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Systematic review

Effectiveness of Pre-Employment Medical Examinations in Preventing Occupational Injury and Disease: A Systematic Review

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Abstract

Background: Pre-employment medical examinations are widely used to assess fitness for work. Identifying health abnormalities does not establish prevention of occupational harm. This review examined their effectiveness in reducing occupational injury, disease, and sickness absence, distinguishing programme evaluations from studies of predictive validity. **Methods:** Comparative and longitudinal research published through 31 August 2026 was considered. Contextual literature addressed screening validity and employment consequences. Fifteen original research reports were synthesized narratively because examination content, occupations, comparators, and outcomes differed substantially. **Results:** Ten reports evaluated screening programmes or subsequent risk

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mitigation, and five examined prediction of later injury or disease. General examinations offered no clear benefit for nonhazardous light-duty work. Selected job-specific programmes reported fewer musculoskeletal injuries, although historical comparisons, differences between workers, and concurrent interventions restricted causal interpretation. A military trial reported 648 versus 612 days fit for duty over two years. Functional testing predicted injury in some industrial cohorts, whereas testing among 538 paramedics did not distinguish subsequent injury risk. Nerve-conduction screening produced inconsistent prediction of carpal tunnel syndrome and low positive predictive values. Data concerning occupational disease was sparse and concentrated on asthma and carpal tunnel syndrome. **Conclusions:** Findings favour cautious, occupation-specific assessment linked to accommodation and risk reduction rather than universal medical exclusion. Reliable prevention estimates require prospective comparisons. Comparisons must measure subsequent health outcomes, rejected applicants, costs, and employment consequences.

Keywords: Pre-employment examination; preplacement assessment; occupational injury; occupational disease; fitness for work; functional capacity evaluation; screening.

Introduction

Pre-employment medical examinations assess whether applicants meet the health and functional requirements of a proposed job without unacceptable risks to themselves or others. Their practical affect extends beyond diagnosis because fitness decisions determine access to employment, work restrictions, and opportunities for reasonable workplace modification. Published assessments describe substantial variation in examination content and fitness criteria, reflecting differences between occupations and uncertainty about the relationship between clinical abnormalities and safe job performance (1).

The rationale for screening rests on identifying a modifiable mismatch between an applicant's capabilities and essential occupational demands, followed by an effective preventive response. Broad examinations detect findings unrelated to those demands, generating additional investigations and costs without established occupational benefit (2). Preventive effectiveness depends on test accuracy, the frequency of the adverse outcome, and the consequences of acting on a positive result, rather than the number of abnormalities detected. Rejecting applicants with positive results also creates an employment consequence that belongs within the assessment of overall screening value (3).

Questionnaires offer a less resource-intensive approach, although a systematic review found weak prediction of subsequent adverse health and employment outcomes (4). The Cochrane review identified inconsistent findings for job-focused examinations and very uncertain data between the comparisons evaluated (5). These findings distinguish administrative reassurance from demonstrated prevention and underline the importance of linking assessment results to specific actions, including training, task modification, and exposure reduction (4,5). These distinctions are especially important when healthy applicants enter occupations with different physical and environmental demands (5). A screening programme requires data about the complete pathway from examination to decision and eventual occupational outcome, rather than evidence about test performance alone (3,5).

Functional capacity evaluations have attracted interest in physically demanding occupations because they compare observed performance with actual work requirements. Their use in healthy applicants requires separate validation from their established application in rehabilitation (6). A recent scoping review in meat processing also described limited direct data connecting pre-employment assessments with improved worker health, reinforcing the need for occupation-specific evaluation (7). The present review examined original studies on occupational injury, disease, and

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sickness absence following pre-employment assessment, while separating intervention effectiveness from prognostic associations. This distinction provides a clinically relevant basis for interpreting apparent benefits, evaluating employment-related harms, and identifying the examination components supported by observed occupational outcomes rather than tradition alone.

Methods

The review addressed examinations performed before employment or initial placement and their relationship with occupational health outcomes. Publication eligibility till 31 August 2026, with no lower date boundary. The synthesis distinguished direct evaluations of screening programmes from longitudinal studies assessing whether examination findings predicted later injury or disease, because prediction and prevention represent different research questions.

Studies were located through targeted searches of publicly accessible bibliographic records, original journal sources, full-text repositories, and reference lists. PubMed-indexed articles and Cochrane reviews provided initial entry points, followed by searches for individual studies and later publications. Search concepts covered pre-employment, preplacement, post-offer assessment, physical examination, functional capacity, injury, occupational disease, sickness absence, and predictive validity, with spelling variants and occupation-specific terms used to identify relevant reports.

Eligible primary research involved applicants, newly hired workers, or recruits assessed before their occupational assignment and reported injury, occupational disease, sickness absence, fitness for duty, or related prospective outcomes. Comparative screening evaluations included randomized studies, nonrandomized controlled studies, and longitudinal programme evaluations; prognostic cohorts formed a separate secondary data group. Cross-sectional studies describing abnormalities or physical performance without subsequent occupational outcomes were excluded from the outcome synthesis, while reviews and methodological papers informed background interpretation.

Two authors independently screened titles, abstracts, and available full texts, extracted study data, and examined methodological limitations; disagreements were resolved through discussion. Extracted information comprised study design, occupational setting, participant numbers, assessment content, comparator, follow-up, outcome definition, numerical findings, and reported limitations. Applicant numbers, employed populations, injury events, and disease cases were kept distinct, and numerical results were retained in the form reported without reconstructing missing denominators or generating additional effect estimates.

Methodological interpretation considered allocation procedures, historical comparators, baseline differences, cointerventions, attrition, outcome ascertainment, and adjustment for occupational exposure. Particular attention was given to whether the study tested an entire screening pathway, an intervention following an abnormal finding, or prediction without an implemented preventive decision. Findings were synthesized narratively by examination type and outcome, with direct programme evaluations presented separately from prognostic data in two tables.

Meta-analysis was not performed because populations, screening strategies, comparators, follow-up intervals, and outcome definitions differed substantially. Statistical significance was not treated as sufficient data of causal prevention, and unadjusted associations were distinguished from adjusted estimates. Interpretation considered

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reported employment exclusion and financial consequences alongside health outcomes, without assigning a numerical quality score or a pooled preventive effect to heterogeneous findings.

Results

The synthesis comprised 15 original reports, with general screening providing a contrasting starting point. Alexander et al. studied 6,125 applicants for nonhazardous telephone-company work and found no meaningful advantage in attendance or performance associated with medical risk classification (8). In a randomized military comparison involving 352 soldiers, job-related assessment produced 648 versus 612 days fit for duty over two years (9). A smaller industrial strength-screening study enrolled 81 applicants, followed 71 hires, and reported musculoskeletal medical-visit rates of 53.6 versus 120.8 per 100 person-years in screened and comparison workers, respectively (10).

Several nonrandomized evaluations reported favourable injury outcomes in physically demanding work, although these findings reflected programme-level comparisons rather than isolated diagnostic effects (11-14). Rosenblum and Shankar compared 503 screened hires with 1,423 controls; unscreened workers had higher odds of relevant overexertion injuries, with an odds ratio of 2.38 (11). Faris reported five injuries in tested nursing personnel compared with 54 among comparison staff, alongside lower recorded injury expenditure (12). Harbin and colleagues reported shoulder injury frequencies of 0% versus 3.8% following post-offer testing, using historical controls (13). Nassau described lower injury severity, medical costs, and lost workdays within a staged hospital programme that also included case management and return-to-work policies (14).

Disease-prevention data included an aluminium-smelter evaluation of histamine provocation testing, which described 157 asthma cases among earlier hires and 17 among hires after testing began, alongside declining fluoride exposure. These case counts alone did not provide comparable incidence denominators or isolate screening from exposure control (15). Nachreiner and colleagues identified 67 workers receiving restrictions and 264 matched controls, with no significant difference in musculoskeletal injury distribution (16). Knapik et al. compared preconditioned, non-preconditioned, and initially fit military recruits, reporting improved training completion after preconditioning and injury risks that remained dependent on sex and baseline fitness. Between these programmes, variation in follow-up, workforce composition, and outcome recording limited direct comparison of reported effects, so favourable individual findings did not establish a uniform preventive effect between diverse occupational settings (11-17).

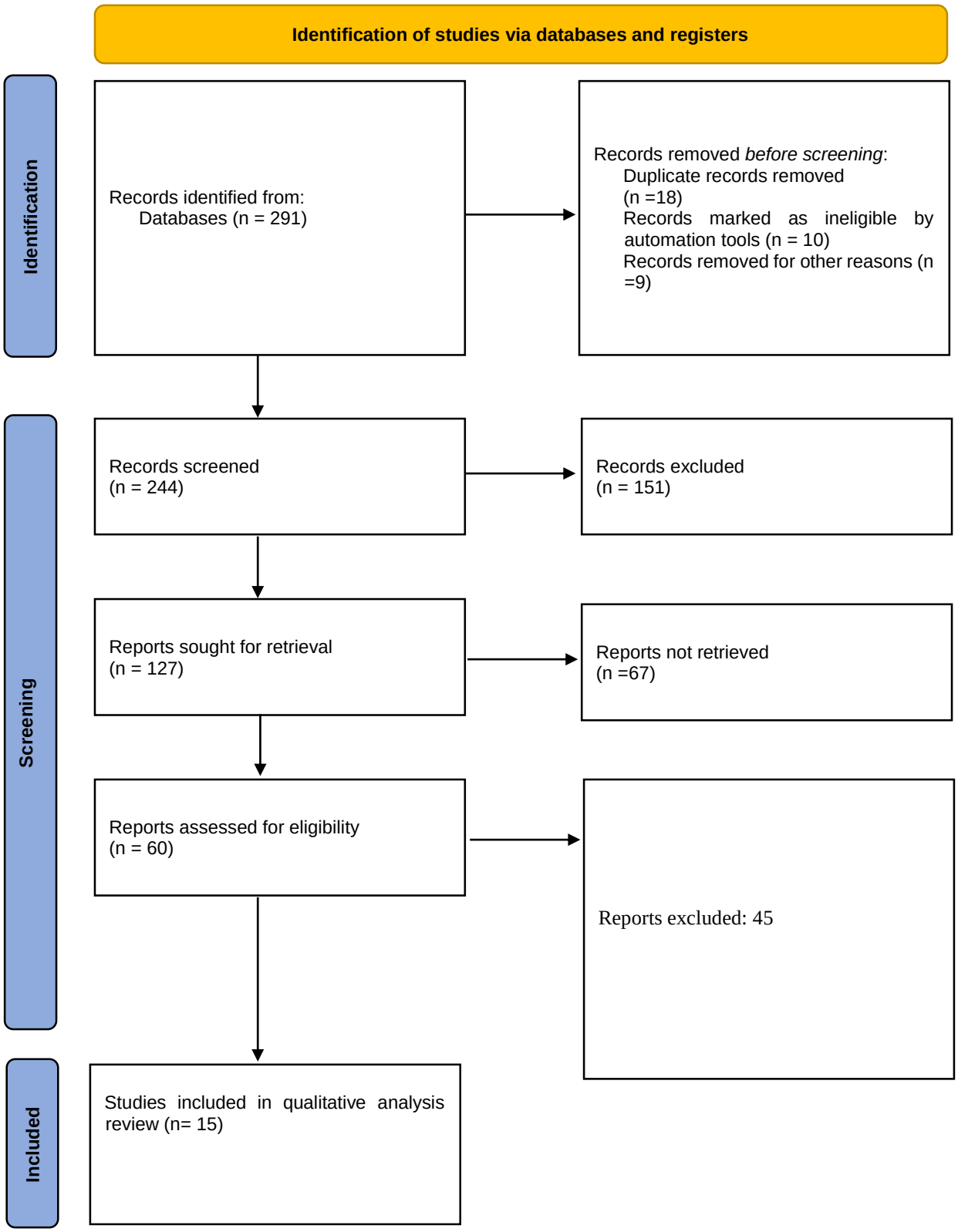
Five reports addressed prediction, providing indirect data relevant to examination selection rather than proof of prevented injuries (18-22). Harbin and Olson reported lower-back injury frequencies of 3% among workers meeting job requirements and 33% among those without matching capacity, while strength testing alone lacked predictive value (18). Among 600 male mineworkers, Legge et al. found that unmet functional demands predicted later injury after 1.3 years; the adjusted hazard ratio for any injury was 2.3, with a 95% confidence interval of 1.4-3.9 (19).

Nerve-conduction findings differed between cohorts, demonstrating that associations with future disease did not establish a reliable employment-screening strategy (20,21). In 1,027 newly hired workers, abnormal results predicted later carpal tunnel syndrome, although positive predictive values ranged from 6.4% to 18.5% (20). A separate cohort of 1,648 manufacturing workers found no association between abnormal screening results and incident syndrome, whereas high hand/wrist exposure predicted increased risk (21).

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Among 538 paramedics, 34 experienced a manual-handling injury, and baseline physical capacity scores did not differentiate subsequent injury risk (22)

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Table 1. Studies evaluating screening programmes or subsequent interventions

Study	Design and population	Examination or intervention	Finding and interpretation
Alexander et al., 1977	Prospective controlled evaluation; 6,125 applicants	General medical assessment for light-duty work	Medical risk classification did not distinguish attendance or performance; routine general screening lacked demonstrated occupational benefit (8).
de Raad and Redekop, 2004	Randomized trial; 352 soldiers	Job-related requirements versus traditional assessment	Mean fitness for duty: 648 versus 612 days over two years; findings apply to military selection (9).
Keyserling et al., 1980	Controlled industrial study; 81 applicants, 71 hires	Job-specific isometric strength standards	Medical-visit rates: 53.6 versus 120.8 per 100 person-years; small comparison groups restricted precision (10).
Rosenblum and Shankar, 2006	Nonrandomized comparison; 1,926 workers	Isokinetic screening matched to job demands	Unscreened workers had 2.38-fold higher injury odds; substantial differences between groups complicated causal interpretation (11).
Faris, 2008	Historical comparison; nursing personnel	Post-offer functional testing	Five versus 54 injuries; expenditure was also lower, with unequal comparison populations limiting interpretation (12).
Harbin et al., 2011	Historical comparison; custodial workers	Physical capacity matched to work requirements	Shoulder injury frequency: 0% versus 3.8%; historical controls limited attribution to testing alone (13).
Nassau, 1999	Longitudinal hospital programme	Functional screening within staged prevention measures	Injury severity, costs, and lost workdays declined; concurrent case management and return-to-work measures prevented isolation of screening effects (14).
De Looff et al., 1992	Smelter evaluation; 174 asthma cases	Addition of histamine provocation testing	Earlier/later hires accounted for 157/17 cases; exposure also declined, precluding interpretation as a simple relative-risk reduction (15).
Nachreiner et al., 1999	Matched observational study; 67 restricted workers, 264 controls	Assessment-linked work restrictions	No significant difference in musculoskeletal injury distribution; findings support accommodation research without establishing equivalence (16).
Knapik et al., 2006	Nonrandomized military programme; 2,072 recruits	Fitness assessment followed by preconditioning	Completion improved in initially unfit recruits; injury estimates differed by sex and baseline fitness (17).

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Table 2. Studies of predictive validity

Study	Population and follow-up	Predictive finding	Relevance to prevention
Harbin and Olson, 2005	Industrial testing; 2,482 applicants in the first study	Back injury frequency: 3% with matching capacity versus 33% without	Functional matching was associated with injury; isolated strength testing lacked predictive value (18).
Legge et al., 2013	600 male mineworkers; follow-up to six years	After 1.3 years, adjusted HR for any injury: 2.3; 95% CI 1.4-3.9	Prognostic association did not establish prevention from employment selection (19).
Dale et al., 2014	1,027 new workers; mean 3.7 years	Abnormal nerve conduction predicted CTS; PPV 6.4%-18.5%	Most positive screens did not identify future diagnosed cases (20).
Dale et al., 2016	1,648 manufacturing workers; five years	Abnormal screening did not predict CTS; high exposure RR 2.82, 95% CI 1.52-5.22	Findings favoured assessment of occupational exposure over this screening result (21).
Jenkins et al., 2021	538 paramedics; retrospective follow-up	Thirty-four manual-handling injuries; scores did not differentiate injury risk	No demonstrated predictive utility in this paramedic cohort (22).

Discussion

The data distinguishes selected benefits of job-related assessment from the broader claim that routine medical examinations prevent occupational harm between all jobs (5,8-14). Positive findings arose in physically demanding settings, where the assessment was linked to defined work requirements or subsequent preventive action (9-14,16,17). Their interpretation is constrained by historical controls, recruitment differences, short follow-up, and concurrent workplace changes, especially when lower injury frequency is attributed entirely to screening (5,11-14).

Test validity varied between occupations, supporting selection of assessment components rather than routine use of an undifferentiated examination battery (18-22). Additional longitudinal research involving 1,107 newly hired workers found no consistent protective relationship between baseline grip strength and upper-extremity symptoms, disability, or diagnosed musculoskeletal disorders (23). A separate examination study involving 1,108 new workers also documented low diagnostic yield for physical manoeuvres used to identify carpal tunnel syndrome, reinforcing the distinction between performing a test and obtaining useful screening information (24).

Employment decisions require attention because the number of applicants affected often exceeds the number who eventually develop the target outcome (3,20). An analysis of 101,754 pre-employment examinations reported an overall rejection proportion of 0.6%, with diagnoses recorded among approximately one-fifth of applicants (25). Another investigation found poor agreement between experienced occupational physicians reviewing applicant records, with an overall kappa of 0.38 among panel physicians, indicating substantial uncertainty in fitness judgments (26).

Routine imaging provides a further example of examination content exceeding demonstrated

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preventive value (2,27,28). La Rocca and Macnab found that lumbar radiographic abnormalities did not provide reliable individual prediction of later disability, challenging their use as employment-selection criteria (27). Lohiya et al. described discontinuing universal pre-employment chest radiographs after reviewing their limited occupational relevance, radiation exposure, and unnecessary expenditure (28).

Recent large datasets also require interpretation according to the outcomes actually measured, rather than sample size alone (29). A 2026 analysis of 100,000 pre-placement records linked previous lower-back problems with slightly reduced physical performance, without establishing whether screening prevented subsequent injury (29). Its findings inform assessment of functional differences, while longitudinal injury outcomes remain necessary for evaluating preventive effectiveness (29). The practical implication is a stronger focus on functional matching, exposure control, accommodation, and follow-up, accompanied by assessment of unintended employment consequences (1-3,16-22).

The present synthesis benefits from separating programme evaluations from predictive studies and from retaining conflicting findings between occupations and examination types. Its interpretation requires recognition of heterogeneous outcomes, incomplete information about rejected applicants, and the limited applicability of selected military and industrial cohorts to other workforces. The synthesis also places diagnostic yield and functional performance alongside injury outcomes without treating these distinct endpoints as interchangeable measures of successful occupational prevention.

Conclusion

Routine pre-employment medical examinations lack consistent data of preventing occupational injury and disease between diverse workplaces. Selected job-specific assessments reported favourable outcomes when linked to functional job requirements, training, or workplace accommodation. Predictive associations alone did not establish prevention, and several commonly used tests offered limited value. Interpretation requires attention to worker selection, historical comparisons, concurrent interventions, and employment consequences. Occupational health practice benefits from assessments directed at essential tasks and actionable risks, integrated with exposure control and follow-up.

Abbreviations

Abbreviation	Definition
CI	Confidence interval
CTS	Carpal tunnel syndrome
HR	Hazard ratio
PPV	Positive predictive value
PRISMA	Preferred Reporting Items for Systematic Reviews and Meta-Analyses
RR	Relative risk

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