and meta-analysis is based on previously published studies and therefore, the study does not require ethical approval. Results and Findings will be submitted and published in a scientific peer-reviewed journal.

Strengths and limitations

To the best of our knowledge, this systematic review and meta-analysis will be the first study to offer the strongest evidence regarding the association between work-related psychosocial factors and metabolic syndrome because we targeted only prospective studies. Considering the high incidence of metabolic syndrome among the working population, the findings from the study will be useful for public and occupational health, particularly for assessing metabolic syndrome risk factors in the workplace, and determining approaches for prevention of metabolic syndrome in the future. However, a limitation of this study will be confounding factors that were not adjusted for in the selected studies. In addition, our study findings will not be generalizable to other countries or populations.

Author's contributions

Asuka Sakuraya, Kazuhiro Watanabe, Norito Kawakami, Kotaro Imamura, Emiko Ando, Yumi Asai, Hisashi Eguchi, Yuka Kobayashi, Norimitsu Nishida, Hideaki Arima, Akihito Shimazu, and Akizumi Tsutsumi have made substantial contributions to the conception and design, writing of the protocol and revising it critically for important intellectual content, and approving the final version to be published. All authors will be involved in the entire study process (i.e., data collection, assessment, and synthesis).

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Conflict of Interest:

Asuka Sakuraya, Kazuhiro Watanabe, Norito Kawakami, Kotaro Imamura, Emiko Ando, Yumi Asai, Hisashi Eguchi, Yuka Kobayashi, Norimitsu Nishida, Hideaki Arima, Akihito Shimazu, and Akizumi Tsutsumi declare no conflict of interest for this study.

Appendix 1. Search terms used for the electronic databases

Database	Search terms
PubMed	("Stress, Mechanical"[Mesh] OR "Lifting"[Mesh] OR "Moving and Lifting Patients"[Mesh] OR "Weight-Bearing"[Mesh] OR "Biomechanics" OR "Physical Exertion"[Mesh] OR "Torsion, Mechanical"[Mesh] OR "Postural Balance"[Mesh] OR "Walking"[Mesh] OR "Recovery of Function"[Mesh] OR "Relaxation"[Mesh] OR (static[Title/Abstract] AND posture) OR (awkward[Title/Abstract] AND posture) OR (dynamic[Title/Abstract] AND posture) OR static work[Title/Abstract] OR dynamic load*[Title/Abstract] OR lift*[Title/Abstract] OR carry*[Title/Abstract] OR hold*[Title/Abstract] OR pull*[Title/Abstract] OR drag*[Title/Abstract] OR push*[Title/Abstract] OR manual handling[Title/Abstract] OR force*[Title/Abstract] OR biomechanic*[Title/Abstract] OR walking*[Title/Abstract] OR postural balance[Title/Abstract] OR flexion*[Title/Abstract] OR extension*[Title/Abstract] OR turning[Title/Abstract] OR sitting[Title/Abstract] OR kneeling[Title/Abstract] OR squatting[Title/Abstract] OR twisting[Title/Abstract] OR bending[Title/Abstract] OR reaching[Title/Abstract] OR standing[Title/Abstract] OR sedentary[Title/Abstract] OR repetitive movement*[Title/Abstract] OR monotonous work[Title/Abstract] OR relaxation[Title/Abstract] OR recovery of function[Title/Abstract] OR physical demand*[Title/Abstract] OR physically demand*[Title/Abstract]) OR ("Stress, Psychological"[Majr] OR "Social Support"[Majr] OR "Job Satisfaction"[Mesh] OR "Work Schedule Tolerance"[Mesh] OR "Employee Performance Appraisal"[Mesh] OR "Employee Grievances"[Mesh] OR "Social Justice/psychology"[Mesh] OR "Personnel Downsizing"[Mesh] OR "Staff Development"[Mesh] OR "Organizational Culture"[Mesh] OR "Bullying"[Mesh] OR "Prejudice"[Mesh] OR "Social Discrimination"[Mesh] OR "Interpersonal Relations"[Mesh] OR "Communication/psychology"[Mesh]) OR (psychosocial[Title/Abstract] OR job strain[Title/Abstract] OR work strain[Title/Abstract] OR work demand*[Title/Abstract] OR job demand*[Title/Abstract] OR high demand*[Title/Abstract] OR low control[Title/Abstract] OR lack of control[Title/Abstract] OR work control[Title/Abstract] OR job control[Title/Abstract] OR decision latitude[Title/Abstract] OR work influence*[Title/Abstract] OR demand resource*[Title/Abstract] OR effort reward*[Title/Abstract] OR time pressure*[Title/Abstract] OR recuperation*[Title/Abstract] OR work overload*[Title/Abstract] OR work over-load*[Title/Abstract] OR recovery[Title/Abstract] OR coping[Title/Abstract] OR work ability[Title/Abstract] OR social support[Title/Abstract] OR support system*[Title/Abstract] OR social network*[Title/Abstract] OR emotional support[Title/Abstract] OR interpersonal relation*[Title/Abstract] OR interaction*[Title/Abstract] OR justice*[Title/Abstract] OR injustice*[Title/Abstract] OR job satisfaction[Title/Abstract] OR work satisfaction[Title/Abstract] OR boredom[Title/Abstract] OR skill discretion*[Title/Abstract] OR staff development[Title/Abstract] OR discrimination[Title/Abstract] OR harass*[Title/Abstract] OR work-place conflict*[Title/Abstract] OR workplace violen*[Title/Abstract] OR work-place violen*[Title/Abstract] OR bullying[Title/Abstract] OR ageism[Title/Abstract] OR homophobia[Title/Abstract] OR racism[Title/Abstract] OR sexism[Title/Abstract] OR victimization*[Title/Abstract] OR silent workplace*[Title/Abstract] OR role ambiguity[Title/Abstract] OR role-conflict*[Title/Abstract] OR work-role*[Title/Abstract] OR working hour*[Title/Abstract] OR working time[Title/Abstract] OR day-time[Title/Abstract] OR night-time[Title/Abstract] OR shift work*[Title/Abstract] OR work shift*[Title/Abstract] OR temporary work[Title/Abstract] OR full-time[Title/Abstract] OR part-time[Title/Abstract] OR flexible work*[Title/Abstract] OR organizational change[Title/Abstract] OR organisational change[Title/Abstract] OR lean production[Title/Abstract] OR job security[Title/Abstract] OR job insecurity[Title/Abstract]) AND ("Metabolic syndrome" [All Fields] OR "Insulin resistance" [All Fields] OR "Metabolic syndrome X" [MeSH] OR "Cardio-metabolic syndrome" [All Fields] OR "Reaven's syndrome" [All Fields]) AND ((longitudinal study) OR (prospective cohort study) OR (PROSPECTIVE STUDIES) OR (FOLLOW-UP STUDIES) OR (observational stud*))
EMABASE	("Stress, Mechanical" OR "Lifting" OR "Moving and Lifting Patients" OR "Weight-Bearing" OR "Biomechanics" OR "Physical Exertion" OR "Torsion, Mechanical" OR "Postural Balance" OR "Walking" OR "Recovery of Function" OR "Relaxation" OR (static AND posture) OR (awkward AND posture) OR (dynamic AND posture) OR (static AND work) OR (dynamic AND load*) OR lift* OR carry* OR hold* OR pull* OR drag* OR push* OR (manual

	AND handling) OR force* OR biomechanic* OR walking* OR (postural AND balance) OR flexion* OR extension* OR turning OR sitting OR kneeling OR squatting OR twisting OR bending OR reaching OR standing OR sedentary OR (repetitive AND movement*) OR (monotonous AND work) OR relaxation OR (recovery AND of AND function) OR (physical AND demand*) OR (physically AND demand*)) OR ("Stress, Psychological"/exp OR "Stress, Psychological" OR "Social Support"/exp OR "Social Support" OR "Job Satisfaction"/exp OR "Job Satisfaction" OR "Work Schedule Tolerance"/exp OR "Work Schedule Tolerance" OR "Employee Performance Appraisal"/exp OR "Employee Performance Appraisal" OR "Employee Grievances"/exp OR "Employee Grievances" OR "Social Justice/psychology" OR "Personnel Downsizing"/exp OR "Personnel Downsizing" OR "Staff Development"/exp OR "Staff Development" OR "Organizational Culture"/exp OR "Organizational Culture" OR "Bullying"/exp OR "Bullying" OR "Prejudice"/exp OR "Prejudice"/exp OR "Prejudice" OR "Social Discrimination"/exp OR "Social Discrimination" OR "Interpersonal Relations"/exp OR "Interpersonal Relations" OR "Communication/psychology") OR (psychosocial OR (job AND strain) OR (work AND strain) OR (work AND demand*) OR (job AND demand*) OR (high AND demand*) OR (low AND control) OR (lack AND of AND control) OR (work AND control) OR (job AND control) OR (decision AND latitude) OR (work AND influence*) OR (demand AND resource*) OR (effort AND reward*) OR (time AND pressure*) OR recuperation* OR (work AND overload*) OR (work AND over-load*) OR recovery OR coping OR (work AND ability) OR (social AND support) OR (support AND system*) OR (social AND network*) OR (emotional AND support) OR (interpersonal AND relation*) OR interaction* OR justice* OR injustice* OR (job AND satisfaction) OR (work AND satisfaction) OR boredom OR (skill AND discretion*) OR (staff AND development) OR discrimination OR harass* OR (work-place AND conflict*) OR (workplace AND violen*) OR (workplace AND violen*) OR bullying OR ageism OR homophobia OR racism OR sexism OR victimization* OR (silent AND workplace*) OR (role AND ambiguity) OR role-conflict* OR work-role* OR (working AND hour*) OR (working AND time) OR day-time OR night-time OR (shift AND work*) OR (work AND shift*) OR (temporary AND work) OR full-time OR part-time OR (flexible AND work*) OR (organizational AND change) OR (organizational AND change) OR (lean AND production) OR (job AND security) OR (job AND insecurity)) AND ("Metabolic syndrome" OR "Insulin resistance" OR "Metabolic syndrome X" OR "Cardio-metabolic syndrome" OR "Reaven's syndrome") AND ((longitudinal AND study) OR (prospective AND cohort AND study) OR (PROSPECTIVE AND STUDIES) OR (FOLLOW-UP AND STUDIES) OR (observational stud*))
PsycINFO/ PsycARTICLES	("Stress, Mechanical" OR "Lifting" OR" Moving and Lifting Patients" OR "Weight-Bearing" OR "Biomechanics" OR "Physical Exertion" OR "Torsion, Mechanical" OR "Postural Balance" OR "Walking" OR "Recovery of Function" OR "Relaxation" OR (static AND posture) OR (awkward AND posture) OR (dynamic AND posture) OR static work OR dynamic load* OR lift* OR carry* OR hold* OR pull* OR drag* OR push* OR manual handling OR force* OR biomechanic* OR walking* OR postural balance OR flexion* OR extension* OR turning OR sitting OR kneeling OR squatting OR twisting OR bending OR reaching OR standing OR sedentary OR repetitive movement* OR monotonous work OR relaxation OR recovery of function OR physical demand* OR physically demand*) OR ("Stress, Psychological" OR "Social Support" OR "Job Satisfaction" OR "Work Schedule Tolerance" OR "Employee Performance Appraisal" OR "Employee Grievances" OR "Social Justice/psychology" OR "Personnel Downsizing" OR "Staff Development" OR "Organizational Culture" OR "Bullying" OR "Prejudice" OR "Social Discrimination" OR "Interpersonal Relations" OR "Communication/psychology") OR (psychosocial OR job strain OR work strain OR work demand* OR job demand* OR high demand* OR low control OR lack of control OR work control OR job control OR decision latitude OR work influence* OR demand resource* OR effort reward* OR time pressure* OR recuperation* OR work overload* OR work over-load* OR recovery OR coping OR work ability OR social support OR support system* OR social network* OR emotional support OR interpersonal relation* OR interaction* OR justice* OR injustice* OR job satisfaction OR work satisfaction OR boredom OR skill discretion* OR staff development OR discrimination OR harass* OR work-place conflict* OR workplace violen* OR workplace violen* OR bullying OR ageism OR homophobia OR racism OR sexism OR victimization* OR silent workplace* OR role ambiguity OR role-conflict* OR work-role* OR working hour* OR working time OR day-time OR night-time OR shift work* OR work shift* OR temporary work OR full-time OR part-time OR flexible work* OR organizational change OR organizational change OR lean production OR job security OR job insecurity) AND ("Metabolic syndrome" OR "Insulin resistance" OR "Metabolic syndrome X" OR "Cardio-metabolic syndrome" OR "Reaven's syndrome") AND ((longitudinal study) OR (prospective cohort study) OR (PROSPECTIVE STUDIES) OR (FOLLOW-UP STUDIES) OR (observational stud*))

Japan Medical Abstracts Society	(("心理的ストレス"/TH or "Stress, Psychological"/AL) or ("社会的支援"/TH or "Social Support"/AL) or ("職務満足度"/TH or "Job Satisfaction"/AL) or ("勤務体制"/TH or "Work Schedule Tolerance"/AL) or ("従業員の勤務評価"/TH or "Employee Performance Appraisal"/AL) or ("従業員の苦情"/TH or "Employee Grievances"/AL) or "Social Justice/psychology"/AL or ("人員削減"/TH or "Personnel Downsizing"/AL) or ("スタッフ開発"/TH or "Staff Development"/AL) or ("組織の文化"/TH or "Organizational Culture"/AL) or ("いじめ"/TH or "Bullying"/AL) or ("偏見"/TH or "Prejudice"/AL) or ("社会的差別"/TH or "Social Discrimination"/AL) or ("人間関係"/TH or "Interpersonal Relations"/AL) or "Communication/psychology"/AL) OR (("メカニカルストレス"/TH or "Stress, Mechanical"/AL) or ("挙上(力学)"/TH or "Lifting"/AL) or ("患者の移動と持ち上げ"/TH or "Moving and Lifting Patients"/AL) or ("体重負荷"/TH or "Weight-Bearing"/AL) or ("生体力学的現象"/TH or "Biomechanics"/AL) or ("労作"/TH or "Physical Exertion"/AL) or ("機械的ねじれ"/TH or "Torsion, Mechanical"/AL) or ("姿勢バランス"/TH or "Postural Balance"/AL) or ("歩行運動"/TH or "Walking"/AL) or ("生体機能回復"/TH or "Recovery of Function"/AL) or ("リラクゼーション"/TH or "Relaxation"/AL) or (static/AL and (姿勢/TH or posture/AL)) or (awkward/AL and (姿勢/TH or posture/AL)) or (dynamic/AL and (姿勢/TH or posture/AL)) or (static/AL and (労働/TH or work/AL)) or (dynamic/AL and load*/AL) or lift*/AL or carry*/AL or hold*/AL or pull*/AL or drag*/AL or push*/AL or ((マニュアル/TH or manual/AL) and ("ハンドリング(心理学)"/TH or handling/AL)) or force*/AL or biomechanic*/AL or walking*/AL or (postural/AL and (姿勢バランス/TH or balance/AL)) or flexion*/AL or extension*/AL or turning/AL or sitting/AL or kneeling/AL or squatting/AL or twisting/AL or bending/AL or reaching/AL or standing/AL or sedentary/AL or (repetitive/AL and movement*/AL) or (monotonous/AL and (労働/TH or work/AL)) or (リラクゼーション/TH or relaxation/AL) or (recovery/AL and of/AL and function/AL) or (physical/AL and demand*/AL) or (physically/AL and demand*/AL)) OR (psychosocial/AL or (job/AL and (捻挫/TH or strain/AL)) or ((労働/TH or work/AL) and (捻挫/TH or strain/AL)) or ((労働/TH or work/AL) and demand*/AL) or (job/AL and demand*/AL) or (high/AL and demand*/AL) or (low/AL and control/AL) or (lack/AL and of/AL and control/AL) or ((労働/TH or work/AL) and control/AL) or (job/AL and control/AL) or (decision/AL and latitude/AL) or ((労働/TH or work/AL) and influence*/AL) or (demand/AL and resource*/AL) or ((労作/TH or effort/AL) and reward*/AL) or ((時間/TH or time/AL) and pressure*/AL) or recuperation*/AL or ((労働/TH or work/AL) and overload*/AL) or ((労働/TH or work/AL) and over-load*/AL) or recovery/AL or ("コーピング(心理学)"/TH or coping/AL) or ((労働/TH or work/AL) and (適性/TH or ability/AL)) or (social/AL and support/AL) or (support/AL and system*/AL) or (social/AL and network*/AL) or (emotional/AL and support/AL) or (interpersonal/AL and relation*/AL) or interaction*/AL or justice*/AL or injustice*/AL or (job/AL and (個人的満足/TH or satisfaction/AL)) or ((労働/TH or work/AL) and (個人的満足/TH or satisfaction/AL)) or (退屈/TH or boredom/AL) or (skill/AL and discretion*/AL) or (staff/AL and development/AL) or (社会的差別/TH or discrimination/AL) or harass*/AL or (work-place/AL and conflict*/AL) or ((職場/TH or workplace/AL) and violen*/AL) or (work-place/AL and violen*/AL) or (いじめ/TH or bullying/AL) or (年齢差別/TH or ageism/AL) or (同性愛嫌悪/TH or homophobia/AL) or (人種差別/TH or racism/AL) or (性差別/TH or sexism/AL) or victimization*/AL or (silent/AL and workplace*/AL) or ((社会的役割/TH or role/AL) and ambiguity/AL) or role-conflict*/AL or work-role*/AL or (working/AL and hour*/AL) or (working/AL and (時間/TH or time/AL)) or (day-time/AL) or (nighttime/ AL) or (shift/AL and work*/AL) or ((労働/TH or work/AL) and shift*/AL) or (temporary/AL and (労働/TH or work/AL)) or fulltime/ AL or part-time/AL or (flexible/AL and work*/AL) or (organizational/AL and change/AL) or (organisational/AL and change/AL) or (lean/AL and (経済学/TH or production/AL)) or (job/AL and security/AL) or (job/AL and insecurity/AL)) AND (("メタボリックシンドローム"/TH or "Metabolic syndrome"/AL) or ("インスリン抵抗性"/TH or "Insulin resistance"/AL) or ("メタボリックシンドローム"/TH or "Metabolic syndrome X"/AL) or "Cardio-metabolic syndrome"/AL or "Reaven's syndrome"/AL) AND ((longitudinal/AL and study/AL) or (prospective/AL and cohort/AL and study/AL) or (PROSPECTIVE/AL and STUDIES/AL) or (FOLLOWUP/ AL and STUDIES/AL) or (observational/AL and stud*/AL))

PRISMA-P (Preferred Reporting Items for Systematic review and Meta-Analysis Protocols) 2015 checklist: recommended items to address in a systematic review protocol*

Section and topic	Item No	Checklist item	On page #
ADMINISTRATIVE INFORMATION			
Title:			
Identification	1a	Identify the report as a protocol of a systematic review	P. 1
Update	1b	If the protocol is for an update of a previous systematic review, identify as such	N/A
Registration	2	If registered, provide the name of the registry (such as PROSPERO) and registration number	P.2
Authors:			
Contact	3a	Provide name, institutional affiliation, e-mail address of all protocol authors; provide physical mailing address of corresponding author	P.1
Contributions	3b	Describe contributions of protocol authors and identify the guarantor of the review	P. 16
Amendments	4	If the protocol represents an amendment of a previously completed or published protocol, identify as such and list changes; otherwise, state plan for documenting important protocol amendments	N/A
Support:			
Sources	5a	Indicate sources of financial or other support for the review	N/A
Sponsor	5b	Provide name for the review funder and/or sponsor	N/A
Role of sponsor or funder	5c	Describe roles of funder(s), sponsor(s), and/or institution(s), if any, in developing the protocol	N/A
INTRODUCTION			
Rationale	6	Describe the rationale for the review in the context of what is already known	P. 4-5
Objectives	7	Provide an explicit statement of the question(s) the review will address with reference to participants, interventions, comparators, and outcomes (PICO)	P. 5
METHODS			
Eligibility criteria	8	Specify the study characteristics (such as PICO, study design, setting, time frame) and report characteristics (such as years considered, language, publication status) to be used as criteria for eligibility for the review	P. 5-7
Information sources	9	Describe all intended information sources (such as electronic databases, contact with study authors, trial registers or other grey literature sources) with planned dates of coverage	P. 7
Search strategy	10	Present draft of search strategy to be used for at least one electronic database, including planned limits, such that it could be repeated	P. 7-8

Study records:			
Data management	11a	Describe the mechanism(s) that will be used to manage records and data throughout the review	P. 7-8
Selection process	11b	State the process that will be used for selecting studies (such as two independent reviewers) through each phase of the review (that is, screening, eligibility and inclusion in meta-analysis)	P. 7-8
Data collection process	11c	Describe planned method of extracting data from reports (such as piloting forms, done independently, in duplicate), any processes for obtaining and confirming data from investigators	P. 7-8
Data items	12	List and define all variables for which data will be sought (such as PICO items, funding sources), any pre-planned data assumptions and simplifications	P. 7-8
Outcomes and prioritization	13	List and define all outcomes for which data will be sought, including prioritization of main and additional outcomes, with rationale	P. 7-8
Risk of bias in individual studies	14	Describe anticipated methods for assessing risk of bias of individual studies, including whether this will be done at the outcome or study level, or both; state how this information will be used in data synthesis	P. 8-9
Data synthesis	15a	Describe criteria under which study data will be quantitatively synthesised	P. 9-10
	15b	If data are appropriate for quantitative synthesis, describe planned summary measures, methods of handling data and methods of combining data from studies, including any planned exploration of consistency (such as I^2, Kendall's τ)	P. 9-10
	15c	Describe any proposed additional analyses (such as sensitivity or subgroup analyses, meta-regression)	P. 9-10
	15d	If quantitative synthesis is not appropriate, describe the type of summary planned	P. 9-10
Meta-bias(es)	16	Specify any planned assessment of meta-bias(es) (such as publication bias across studies, selective reporting within studies)	P. 9-10
Confidence in cumulative evidence	17	Describe how the strength of the body of evidence will be assessed (such as GRADE)	N/A

*** It is strongly recommended that this checklist be read in conjunction with the PRISMA-P Explanation and Elaboration (cite when available) for important clarification on the items. Amendments to a review protocol should be tracked and dated. The copyright for PRISMA-P (including checklist) is held by the PRISMA-P Group and is distributed under a Creative Commons Attribution Licence 4.0.**

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Work-related psychosocial factors and onset of metabolic syndrome among workers: a systematic review and meta-analysis protocol

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Work-related psychosocial factors and onset of metabolic syndrome among workers: a systematic review and meta-analysis protocol

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Abstract

Introduction: Metabolic syndrome is an important public health target because of its high prevalence worldwide. Work-related psychosocial factors have been identified as determinants of metabolic syndrome components. However, there have been no systematic reviews or meta-analyses conducted to evaluate the relationship between work-related psychosocial factors and metabolic syndrome as an aggregated cluster. The aim of this study is to examine this association from published prospective studies.

Methods and analysis: The systematic review and meta-analysis will be conducted using published studies that will be identified from electronic databases (i.e., PubMed, EMABASE, PsycINFO, PsycARTICLES, and Japan Medical Abstracts Society). Studies that (1) examined the association between work-related psychosocial factors and the onset of metabolic syndrome, (2) had a longitudinal or prospective cohort design, (3) were conducted among workers, (4) provided sufficient data for calculating odds ratios or relative risk with a 95% confidence interval, (5) were published as original articles written in English or Japanese, and (6) having been published until May 2016 will be included. Study selection, data collection, quality assessment, and statistical syntheses will be conducted based on discussions among investigators.

Ethics and Dissemination: Ethics approval was not required for this study because it was based on published studies. The results and findings of this study will be submitted and published in a scientific peer-reviewed journal. The findings from this study could be useful for assessing metabolic syndrome risk factors in the workplace, and determining approaches for prevention of metabolic syndrome in the future.

Trial Registration number: PROSPERO CRD42016039096

(http://www.crd.york.ac.uk/PROSPERO_REBRANDING/display_record.asp?ID=CRD

42016039096)

Article summary

Strengths and limitations of this study

－This systematic review and meta-analysis will offer comprehensive understanding regarding the association between work-related psychosocial factors and metabolic syndrome.

－This study included a wide range of work-related psychosocial factors, and focused on metabolic syndrome as an aggregated cluster.

－This study included only prospective studies for stronger evidence.

－The findings from the study will be useful for assessing metabolic syndrome risk factors in the workplace, and determining approaches for prevention of metabolic syndrome in the future.

－Depending on the results, confounding factors that were not adjusted for in the selected studies, and low generalisability can be limitations.

Introduction

Metabolic syndrome is a cluster of medical conditions that has multiple risk factors for cardiovascular disease and type 2 diabetes, characterized by comorbidity of abdominal obesity, high blood glucose or insulin resistance, hypertension, dyslipidemia (high triglyceride and low high density lipoprotein [HDL] cholesterol), and microalbuminuria[1-5]. Although there are variations by demographic variables (e.g., sex and age) and ethnicity, the prevalence of metabolic syndrome remains high worldwide[6-10]. In addition to elevating the risks for the incidence of cardiovascular disease and diabetes, metabolic syndrome has influence on cancer risks[11], a low health-related quality of life[12], and all-cause mortality[13,14]. Therefore, metabolic syndrome is an important public health target.

Work-related psychosocial factors among workers have been identified as a determinant of health[15-18]. For example, long working hours has been well-known to be correlated with workers' health[19-23]. Relationships between other factors and health status have also been discussed, such as shift work[24,25], job demands and controls[26], effort-reward imbalance[27], organizational justice[28], and social support from supervisors and colleagues[29]. Although the biological mechanisms by which these work-related psychosocial factors influence the health of workers are not currently clear, they could be partially explained by a poor metabolism[16]. In many systematic reviews and meta-analyses, it has been suggested that these work-related psychosocial factors are significant risk factors for metabolic syndrome components, including blood pressure and hypertension[30,31], weight gain and obesity[32,33], and blood glucose and impaired glucose tolerance[34], but insignificant for blood lipids and dyslipidemia[34,35].

However, there have been few systematic reviews and/or meta-analyses

conducted regarding the relationship between work-related psychosocial factors and metabolic syndrome as an aggregated cluster, defined by the international clinical criteria[1-5]. In a previous systematic review conducted by Bergmann et al.,[36] a positive relationship between chronic psychosocial stress and the incident of metabolic syndrome was suggested based on 39 prospective studies. However, they did not statistically synthesize the relationship. In addition, they included studies that targeted both the working and non-working population, and adopted general stressors as exposures and each metabolic syndrome component as an outcome. Another systematic review and meta-analysis[37] only focused on a positive association between night shift work and metabolic syndrome and included both prospective, retrospective, and cross-sectional studies in the review. Additional systematic reviews and meta-analyses are necessary to obtain a more comprehensive understanding and stronger evidence regarding the association between work-related psychosocial factors and the onset of metabolic syndrome among workers.

The objective of this study is to evaluate published prospective studies in order to investigate this association. To the best of our knowledge, this will be the first systematic review and meta-analysis conducted specifically to analyze this association among the working population. We hypothesised that adverse work-related psychosocial factors would elevated the onset probability of metabolic syndrome among workers.

Methods and analysis

Study design

This is a systematic review and meta-analysis protocol of prospective cohort studies, following the Preferred Reporting Items for Systematic reviews and

Meta-Analysis protocols (PRISMA-P) guideline[38]. The systematic review and meta-analysis will be reported according to the Preferred Reporting Items for Systematic Reviews and Meta-analyses (PRISMA) guideline[39]. The study protocol was registered at PROSPERO (CRD42016039096).

Eligibility criteria

The participants, exposures, comparisons, and outcomes (PECO) of the studies in this systematic review and meta-analysis were defined as follows: (P) inclusion of all workers, (E) presence of adverse work-related psychosocial factors, (C) absence of adverse work-related psychosocial factors, and (O) the onset of metabolic syndrome. We targeted all employed workers as participants. There will be no exclusion criteria for workers according to employment status, job-type, and shift-type. The adverse work-related psychosocial factors (i.e., study exposures) included a wide range of task and organizational characteristics, work conditions, and workplace interaction[40], such as job strain, effort-reward imbalance, working hours, shift-work, low social support, and other organizational-level factors. The comparisons will be defined as preferable conditions for these psychosocial factors. The diagnostic standards for metabolic syndrome (i.e., study outcome) that were used in this study were defined by several international institutions, such as the World Health Organization[1,2], National Cholesterol Education Program[3], American Heart Association/National Heart, Lung, and Blood Institute[4], and International Diabetes Foundation[5].

Studies that (1) were conducted to evaluate the association between work-related psychosocial factors and the onset of metabolic syndrome, (2) used a longitudinal or prospective cohort design, (3) were conducted among workers, (4) provided sufficient data for calculating the odds ratios (ORs) or relative risks (RRs) with 95% confidence

intervals, (5) were published as original articles written in English or Japanese, and (6) have been published until May 2016 will be included in this systematic review and meta-analysis.

Information source, search strategy, and data management

Published studies will be searched using the following electronic databases: PubMed, EMABASE, PsycINFO, PsycARTICLES, and Japan Medical Abstracts Society. The search terms will include words related to the PECO of the studies. The search strategy that will be conducted is shown in Appendix 1. All identified studies will be managed within a Microsoft® Excel (Washington, the US) file. Prior to screening the studies, deduplication within this excel file will be conducted by KI. Decisions on all studies will be recorded.

Study selection process

Nine investigators (ASakuraya, KW, KI, EA, YA, HE, YK, NN, and HA) will independently conduct the screening of studies according to the eligibility criteria. Duplicated citations will be excluded. The titles and abstracts will be screened according to the eligibility criteria created earlier in the sifting phase, and the full texts of all eligible studies will be obtained. In the full text review phase, the full texts will be reviewed using a standardized form for assessing eligibility for this study. When resolution cannot be accomplished, the disagreements will be settled by consensus with discussion amongst all authors. Corresponding authors will be contacted directly if (1) the publication is unclear and may be related to multiple interpretations, or (2) the collected data from the publication did not show data relevant to our study analysis. The reasons for excluding studies will be recorded. A flow chart will be provided to show the entire review process.

Data collection

Data will be extracted independently from the included studies by nine investigators (ASakuraya, KW, KI, EA, YA, HE, YK, NN, and HA), using a standardized data extraction form. Any disagreement or inconsistencies will be solved by consultation and consensus amongst all authors.

Data will include the number of participants included in the analysis, country where the study was conducted, length of follow-up, year of publication, number of participants who were excluded or lost to follow-up, demographic characteristics of participants (i.e., mean age, sex proportions, and employment status), sample size, exposure variables (i.e., adverse psychosocial factors at work), diagnostic criteria for metabolic syndrome, number and proportion with metabolic syndrome, and sufficient data for calculating ORs or RRs with 95% confidence intervals for the association between adverse work-related psychosocial factors and the onset of metabolic syndrome. This extraction form will be piloted and modified as required. When multiple ORs or RRs were reported in the included studies, we preferentially selected ORs or RRs adjusted by demographic variables (e.g., age, sex, educational status, and marital status) and lifestyle variables (e.g., smoking, physical activity, and sleep). ORs or RRs adjusted by other adverse work-related psychosocial factors and/or metabolic syndrome components will not be adopted in the systematic review and meta-analysis because of over-adjustment. Sex-stratified ORs or RRs were selected for our study if those were the only reported measures of association. Relevant research teams will be contacted about the possibility of obtaining any missing data from the studies.

Assessment of study quality

Nine investigators (ASakuraya, KW, KI, EA, YA, HE, YK, NN, and HA) will

independently assess each selected study for study quality using the Newcastle-Ottawa Quality Assessment Scale (NOS)[41]. The NOS evaluates cohort studies based on eight items categorized into the following three groups: (1) selection of the study cases, (2) comparability of the population, and (3) ascertainment of whether the exposure or outcome includes any risk of bias (i.e., selection bias or bias from lost to follow-up). The NOS is scored ranging from 0 to 9, and studies with scores ≥7 are considered as high quality[42]. Discrepancy of quality assessment among the investigators will be solved by discussion and consensus amongst all authors.

Data synthesis and statistical methods

The included studies will be statistically synthesized by a meta-analysis to estimate the pooled risk of work-related psychosocial factors related to metabolic syndrome. We will calculate ORs or RRs transformed to a natural logarithm and estimate its standard errors based on the 95% confidence intervals for the association measures. These parameters will be used for the meta-analysis and required for examining publication bias using a funnel plot and the Egger's test[23]. We will use a random effect model to sum the results of the studies[43] using Stata version 12 (LightStone®, Tokyo, Japan). The results will be summed in a narrative format if conducting a meta-analysis is not appropriate or possible. Heterogeneity will be assessed by the χ^2 test on Cochrane's Q statistic, which is calculated into I^2 values[44] assuming that I^2 values of 25%, 50% and 75% indicate low, medium, and high heterogeneity, respectively.

Subgroup and sensitivity analyses will also be conducted to compare the results across subgroups or under specific conditions when sufficient heterogeneity is detected. Major grouping characteristics will include sex, age, employment status, occupational

groups and work-related physical activity[45,46], and study quality. Any subgroup differences will be reported, and our findings will be explained by considering these differences. A possible sensitivity analysis will be conducted for included studies that only scored as high quality according to the NOS (≥ 7).

All the collected data and analyzed results will be deposited by the corresponding author and available upon requests by external reviewers and readers.

Ethics and dissemination

This systematic review and meta-analysis is based on previously published studies and therefore, the study does not require ethical approval. Results and Findings will be submitted and published in a scientific peer-reviewed journal.

Strengths and limitations

To the best of our knowledge, this systematic review and meta-analysis will be the first study to offer the strongest evidence regarding the association between work-related psychosocial factors and metabolic syndrome because we targeted only prospective studies. Considering the high incidence of metabolic syndrome among the working population, the findings from the study will be useful for public and occupational health, particularly for assessing metabolic syndrome risk factors in the workplace, and determining approaches for prevention of metabolic syndrome in the future. However, a limitation of this study will be confounding factors that were not adjusted for in the selected studies. In addition, our study findings will not be generalisable to other countries or populations.

Author's contributions

Asuka Sakuraya, Kazuhiro Watanabe, Norito Kawakami, Kotaro Imamura, Emiko Ando, Yumi Asai, Hisashi Eguchi, Yuka Kobayashi, Norimitsu Nishida, Hideaki Arima, Akihito Shimazu, and Akizumi Tsutsumi have made substantial contributions to the conception and design, writing of the protocol and revising it critically for important intellectual content, and approving the final version to be published. All authors will be involved in the entire study process (i.e., data collection, assessment, and synthesis).

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Conflict of Interest:

Asuka Sakuraya, Kazuhiro Watanabe, Norito Kawakami, Kotaro Imamura, Emiko Ando, Yumi Asai, Hisashi Eguchi, Yuka Kobayashi, Norimitsu Nishida, Hideaki Arima, Akihito Shimazu, and Akizumi Tsutsumi declare no conflict of interest for this study.

Appendix 1. Search terms used for the electronic databases

Database	Search terms
PubMed	("Stress, Mechanical"[Mesh] OR "Lifting"[Mesh] OR "Moving and Lifting Patients"[Mesh] OR "Weight-Bearing"[Mesh] OR "Biomechanics" OR "Physical Exertion"[Mesh] OR "Torsion, Mechanical"[Mesh] OR "Postural Balance"[Mesh] OR "Walking"[Mesh] OR "Recovery of Function"[Mesh] OR "Relaxation"[Mesh] OR (static[Title/Abstract] AND posture) OR (awkward[Title/Abstract] AND posture) OR (dynamic[Title/Abstract] AND posture) OR static work[Title/Abstract] OR dynamic load*[Title/Abstract] OR lift*[Title/Abstract] OR carry*[Title/Abstract] OR hold*[Title/Abstract] OR pull*[Title/Abstract] OR drag*[Title/Abstract] OR push*[Title/Abstract] OR manual handling[Title/Abstract] OR force*[Title/Abstract] OR biomechanic*[Title/Abstract] OR walking*[Title/Abstract] OR postural balance[Title/Abstract] OR flexion*[Title/Abstract] OR extension*[Title/Abstract] OR turning[Title/Abstract] OR sitting[Title/Abstract] OR kneeling[Title/Abstract] OR squatting[Title/Abstract] OR twisting[Title/Abstract] OR bending[Title/Abstract] OR reaching[Title/Abstract] OR standing[Title/Abstract] OR sedentary[Title/Abstract] OR repetitive movement*[Title/Abstract] OR monotonous work[Title/Abstract] OR relaxation[Title/Abstract] OR recovery of function[Title/Abstract] OR physical demand*[Title/Abstract] OR physically demand*[Title/Abstract]) OR ("Stress, Psychological"[Majr] OR "Social Support"[Majr] OR "Job Satisfaction"[Mesh] OR "Work Schedule Tolerance"[Mesh] OR "Employee Performance Appraisal"[Mesh] OR "Employee Grievances"[Mesh] OR "Social Justice/psychology"[Mesh] OR "Personnel Downsizing"[Mesh] OR "Staff Development"[Mesh] OR "Organizational Culture"[Mesh] OR "Bullying"[Mesh] OR "Prejudice"[Mesh] OR "Social Discrimination"[Mesh] OR "Interpersonal Relations"[Mesh] OR "Communication/psychology"[Mesh]) OR psychosocial[Title/Abstract] OR job strain[Title/Abstract] OR work strain[Title/Abstract] OR work demand*[Title/Abstract] OR job demand*[Title/Abstract] OR high demand*[Title/Abstract] OR low control[Title/Abstract] OR lack of control[Title/Abstract] OR work control[Title/Abstract] OR job control[Title/Abstract] OR decision latitude[Title/Abstract] OR work influence*[Title/Abstract] OR demand resource*[Title/Abstract] OR effort reward*[Title/Abstract] OR time pressure*[Title/Abstract] OR recuperation*[Title/Abstract] OR work overload*[Title/Abstract] OR work over-load*[Title/Abstract] OR recovery[Title/Abstract] OR coping[Title/Abstract] OR work ability[Title/Abstract] OR social support[Title/Abstract] OR support system*[Title/Abstract] OR social network*[Title/Abstract] OR emotional support[Title/Abstract] OR interpersonal relation*[Title/Abstract] OR interaction*[Title/Abstract] OR justice*[Title/Abstract] OR injustice*[Title/Abstract] OR job satisfaction[Title/Abstract] OR work satisfaction[Title/Abstract] OR boredom[Title/Abstract] OR skill discretion*[Title/Abstract] OR staff development[Title/Abstract] OR discrimination[Title/Abstract] OR harass*[Title/Abstract] OR work-place conflict*[Title/Abstract] OR workplace violen*[Title/Abstract] OR work-place violen*[Title/Abstract] OR bullying[Title/Abstract] OR ageism[Title/Abstract] OR homophobia[Title/Abstract] OR racism[Title/Abstract] OR sexism[Title/Abstract] OR victimization*[Title/Abstract] OR silent workplace*[Title/Abstract] OR role ambiguity[Title/Abstract] OR role-conflict*[Title/Abstract] OR work-role*[Title/Abstract] OR working hour*[Title/Abstract] OR working time[Title/Abstract] OR day-time[Title/Abstract] OR night-time[Title/Abstract] OR shift work*[Title/Abstract] OR work shift*[Title/Abstract] OR temporary work[Title/Abstract] OR full-time[Title/Abstract] OR part-time[Title/Abstract] OR flexible work*[Title/Abstract] OR organizational change[Title/Abstract] OR organisational change[Title/Abstract] OR lean production[Title/Abstract] OR job security[Title/Abstract] OR job insecurity[Title/Abstract]) AND ("Metabolic syndrome" [All Fields] OR "Insulin resistance" [All Fields] OR "Metabolic syndrome X" [MeSH] OR "Cardio-metabolic syndrome" [All Fields] OR "Reaven's syndrome" [All Fields]) AND ((longitudinal study) OR (prospective cohort study) OR (PROSPECTIVE STUDIES) OR (FOLLOW-UP STUDIES) OR (observational stud*))
EMABASE	("Stress, Mechanical" OR "Lifting" OR "Moving and Lifting Patients" OR "Weight-Bearing" OR "Biomechanics" OR "Physical Exertion" OR "Torsion, Mechanical" OR "Postural Balance" OR "Walking" OR "Recovery of Function" OR "Relaxation" OR (static AND posture) OR (awkward AND posture) OR (dynamic AND posture) OR (static AND work) OR (dynamic AND load*) OR lift* OR carry* OR hold* OR pull* OR drag* OR push* OR (manual

	AND handling) OR force* OR biomechanic* OR walking* OR (postural AND balance) OR flexion* OR extension* OR turning OR sitting OR kneeling OR squatting OR twisting OR bending OR reaching OR standing OR sedentary OR (repetitive AND movement*) OR (monotonous AND work) OR relaxation OR (recovery AND of AND function) OR (physical AND demand*) OR (physically AND demand*)) OR ("Stress, Psychological"/exp OR "Stress, Psychological" OR "Social Support"/exp OR "Social Support" OR "Job Satisfaction"/exp OR "Job Satisfaction" OR "Work Schedule Tolerance"/exp OR "Work Schedule Tolerance" OR "Employee Performance Appraisal"/exp OR "Employee Performance Appraisal" OR "Employee Grievances"/exp OR "Employee Grievances" OR "Social Justice/psychology" OR "Personnel Downsizing"/exp OR "Personnel Downsizing" OR "Staff Development"/exp OR "Staff Development" OR "Organizational Culture"/exp OR "Organizational Culture" OR "Bullying"/exp OR "Bullying" OR "Prejudice"/exp OR "Prejudice"/exp OR "Prejudice" OR "Social Discrimination"/exp OR "Social Discrimination" OR "Interpersonal Relations"/exp OR "Interpersonal Relations" OR "Communication/psychology") OR (psychosocial OR (job AND strain) OR (work AND strain) OR (work AND demand*) OR (job AND demand*) OR (high AND demand*) OR (low AND control) OR (lack AND of AND control) OR (work AND control) OR (job AND control) OR (decision AND latitude) OR (work AND influence*) OR (demand AND resource*) OR (effort AND reward*) OR (time AND pressure*) OR recuperation* OR (work AND overload*) OR (work AND over-load*) OR recovery OR coping OR (work AND ability) OR (social AND support) OR (support AND system*) OR (social AND network*) OR (emotional AND support) OR (interpersonal AND relation*) OR interaction* OR justice* OR injustice* OR (job AND satisfaction) OR (work AND satisfaction) OR boredom OR (skill AND discretion*) OR (staff AND development) OR discrimination OR harass* OR (work-place AND conflict*) OR (workplace AND violen*) OR (workplace AND violen*) OR bullying OR ageism OR homophobia OR racism OR sexism OR victimization* OR (silent AND workplace*) OR (role AND ambiguity) OR role-conflict* OR work-role* OR (working AND hour*) OR (working AND time) OR day-time OR night-time OR (shift AND work*) OR (work AND shift*) OR (temporary AND work) OR full-time OR part-time OR (flexible AND work*) OR (organizational AND change) OR (organizational AND change) OR (lean AND production) OR (job AND security) OR (job AND insecurity)) AND ("Metabolic syndrome" OR "Insulin resistance" OR "Metabolic syndrome X" OR "Cardio-metabolic syndrome" OR "Reaven's syndrome") AND ((longitudinal AND study) OR (prospective AND cohort AND study) OR (PROSPECTIVE AND STUDIES) OR (FOLLOW-UP AND STUDIES) OR (observational stud*))
PsycINFO/ PsycARTICLES	("Stress, Mechanical" OR "Lifting" OR" Moving and Lifting Patients" OR "Weight-Bearing" OR "Biomechanics" OR "Physical Exertion" OR "Torsion, Mechanical" OR "Postural Balance" OR "Walking" OR "Recovery of Function" OR "Relaxation" OR (static AND posture) OR (awkward AND posture) OR (dynamic AND posture) OR static work OR dynamic load* OR lift* OR carry* OR hold* OR pull* OR drag* OR push* OR manual handling OR force* OR biomechanic* OR walking* OR postural balance OR flexion* OR extension* OR turning OR sitting OR kneeling OR squatting OR twisting OR bending OR reaching OR standing OR sedentary OR repetitive movement* OR monotonous work OR relaxation OR recovery of function OR physical demand* OR physically demand*) OR ("Stress, Psychological" OR "Social Support" OR "Job Satisfaction" OR "Work Schedule Tolerance" OR "Employee Performance Appraisal" OR "Employee Grievances" OR "Social Justice/psychology" OR "Personnel Downsizing" OR "Staff Development" OR "Organizational Culture" OR "Bullying" OR "Prejudice" OR "Social Discrimination" OR "Interpersonal Relations" OR "Communication/psychology") OR (psychosocial OR job strain OR work strain OR work demand* OR job demand* OR high demand* OR low control OR lack of control OR work control OR job control OR decision latitude OR work influence* OR demand resource* OR effort reward* OR time pressure* OR recuperation* OR work overload* OR work over-load* OR recovery OR coping OR work ability OR social support OR support system* OR social network* OR emotional support OR interpersonal relation* OR interaction* OR justice* OR injustice* OR job satisfaction OR work satisfaction OR boredom OR skill discretion* OR staff development OR discrimination OR harass* OR work-place conflict* OR workplace violen* OR workplace violen* OR bullying OR ageism OR homophobia OR racism OR sexism OR victimization* OR silent workplace* OR role ambiguity OR role-conflict* OR work-role* OR working hour* OR working time OR day-time OR night-time OR shift work* OR work shift* OR temporary work OR full-time OR part-time OR flexible work* OR organizational change OR organizational change OR lean production OR job security OR job insecurity) AND ("Metabolic syndrome" OR "Insulin resistance" OR "Metabolic syndrome X" OR "Cardio-metabolic syndrome" OR "Reaven's syndrome") AND ((longitudinal study) OR (prospective cohort study) OR (PROSPECTIVE STUDIES) OR (FOLLOW-UP STUDIES) OR (observational stud*))

Japan Medical Abstracts Society	(("心理的ストレス"/TH or "Stress, Psychological"/AL) or ("社会的支援"/TH or "Social Support"/AL) or ("職務満足度"/TH or "Job Satisfaction"/AL) or ("勤務体制"/TH or "Work Schedule Tolerance"/AL) or ("従業員の勤務評価"/TH or "Employee Performance Appraisal"/AL) or ("従業員の苦情"/TH or "Employee Grievances"/AL) or "Social Justice/psychology"/AL or ("人員削減"/TH or "Personnel Downsizing"/AL) or ("スタッフ開発"/TH or "Staff Development"/AL) or ("組織の文化"/TH or "Organizational Culture"/AL) or ("いじめ"/TH or "Bullying"/AL) or ("偏見"/TH or "Prejudice"/AL) or ("社会的差別"/TH or "Social Discrimination"/AL) or ("人間関係"/TH or "Interpersonal Relations"/AL) or "Communication/psychology"/AL) OR (("メカニカルストレス"/TH or "Stress, Mechanical"/AL) or ("挙上(力学)"/TH or "Lifting"/AL) or ("患者の移動と持ち上げ"/TH or "Moving and Lifting Patients"/AL) or ("体重負荷"/TH or "Weight-Bearing"/AL) or ("生体力学的現象"/TH or "Biomechanics"/AL) or ("労作"/TH or "Physical Exertion"/AL) or ("機械的ねじれ"/TH or "Torsion, Mechanical"/AL) or ("姿勢バランス"/TH or "Postural Balance"/AL) or ("歩行運動"/TH or "Walking"/AL) or ("生体機能回復"/TH or "Recovery of Function"/AL) or ("リラクゼーション"/TH or "Relaxation"/AL) or (static/AL and (姿勢/TH or posture/AL)) or (awkward/AL and (姿勢/TH or posture/AL)) or (dynamic/AL and (姿勢/TH or posture/AL)) or (static/AL and (労働/TH or work/AL)) or (dynamic/AL and load*/AL) or lift*/AL or carry*/AL or hold*/AL or pull*/AL or drag*/AL or push*/AL or ((マニュアル/TH or manual/AL) and ("ハンドリング(心理学)"/TH or handling/AL)) or force*/AL or biomechanic*/AL or walking*/AL or (postural/AL and (姿勢バランス/TH or balance/AL)) or flexion*/AL or extension*/AL or turning/AL or sitting/AL or kneeling/AL or squatting/AL or twisting/AL or bending/AL or reaching/AL or standing/AL or sedentary/AL or (repetitive/AL and movement*/AL) or (monotonous/AL and (労働/TH or work/AL)) or (リラクゼーション/TH or relaxation/AL) or (recovery/AL and of/AL and function/AL) or (physical/AL and demand*/AL) or (physically/AL and demand*/AL)) OR (psychosocial/AL or (job/AL and (捻挫/TH or strain/AL)) or ((労働/TH or work/AL) and (捻挫/TH or strain/AL)) or ((労働/TH or work/AL) and demand*/AL) or (job/AL and demand*/AL) or (high/AL and demand*/AL) or (low/AL and control/AL) or (lack/AL and of/AL and control/AL) or ((労働/TH or work/AL) and control/AL) or (job/AL and control/AL) or (decision/AL and latitude/AL) or ((労働/TH or work/AL) and influence*/AL) or (demand/AL and resource*/AL) or ((労作/TH or effort/AL) and reward*/AL) or ((時間/TH or time/AL) and pressure*/AL) or recuperation*/AL or ((労働/TH or work/AL) and overload*/AL) or ((労働/TH or work/AL) and over-load*/AL) or recovery/AL or ("コーピング(心理学)"/TH or coping/AL) or ((労働/TH or work/AL) and 適性/TH or ability/AL)) or (social/AL and support/AL) or (support/AL and system*/AL) or (social/AL and network*/AL) or (emotional/AL and support/AL) or (interpersonal/AL and relation*/AL) or interaction*/AL or justice*/AL or injustice*/AL or (job/AL and (個人的満足/TH or satisfaction/AL)) or ((労働/TH or work/AL) and (個人的満足/TH or satisfaction/AL)) or (退屈/TH or boredom/AL) or (skill/AL and discretion*/AL) or (staff/AL and development/AL) or (社会的差別/TH or discrimination/AL) or harass*/AL or (work-place/AL and conflict*/AL) or ((職場/TH or workplace/AL) and violen*/AL) or (work-place/AL and violen*/AL) or (いじめ/TH or bullying/AL) or (年齢差別/TH or ageism/AL) or (同性愛嫌悪/TH or homophobia/AL) or (人種差別/TH or racism/AL) or (性差別/TH or sexism/AL) or victimization*/AL or (silent/AL and workplace*/AL) or ((社会的役割/TH or role/AL) and ambiguity/AL) or role-conflict*/AL or work-role*/AL or (working/AL and hour*/AL) or (working/AL and (時間/TH or time/AL)) or day-time/AL) or (nighttime/ AL) or (shift/AL and work*/AL) or ((労働/TH or work/AL) and shift*/AL) or (temporary/AL and (労働/TH or work/AL)) or fulltime/ AL or part-time/AL or (flexible/AL and work*/AL) or (organizational/AL and change/AL) or (organisational/AL and change/AL) or (lean/AL and (経済学/TH or production/AL)) or (job/AL and security/AL) or (job/AL and insecurity/AL)) AND (("メタボリックシンドローム"/TH or "Metabolic syndrome"/AL) or ("インスリン抵抗性"/TH or "Insulin resistance"/AL) or ("メタボリックシンドローム"/TH or "Metabolic syndrome X"/AL) or "Cardio-metabolic syndrome"/AL or "Reaven's syndrome"/AL) AND ((longitudinal/AL and study/AL) or (prospective/AL and cohort/AL and study/AL) or (PROSPECTIVE/AL and STUDIES/AL) or (FOLLOWUP/ AL and STUDIES/AL) or (observational/AL and stud*/AL))

PRISMA-P (Preferred Reporting Items for Systematic review and Meta-Analysis Protocols) 2015 checklist: recommended items to address in a systematic review protocol*

Section and topic	Item No	Checklist item	On page #
ADMINISTRATIVE INFORMATION			
Title:			
Identification	1a	Identify the report as a protocol of a systematic review	P. 1
Update	1b	If the protocol is for an update of a previous systematic review, identify as such	N/A
Registration	2	If registered, provide the name of the registry (such as PROSPERO) and registration number	P.2
Authors:			
Contact	3a	Provide name, institutional affiliation, e-mail address of all protocol authors; provide physical mailing address of corresponding author	P.1
Contributions	3b	Describe contributions of protocol authors and identify the guarantor of the review	P. 16
Amendments	4	If the protocol represents an amendment of a previously completed or published protocol, identify as such and list changes; otherwise, state plan for documenting important protocol amendments	N/A
Support:			
Sources	5a	Indicate sources of financial or other support for the review	N/A
Sponsor	5b	Provide name for the review funder and/or sponsor	N/A
Role of sponsor or funder	5c	Describe roles of funder(s), sponsor(s), and/or institution(s), if any, in developing the protocol	N/A
INTRODUCTION			
Rationale	6	Describe the rationale for the review in the context of what is already known	P. 4-5
Objectives	7	Provide an explicit statement of the question(s) the review will address with reference to participants, interventions, comparators, and outcomes (PICO)	P. 5
METHODS			
Eligibility criteria	8	Specify the study characteristics (such as PICO, study design, setting, time frame) and report characteristics (such as years considered, language, publication status) to be used as criteria for eligibility for the review	P. 5-7
Information sources	9	Describe all intended information sources (such as electronic databases, contact with study authors, trial registers or other grey literature sources) with planned dates of coverage	P. 7
Search strategy	10	Present draft of search strategy to be used for at least one electronic database, including planned limits, such that it could be repeated	P. 7-8

Study records:			
Data management	11a	Describe the mechanism(s) that will be used to manage records and data throughout the review	P. 7-8
Selection process	11b	State the process that will be used for selecting studies (such as two independent reviewers) through each phase of the review (that is, screening, eligibility and inclusion in meta-analysis)	P. 7-8
Data collection process	11c	Describe planned method of extracting data from reports (such as piloting forms, done independently, in duplicate), any processes for obtaining and confirming data from investigators	P. 7-8
Data items	12	List and define all variables for which data will be sought (such as PICO items, funding sources), any pre-planned data assumptions and simplifications	P. 7-8
Outcomes and prioritization	13	List and define all outcomes for which data will be sought, including prioritization of main and additional outcomes, with rationale	P. 7-8
Risk of bias in individual studies	14	Describe anticipated methods for assessing risk of bias of individual studies, including whether this will be done at the outcome or study level, or both; state how this information will be used in data synthesis	P. 8-9
Data synthesis	15a	Describe criteria under which study data will be quantitatively synthesised	P. 9-10
	15b	If data are appropriate for quantitative synthesis, describe planned summary measures, methods of handling data and methods of combining data from studies, including any planned exploration of consistency (such as I^2, Kendall's τ)	P. 9-10
	15c	Describe any proposed additional analyses (such as sensitivity or subgroup analyses, meta-regression)	P. 9-10
	15d	If quantitative synthesis is not appropriate, describe the type of summary planned	P. 9-10
Meta-bias(es)	16	Specify any planned assessment of meta-bias(es) (such as publication bias across studies, selective reporting within studies)	P. 9-10
Confidence in cumulative evidence	17	Describe how the strength of the body of evidence will be assessed (such as GRADE)	N/A

*** It is strongly recommended that this checklist be read in conjunction with the PRISMA-P Explanation and Elaboration (cite when available) for important clarification on the items. Amendments to a review protocol should be tracked and dated. The copyright for PRISMA-P (including checklist) is held by the PRISMA-P Group and is distributed under a Creative Commons Attribution Licence 4.0.**

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Work-related psychosocial factors and onset of metabolic syndrome among workers: a systematic review and meta-analysis protocol

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Work-related psychosocial factors and onset of metabolic syndrome among workers: a systematic review and meta-analysis protocol

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Abstract

Introduction: Metabolic syndrome is an important public health target because of its high prevalence worldwide. Work-related psychosocial factors have been identified as determinants of metabolic syndrome components. However, there have been no systematic reviews or meta-analyses conducted to evaluate the relationship between work-related psychosocial factors and metabolic syndrome as an aggregated cluster. The aim of this study is to examine this association from published prospective studies.

Methods and analysis: The systematic review and meta-analysis will be conducted using published studies that will be identified from electronic databases (i.e., PubMed, EMABASE, PsycINFO, PsycARTICLES, and Japan Medical Abstracts Society). Studies that (1) examined the association between work-related psychosocial factors and the onset of metabolic syndrome, (2) had a longitudinal or prospective cohort design, (3) were conducted among workers, (4) provided sufficient data for calculating odds ratios or relative risk with a 95% confidence interval, (5) were published as original articles written in English or Japanese, and (6) having been published until the end of 2016 will be included. Study selection, data collection, quality assessment, and statistical syntheses will be conducted based on discussions among investigators.

Ethics and Dissemination: Ethics approval was not required for this study because it was based on published studies. The results and findings of this study will be submitted and published in a scientific peer-reviewed journal. The findings from this study could be useful for assessing metabolic syndrome risk factors in the workplace, and determining approaches for prevention of metabolic syndrome in the future.

Trial Registration number: PROSPERO CRD42016039096

(http://www.crd.york.ac.uk/PROSPERO_REBRANDING/display_record.asp?ID=CRD

42016039096)

Article summary

Strengths and limitations of this study

－This systematic review and meta-analysis will offer comprehensive understanding regarding the association between work-related psychosocial factors and metabolic syndrome.

－This study included a wide range of work-related psychosocial factors, and focused on metabolic syndrome as an aggregated cluster.

－This study included only prospective studies for stronger evidence.

－The findings from the study will be useful for assessing metabolic syndrome risk factors in the workplace, and determining approaches for prevention of metabolic syndrome in the future.

－Depending on the results, confounding factors that were not adjusted for in the selected studies, and low generalisability can be limitations.

Introduction

Metabolic syndrome is a cluster of medical conditions that has multiple risk factors for cardiovascular disease and type 2 diabetes, characterized by comorbidity of abdominal obesity, high blood glucose or insulin resistance, hypertension, dyslipidemia (high triglyceride and low high density lipoprotein [HDL] cholesterol), and microalbuminuria[1-5]. Although there are variations by demographic variables (e.g., sex and age) and ethnicity, the prevalence of metabolic syndrome remains high worldwide[6-10]. In addition to elevating the risks for the incidence of cardiovascular disease and diabetes, metabolic syndrome has influence on cancer risks[11], a low health-related quality of life[12], and all-cause mortality[13,14]. Therefore, metabolic syndrome is an important public health target.

Work-related psychosocial factors among workers have been identified as a determinant of health[15-18]. For example, long working hours has been well-known to be correlated with workers' health[19-23]. Relationships between other factors and health status have also been discussed, such as shift work[24,25], job demands and controls[26], effort-reward imbalance[27], organizational justice[28], and social support from supervisors and colleagues[29]. Although the biological mechanisms by which these work-related psychosocial factors influence the health of workers are not currently clear, they could be partially explained by a poor metabolism[16]. In many systematic reviews and meta-analyses, it has been suggested that these work-related psychosocial factors are significant risk factors for metabolic syndrome components, including blood pressure and hypertension[30,31], weight gain and obesity[32,33], and blood glucose and impaired glucose tolerance[34], but insignificant for blood lipids and dyslipidemia[34,35].

However, there have been few systematic reviews and/or meta-analyses

conducted regarding the relationship between work-related psychosocial factors and metabolic syndrome as an aggregated cluster, defined by the international clinical criteria[1-5]. In a previous systematic review conducted by Bergmann et al.,[36] a positive relationship between chronic psychosocial stress and the incident of metabolic syndrome was suggested based on 39 prospective studies. However, they did not statistically synthesize the relationship. In addition, they included studies that targeted both the working and non-working population, and adopted general stressors as exposures and each metabolic syndrome component as an outcome. Another systematic review and meta-analysis[37] only focused on a positive association between night shift work and metabolic syndrome and included both prospective, retrospective, and cross-sectional studies in the review. Additional systematic reviews and meta-analyses are necessary to obtain a more comprehensive understanding and stronger evidence regarding the association between work-related psychosocial factors and the onset of metabolic syndrome among workers.

The objective of this study is to evaluate published prospective studies in order to investigate this association. To the best of our knowledge, this will be the first systematic review and meta-analysis conducted specifically to analyze this association among the working population. We hypothesised that adverse work-related psychosocial factors would elevated the onset probability of metabolic syndrome among workers.

Methods and analysis

Study design

This is a systematic review and meta-analysis protocol of prospective cohort studies, following the Preferred Reporting Items for Systematic reviews and

Meta-Analysis protocols (PRISMA-P) guideline[38]. The systematic review and meta-analysis will be reported according to the Preferred Reporting Items for Systematic Reviews and Meta-analyses (PRISMA) guideline[39]. The study protocol was registered at PROSPERO (CRD42016039096).

Eligibility criteria

The participants, exposures, comparisons, and outcomes (PECO) of the studies in this systematic review and meta-analysis were defined as follows: (P) inclusion of all workers, (E) presence of adverse work-related psychosocial factors, (C) absence of adverse work-related psychosocial factors, and (O) the onset of metabolic syndrome. We targeted all employed workers as participants. There will be no exclusion criteria for workers according to employment status, job-type, and shift-type. The adverse work-related psychosocial factors (i.e., study exposures) included a wide range of task and organizational characteristics, work conditions, and workplace interaction[40], such as job strain, effort-reward imbalance, working hours, shift-work, low social support, and other organizational-level factors. The comparisons will be defined as preferable conditions for these psychosocial factors. The diagnostic standards for metabolic syndrome (i.e., study outcome) that were used in this study were defined by several international institutions, such as the World Health Organization[1,2], National Cholesterol Education Program[3], American Heart Association/National Heart, Lung, and Blood Institute[4], and International Diabetes Foundation[5].

Studies that (1) were conducted to evaluate the association between work-related psychosocial factors and the onset of metabolic syndrome, (2) used a longitudinal or prospective cohort design, (3) were conducted among workers, (4) provided sufficient data for calculating the odds ratios (ORs) or relative risks (RRs) with 95% confidence

intervals, (5) were published as original articles written in English or Japanese, and (6) have been published until the end of 2016 will be included in this systematic review and meta-analysis.

Information source, search strategy, and data management

Published studies will be searched using the following electronic databases: PubMed, EMABASE, PsycINFO, PsycARTICLES, and Japan Medical Abstracts Society. The search terms will include words related to the PECO of the studies. The search strategy that will be conducted is shown in Appendix 1. All identified studies will be managed within a Microsoft® Excel (Washington, the US) file. Prior to screening the studies, deduplication within this excel file will be conducted by KI. Decisions on all studies will be recorded.

Study selection process

Nine investigators (ASakuraya, KW, KI, EA, YA, HE, YK, NN, and HA) will independently conduct the screening of studies according to the eligibility criteria. Duplicated citations will be excluded. The titles and abstracts will be screened according to the eligibility criteria created earlier in the sifting phase, and the full texts of all eligible studies will be obtained. In the full text review phase, the full texts will be reviewed using a standardized form for assessing eligibility for this study. When resolution cannot be accomplished, the disagreements will be settled by consensus with discussion amongst all authors. Corresponding authors will be contacted directly if (1) the publication is unclear and may be related to multiple interpretations, or (2) the collected data from the publication did not show data relevant to our study analysis. The reasons for excluding studies will be recorded. A flow chart will be provided to show the entire review process.

Data collection

Data will be extracted independently from the included studies by nine investigators (ASakuraya, KW, KI, EA, YA, HE, YK, NN, and HA), using a standardized data extraction form. Any disagreement or inconsistencies will be solved by consultation and consensus amongst all authors.

Data will include the number of participants included in the analysis, country where the study was conducted, length of follow-up, year of publication, number of participants who were excluded or lost to follow-up, demographic characteristics of participants (i.e., mean age, sex proportions, and employment status), sample size, exposure variables (i.e., adverse psychosocial factors at work), diagnostic criteria for metabolic syndrome, number and proportion with metabolic syndrome, and sufficient data for calculating ORs or RRs with 95% confidence intervals for the association between adverse work-related psychosocial factors and the onset of metabolic syndrome. This extraction form will be piloted and modified as required. When multiple ORs or RRs were reported in the included studies, we preferentially selected ORs or RRs adjusted by demographic variables (e.g., age, sex, educational status, and marital status) and lifestyle variables (e.g., smoking, physical activity, and sleep). ORs or RRs adjusted by other adverse work-related psychosocial factors and/or metabolic syndrome components will not be adopted in the systematic review and meta-analysis because of over-adjustment. Sex-stratified ORs or RRs were selected for our study if those were the only reported measures of association. Relevant research teams will be contacted about the possibility of obtaining any missing data from the studies.

Assessment of study quality

Nine investigators (ASakuraya, KW, KI, EA, YA, HE, YK, NN, and HA) will

independently assess each selected study for study quality using the Newcastle-Ottawa Quality Assessment Scale (NOS)[41]. The NOS evaluates cohort studies based on eight items categorized into the following three groups: (1) selection of the study cases, (2) comparability of the population, and (3) ascertainment of whether the exposure or outcome includes any risk of bias (i.e., selection bias or bias from lost to follow-up). The NOS is scored ranging from 0 to 9, and studies with scores ≥7 are considered as high quality[42]. Discrepancy of quality assessment among the investigators will be solved by discussion and consensus amongst all authors.

Data synthesis and statistical methods

The included studies will be statistically synthesized by a meta-analysis to estimate the pooled risk of work-related psychosocial factors related to metabolic syndrome. We will calculate ORs or RRs transformed to a natural logarithm and estimate its standard errors based on the 95% confidence intervals for the association measures. These parameters will be used for the meta-analysis and required for examining publication bias using a funnel plot and the Egger's test[23]. We will use a random effect model to sum the results of the studies[43] using Stata version 12 (LightStone®, Tokyo, Japan). The results will be summed in a narrative format if conducting a meta-analysis is not appropriate or possible. Heterogeneity will be assessed by the χ^2 test on Cochrane's Q statistic, which is calculated into I^2 values[44] assuming that I^2 values of 25%, 50% and 75% indicate low, medium, and high heterogeneity, respectively.

Subgroup and sensitivity analyses will also be conducted to compare the results across subgroups or under specific conditions when sufficient heterogeneity is detected. Major grouping characteristics will include sex, age, employment status, occupational

groups and work-related physical activity[45,46], and study quality. Any subgroup differences will be reported, and our findings will be explained by considering these differences. A possible sensitivity analysis will be conducted for included studies that only scored as high quality according to the NOS (≥ 7).

All the collected data and analyzed results will be deposited by the corresponding author and available upon requests by external reviewers and readers.

Ethics and dissemination

This systematic review and meta-analysis is based on previously published studies and therefore, the study does not require ethical approval. Results and Findings will be submitted and published in a scientific peer-reviewed journal.

Strengths and limitations

To the best of our knowledge, this systematic review and meta-analysis will be the first study to offer the strongest evidence regarding the association between work-related psychosocial factors and metabolic syndrome because we targeted only prospective studies. Considering the high incidence of metabolic syndrome among the working population, the findings from the study will be useful for public and occupational health, particularly for assessing metabolic syndrome risk factors in the workplace, and determining approaches for prevention of metabolic syndrome in the future. However, a limitation of this study will be confounding factors that were not adjusted for in the selected studies. In addition, our study findings will not be generalisable to other countries or populations.

Author's contributions

Asuka Sakuraya, Kazuhiro Watanabe, Norito Kawakami, Kotaro Imamura, Emiko Ando, Yumi Asai, Hisashi Eguchi, Yuka Kobayashi, Norimitsu Nishida, Hideaki Arima, Akihito Shimazu, and Akizumi Tsutsumi have made substantial contributions to the conception and design, writing of the protocol and revising it critically for important intellectual content, and approving the final version to be published. All authors will be involved in the entire study process (i.e., data collection, assessment, and synthesis).

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Conflict of Interest:

Asuka Sakuraya, Kazuhiro Watanabe, Norito Kawakami, Kotaro Imamura, Emiko Ando, Yumi Asai, Hisashi Eguchi, Yuka Kobayashi, Norimitsu Nishida, Hideaki Arima, Akihito Shimazu, and Akizumi Tsutsumi declare no conflict of interest for this study.

Appendix 1. Search terms used for the electronic databases

Database	Search terms
PubMed	("Stress, Mechanical"[Mesh] OR "Lifting"[Mesh] OR "Moving and Lifting Patients"[Mesh] OR "Weight-Bearing"[Mesh] OR "Biomechanics" OR "Physical Exertion"[Mesh] OR "Torsion, Mechanical"[Mesh] OR "Postural Balance"[Mesh] OR "Walking"[Mesh] OR "Recovery of Function"[Mesh] OR "Relaxation"[Mesh] OR (static[Title/Abstract] AND posture) OR (awkward[Title/Abstract] AND posture) OR (dynamic[Title/Abstract] AND posture) OR static work[Title/Abstract] OR dynamic load*[Title/Abstract] OR lift*[Title/Abstract] OR carry*[Title/Abstract] OR hold*[Title/Abstract] OR pull*[Title/Abstract] OR drag*[Title/Abstract] OR push*[Title/Abstract] OR manual handling[Title/Abstract] OR force*[Title/Abstract] OR biomechanic*[Title/Abstract] OR walking*[Title/Abstract] OR postural balance[Title/Abstract] OR flexion*[Title/Abstract] OR extension*[Title/Abstract] OR turning[Title/Abstract] OR sitting[Title/Abstract] OR kneeling[Title/Abstract] OR squatting[Title/Abstract] OR twisting[Title/Abstract] OR bending[Title/Abstract] OR reaching[Title/Abstract] OR standing[Title/Abstract] OR sedentary[Title/Abstract] OR repetitive movement*[Title/Abstract] OR monotonous work[Title/Abstract] OR relaxation[Title/Abstract] OR recovery of function[Title/Abstract] OR physical demand*[Title/Abstract] OR physically demand*[Title/Abstract]) OR ("Stress, Psychological"[Majr] OR "Social Support"[Majr] OR "Job Satisfaction"[Mesh] OR "Work Schedule Tolerance"[Mesh] OR "Employee Performance Appraisal"[Mesh] OR "Employee Grievances"[Mesh] OR "Social Justice/psychology"[Mesh] OR "Personnel Downsizing"[Mesh] OR "Staff Development"[Mesh] OR "Organizational Culture"[Mesh] OR "Bullying"[Mesh] OR "Prejudice"[Mesh] OR "Social Discrimination"[Mesh] OR "Interpersonal Relations"[Mesh] OR "Communication/psychology"[Mesh]) OR psychosocial[Title/Abstract] OR job strain[Title/Abstract] OR work strain[Title/Abstract] OR work demand*[Title/Abstract] OR job demand*[Title/Abstract] OR high demand*[Title/Abstract] OR low control[Title/Abstract] OR lack of control[Title/Abstract] OR work control[Title/Abstract] OR job control[Title/Abstract] OR decision latitude[Title/Abstract] OR work influence*[Title/Abstract] OR demand resource*[Title/Abstract] OR effort reward*[Title/Abstract] OR time pressure*[Title/Abstract] OR recuperation*[Title/Abstract] OR work overload*[Title/Abstract] OR work over-load*[Title/Abstract] OR recovery[Title/Abstract] OR coping[Title/Abstract] OR work ability[Title/Abstract] OR social support[Title/Abstract] OR support system*[Title/Abstract] OR social network*[Title/Abstract] OR emotional support[Title/Abstract] OR interpersonal relation*[Title/Abstract] OR interaction*[Title/Abstract] OR justice*[Title/Abstract] OR injustice*[Title/Abstract] OR job satisfaction[Title/Abstract] OR work satisfaction[Title/Abstract] OR boredom[Title/Abstract] OR skill discretion*[Title/Abstract] OR staff development[Title/Abstract] OR discrimination[Title/Abstract] OR harass*[Title/Abstract] OR work-place conflict*[Title/Abstract] OR workplace violen*[Title/Abstract] OR work-place violen*[Title/Abstract] OR bullying[Title/Abstract] OR ageism[Title/Abstract] OR homophobia[Title/Abstract] OR racism[Title/Abstract] OR sexism[Title/Abstract] OR victimization*[Title/Abstract] OR silent workplace*[Title/Abstract] OR role ambiguity[Title/Abstract] OR role-conflict*[Title/Abstract] OR work-role*[Title/Abstract] OR working hour*[Title/Abstract] OR working time[Title/Abstract] OR day-time[Title/Abstract] OR night-time[Title/Abstract] OR shift work*[Title/Abstract] OR work shift*[Title/Abstract] OR temporary work[Title/Abstract] OR full-time[Title/Abstract] OR part-time[Title/Abstract] OR flexible work*[Title/Abstract] OR organizational change[Title/Abstract] OR organisational change[Title/Abstract] OR lean production[Title/Abstract] OR job security[Title/Abstract] OR job insecurity[Title/Abstract]) AND ("Metabolic syndrome" [All Fields] OR "Insulin resistance" [All Fields] OR "Metabolic syndrome X" [MeSH] OR "Cardio-metabolic syndrome" [All Fields] OR "Reaven's syndrome" [All Fields]) AND ((longitudinal study) OR (prospective cohort study) OR (PROSPECTIVE STUDIES) OR (FOLLOW-UP STUDIES) OR (observational stud*))
EMABASE	("Stress, Mechanical" OR "Lifting" OR "Moving and Lifting Patients" OR "Weight-Bearing" OR "Biomechanics" OR "Physical Exertion" OR "Torsion, Mechanical" OR "Postural Balance" OR "Walking" OR "Recovery of Function" OR "Relaxation" OR (static AND posture) OR (awkward AND posture) OR (dynamic AND posture) OR (static AND work) OR (dynamic AND load*) OR lift* OR carry* OR hold* OR pull* OR drag* OR push* OR (manual

	AND handling) OR force* OR biomechanic* OR walking* OR (postural AND balance) OR flexion* OR extension* OR turning OR sitting OR kneeling OR squatting OR twisting OR bending OR reaching OR standing OR sedentary OR (repetitive AND movement*) OR (monotonous AND work) OR relaxation OR (recovery AND of AND function) OR (physical AND demand*) OR (physically AND demand*)) OR ("Stress, Psychological"/exp OR "Stress, Psychological" OR "Social Support"/exp OR "Social Support" OR "Job Satisfaction"/exp OR "Job Satisfaction" OR "Work Schedule Tolerance"/exp OR "Work Schedule Tolerance" OR "Employee Performance Appraisal"/exp OR "Employee Performance Appraisal" OR "Employee Grievances"/exp OR "Employee Grievances" OR "Social Justice/psychology" OR "Personnel Downsizing"/exp OR "Personnel Downsizing" OR "Staff Development"/exp OR "Staff Development" OR "Organizational Culture"/exp OR "Organizational Culture" OR "Bullying"/exp OR "Bullying" OR "Prejudice"/exp OR "Prejudice"/exp OR "Prejudice" OR "Social Discrimination"/exp OR "Social Discrimination" OR "Interpersonal Relations"/exp OR "Interpersonal Relations" OR "Communication/psychology") OR (psychosocial OR (job AND strain) OR (work AND strain) OR (work AND demand*) OR (job AND demand*) OR (high AND demand*) OR (low AND control) OR (lack AND of AND control) OR (work AND control) OR (job AND control) OR (decision AND latitude) OR (work AND influence*) OR (demand AND resource*) OR (effort AND reward*) OR (time AND pressure*) OR recuperation* OR (work AND overload*) OR (work AND over-load*) OR recovery OR coping OR (work AND ability) OR (social AND support) OR (support AND system*) OR (social AND network*) OR (emotional AND support) OR (interpersonal AND relation*) OR interaction* OR justice* OR injustice* OR (job AND satisfaction) OR (work AND satisfaction) OR boredom OR (skill AND discretion*) OR (staff AND development) OR discrimination OR harass* OR (work-place AND conflict*) OR (workplace AND violen*) OR (workplace AND violen*) OR bullying OR ageism OR homophobia OR racism OR sexism OR victimization* OR (silent AND workplace*) OR (role AND ambiguity) OR role-conflict* OR work-role* OR (working AND hour*) OR (working AND time) OR day-time OR night-time OR (shift AND work*) OR (work AND shift*) OR (temporary AND work) OR full-time OR part-time OR (flexible AND work*) OR (organizational AND change) OR (organizational AND change) OR (lean AND production) OR (job AND security) OR (job AND insecurity)) AND ("Metabolic syndrome" OR "Insulin resistance" OR "Metabolic syndrome X" OR "Cardio-metabolic syndrome" OR "Reaven's syndrome") AND ((longitudinal AND study) OR (prospective AND cohort AND study) OR (PROSPECTIVE AND STUDIES) OR (FOLLOW-UP AND STUDIES) OR (observational stud*))
PsycINFO/ PsycARTICLES	("Stress, Mechanical" OR "Lifting" OR" Moving and Lifting Patients" OR "Weight-Bearing" OR "Biomechanics" OR "Physical Exertion" OR "Torsion, Mechanical" OR "Postural Balance" OR "Walking" OR "Recovery of Function" OR "Relaxation" OR (static AND posture) OR (awkward AND posture) OR (dynamic AND posture) OR static work OR dynamic load* OR lift* OR carry* OR hold* OR pull* OR drag* OR push* OR manual handling OR force* OR biomechanic* OR walking* OR postural balance OR flexion* OR extension* OR turning OR sitting OR kneeling OR squatting OR twisting OR bending OR reaching OR standing OR sedentary OR repetitive movement* OR monotonous work OR relaxation OR recovery of function OR physical demand* OR physically demand*) OR ("Stress, Psychological" OR "Social Support" OR "Job Satisfaction" OR "Work Schedule Tolerance" OR "Employee Performance Appraisal" OR "Employee Grievances" OR "Social Justice/psychology" OR "Personnel Downsizing" OR "Staff Development" OR "Organizational Culture" OR "Bullying" OR "Prejudice" OR "Social Discrimination" OR "Interpersonal Relations" OR "Communication/psychology") OR (psychosocial OR job strain OR work strain OR work demand* OR job demand* OR high demand* OR low control OR lack of control OR work control OR job control OR decision latitude OR work influence* OR demand resource* OR effort reward* OR time pressure* OR recuperation* OR work overload* OR work over-load* OR recovery OR coping OR work ability OR social support OR support system* OR social network* OR emotional support OR interpersonal relation* OR interaction* OR justice* OR injustice* OR job satisfaction OR work satisfaction OR boredom OR skill discretion* OR staff development OR discrimination OR harass* OR work-place conflict* OR workplace violen* OR workplace violen* OR bullying OR ageism OR homophobia OR racism OR sexism OR victimization* OR silent workplace* OR role ambiguity OR role-conflict* OR work-role* OR working hour* OR working time OR day-time OR night-time OR shift work* OR work shift* OR temporary work OR full-time OR part-time OR flexible work* OR organizational change OR organizational change OR lean production OR job security OR job insecurity) AND ("Metabolic syndrome" OR "Insulin resistance" OR "Metabolic syndrome X" OR "Cardio-metabolic syndrome" OR "Reaven's syndrome") AND ((longitudinal study) OR (prospective cohort study) OR (PROSPECTIVE STUDIES) OR (FOLLOW-UP STUDIES) OR (observational stud*))

Japan Medical Abstracts Society	(("心理的ストレス"/TH or "Stress, Psychological"/AL) or ("社会的支援"/TH or "Social Support"/AL) or ("職務満足度"/TH or "Job Satisfaction"/AL) or ("勤務体制"/TH or "Work Schedule Tolerance"/AL) or ("従業員の勤務評価"/TH or "Employee Performance Appraisal"/AL) or ("従業員の苦情"/TH or "Employee Grievances"/AL) or "Social Justice/psychology"/AL or ("人員削減"/TH or "Personnel Downsizing"/AL) or ("スタッフ開発"/TH or "Staff Development"/AL) or ("組織の文化"/TH or "Organizational Culture"/AL) or ("いじめ"/TH or "Bullying"/AL) or ("偏見"/TH or "Prejudice"/AL) or ("社会的差別"/TH or "Social Discrimination"/AL) or ("人間関係"/TH or "Interpersonal Relations"/AL) or "Communication/psychology"/AL) OR (("メカニカルストレス"/TH or "Stress, Mechanical"/AL) or ("挙上(力学)"/TH or "Lifting"/AL) or ("患者の移動と持ち上げ"/TH or "Moving and Lifting Patients"/AL) or ("体重負荷"/TH or "Weight-Bearing"/AL) or ("生体力学的現象"/TH or "Biomechanics"/AL) or ("労作"/TH or "Physical Exertion"/AL) or ("機械的ねじれ"/TH or "Torsion, Mechanical"/AL) or ("姿勢バランス"/TH or "Postural Balance"/AL) or ("歩行運動"/TH or "Walking"/AL) or ("生体機能回復"/TH or "Recovery of Function"/AL) or ("リラクゼーション"/TH or "Relaxation"/AL) or (static/AL and (姿勢/TH or posture/AL)) or (awkward/AL and (姿勢/TH or posture/AL)) or (dynamic/AL and (姿勢/TH or posture/AL)) or (static/AL and (労働/TH or work/AL)) or (dynamic/AL and load*/AL) or lift*/AL or carry*/AL or hold*/AL or pull*/AL or drag*/AL or push*/AL or ((マニュアル/TH or manual/AL) and ("ハンドリング(心理学)"/TH or handling/AL)) or force*/AL or biomechanic*/AL or walking*/AL or (postural/AL and (姿勢バランス/TH or balance/AL)) or flexion*/AL or extension*/AL or turning/AL or sitting/AL or kneeling/AL or squatting/AL or twisting/AL or bending/AL or reaching/AL or standing/AL or sedentary/AL or (repetitive/AL and movement*/AL) or (monotonous/AL and (労働/TH or work/AL)) or (リラクゼーション/TH or relaxation/AL) or (recovery/AL and of/AL and function/AL) or (physical/AL and demand*/AL) or (physically/AL and demand*/AL)) OR (psychosocial/AL or (job/AL and (捻挫/TH or strain/AL)) or ((労働/TH or work/AL) and (捻挫/TH or strain/AL)) or ((労働/TH or work/AL) and demand*/AL) or (job/AL and demand*/AL) or (high/AL and demand*/AL) or (low/AL and control/AL) or (lack/AL and of/AL and control/AL) or ((労働/TH or work/AL) and control/AL) or (job/AL and control/AL) or (decision/AL and latitude/AL) or ((労働/TH or work/AL) and influence*/AL) or (demand/AL and resource*/AL) or ((労作/TH or effort/AL) and reward*/AL) or ((時間/TH or time/AL) and pressure*/AL) or recuperation*/AL or ((労働/TH or work/AL) and overload*/AL) or ((労働/TH or work/AL) and over-load*/AL) or recovery/AL or ("コーピング(心理学)"/TH or coping/AL) or ((労働/TH or work/AL) and 適性/TH or ability/AL)) or (social/AL and support/AL) or (support/AL and system*/AL) or (social/AL and network*/AL) or (emotional/AL and support/AL) or (interpersonal/AL and relation*/AL) or interaction*/AL or justice*/AL or injustice*/AL or (job/AL and (個人的満足/TH or satisfaction/AL)) or ((労働/TH or work/AL) and (個人的満足/TH or satisfaction/AL)) or (退屈/TH or boredom/AL) or (skill/AL and discretion*/AL) or (staff/AL and development/AL) or (社会的差別/TH or discrimination/AL) or harass*/AL or (work-place/AL and conflict*/AL) or ((職場/TH or workplace/AL) and violen*/AL) or (work-place/AL and violen*/AL) or (いじめ/TH or bullying/AL) or (年齢差別/TH or ageism/AL) or (同性愛嫌悪/TH or homophobia/AL) or (人種差別/TH or racism/AL) or (性差別/TH or sexism/AL) or victimization*/AL or (silent/AL and workplace*/AL) or ((社会的役割/TH or role/AL) and ambiguity/AL) or role-conflict*/AL or work-role*/AL or (working/AL and hour*/AL) or (working/AL and (時間/TH or time/AL)) or day-time/AL) or (nighttime/ AL) or (shift/AL and work*/AL) or ((労働/TH or work/AL) and shift*/AL) or (temporary/AL and (労働/TH or work/AL)) or fulltime/ AL or part-time/AL or (flexible/AL and work*/AL) or (organizational/AL and change/AL) or (organisational/AL and change/AL) or (lean/AL and (経済学/TH or production/AL)) or (job/AL and security/AL) or (job/AL and insecurity/AL)) AND (("メタボリックシンドローム"/TH or "Metabolic syndrome"/AL) or ("インスリン抵抗性"/TH or "Insulin resistance"/AL) or ("メタボリックシンドローム"/TH or "Metabolic syndrome X"/AL) or "Cardio-metabolic syndrome"/AL or "Reaven's syndrome"/AL) AND ((longitudinal/AL and study/AL) or (prospective/AL and cohort/AL and study/AL) or (PROSPECTIVE/AL and STUDIES/AL) or (FOLLOWUP/ AL and STUDIES/AL) or (observational/AL and stud*/AL))

PRISMA-P (Preferred Reporting Items for Systematic review and Meta-Analysis Protocols) 2015 checklist: recommended items to address in a systematic review protocol*

Section and topic	Item No	Checklist item	On page #
ADMINISTRATIVE INFORMATION			
Title:			
Identification	1a	Identify the report as a protocol of a systematic review	P. 1
Update	1b	If the protocol is for an update of a previous systematic review, identify as such	N/A
Registration	2	If registered, provide the name of the registry (such as PROSPERO) and registration number	P.2
Authors:			
Contact	3a	Provide name, institutional affiliation, e-mail address of all protocol authors; provide physical mailing address of corresponding author	P.1
Contributions	3b	Describe contributions of protocol authors and identify the guarantor of the review	P. 16
Amendments	4	If the protocol represents an amendment of a previously completed or published protocol, identify as such and list changes; otherwise, state plan for documenting important protocol amendments	N/A
Support:			
Sources	5a	Indicate sources of financial or other support for the review	N/A
Sponsor	5b	Provide name for the review funder and/or sponsor	N/A
Role of sponsor or funder	5c	Describe roles of funder(s), sponsor(s), and/or institution(s), if any, in developing the protocol	N/A
INTRODUCTION			
Rationale	6	Describe the rationale for the review in the context of what is already known	P. 4-5
Objectives	7	Provide an explicit statement of the question(s) the review will address with reference to participants, interventions, comparators, and outcomes (PICO)	P. 5
METHODS			
Eligibility criteria	8	Specify the study characteristics (such as PICO, study design, setting, time frame) and report characteristics (such as years considered, language, publication status) to be used as criteria for eligibility for the review	P. 5-7
Information sources	9	Describe all intended information sources (such as electronic databases, contact with study authors, trial registers or other grey literature sources) with planned dates of coverage	P. 7
Search strategy	10	Present draft of search strategy to be used for at least one electronic database, including planned limits, such that it could be repeated	P. 7-8

Study records:			
Data management	11a	Describe the mechanism(s) that will be used to manage records and data throughout the review	P. 7-8
Selection process	11b	State the process that will be used for selecting studies (such as two independent reviewers) through each phase of the review (that is, screening, eligibility and inclusion in meta-analysis)	P. 7-8
Data collection process	11c	Describe planned method of extracting data from reports (such as piloting forms, done independently, in duplicate), any processes for obtaining and confirming data from investigators	P. 7-8
Data items	12	List and define all variables for which data will be sought (such as PICO items, funding sources), any pre-planned data assumptions and simplifications	P. 7-8
Outcomes and prioritization	13	List and define all outcomes for which data will be sought, including prioritization of main and additional outcomes, with rationale	P. 7-8
Risk of bias in individual studies	14	Describe anticipated methods for assessing risk of bias of individual studies, including whether this will be done at the outcome or study level, or both; state how this information will be used in data synthesis	P. 8-9
Data synthesis	15a	Describe criteria under which study data will be quantitatively synthesised	P. 9-10
	15b	If data are appropriate for quantitative synthesis, describe planned summary measures, methods of handling data and methods of combining data from studies, including any planned exploration of consistency (such as I^2, Kendall's τ)	P. 9-10
	15c	Describe any proposed additional analyses (such as sensitivity or subgroup analyses, meta-regression)	P. 9-10
	15d	If quantitative synthesis is not appropriate, describe the type of summary planned	P. 9-10
Meta-bias(es)	16	Specify any planned assessment of meta-bias(es) (such as publication bias across studies, selective reporting within studies)	P. 9-10
Confidence in cumulative evidence	17	Describe how the strength of the body of evidence will be assessed (such as GRADE)	N/A

*** It is strongly recommended that this checklist be read in conjunction with the PRISMA-P Explanation and Elaboration (cite when available) for important clarification on the items. Amendments to a review protocol should be tracked and dated. The copyright for PRISMA-P (including checklist) is held by the PRISMA-P Group and is distributed under a Creative Commons Attribution Licence 4.0.**

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