

A systematic review of OHS interventions with economic evaluations

VOLUME 2 - Appendices

sharing best evidence

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Appendix A

Attendees at the first stakeholder workshop

External Participants

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	(WSIB)
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Norma Akinbiyi	WSIB
John Vander Dolen	Ministry of Labour
John MacNamara	Dofasco [by phone]
Richard Wells	University of Waterloo
Elizabeth Mills	Ontario Service Safety Alliance

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A systematic review of OHS interventions with economic evaluations

Appendix C

MEDLINE search strategy

Ovid Technologies, Inc. Email Service

Search for: limit 180 to yr="1990 - 2006" Results: 1

Database: Ovid MEDLINE(R) <1966 to July Week 4 2006> Search Strategy:

- 1 intervention studies/ (3462)
- 2 evaluation studies/ (120479)
- 3 intervention\$.mp. (252603)
- 4 evaluation\$.mp. (730245)
- 5 or/1-4 (948930)
- 6 workplace/ (5931)

- 7 work?place?.mp. (16072)
- 8 work?site?.mp. (1553)
- 9 work?environment?.mp. (0)
- 10 work environment?.mp. (3444)
- 11 work-environment?.mp. (3444)
- 12 work/ (6662)
- 13 worker?.mp. (88659)
- 14 employ\$.mp. (227253)
- 15 company.mp. (12077)
- 16 companies.mp. (9312)
- 17 employer?.mp. (8320)
- 18 organizations/ (5368)
- 19 organi#ation?.mp. (199323)
- 20 firm?.mp. (12318)
- 21 hospital?.mp. (611406)
- 22 hospitals/ (32072)
- 23 plant?.mp. (271454)
- 24 factory.mp. (4938)
- 25 factories.mp. (2115)
- 26 restaurant?.mp. (2231)
- 27 agricultur\$.mp. (33587)
- 28 office?.mp. (40638)

- 29 industry/ (15510)
- 30 industr\$.mp. (121169)
- 31 paid?work.mp. (0)
- 32 paid work.mp. (245)
- 33 paid-work.mp. (245)
- 34 or/6-33 (1464023)
- 35 HEALTH/ (14635)
- 36 Workers' Compensation/ (4707)
- 37 claim?.mp. (24813)
- 38 time#los?.mp. (0)
- 39 time los?.mp. (571)
- 40 time-los?.mp. (571)
- 41 lost?time.mp. (0)
- 42 lost-time.mp. (288)
- 43 lost time.mp. (288)
- 44 lost#time.mp. (0)
- 45 impairment?.mp. (113786)
- 46 SAFETY/ (23282)
- 47 OHS.mp. (440)
- 48 OSH.mp. (108)
- 49 disabilit\$.mp. (70486)
- 50 disease/ (12454)
- 51 disease?.mp. (2900919)
- 52 return#to#work.mp. (0)
- 53 return?to?work.mp. (0)
- 54 return to work.mp. (3097)
- 55 return-to-work.mp. (3097)
- 56 "Sprains and Strains"/ (2461)
- 57 mental health/ (9755)
- 58 trauma?.mp. (110625)
- 59 fatal\$.mp. (86359)
- 60 death/ (8881)
- 61 ACCIDENT PREVENTION/ or PRIMARY PREVENTION/ (15374)
- 62 "Wounds and Injuries"/ (38378)
- 63 low back pain/ (7238)
- 64 lower back.mp. (1261)
- 65 low back pain.mp. (11398)
- 66 lumbar vertebrae/ (24942)
- 67 lumbar vertebrae.mp. (25662)
- 68 exp cervical vertebrae/ (19962)
- 69 cervical vertebrae.mp. (18352)
- 70 thoracic vertebrae.mp. (10074)
- 71 thoracic vertebrae/ (9782)
- 72 intervertebral disk/ (6612)
- 73 intervertebral disk.mp. (15941)
- 74 shoulder/ (5905)
- 75 shoulder.mp. (27930)

- 76 exp arm/ (19621)
- 77 arm.mp. (70773)
- 78 upper arm.mp. (2779)
- 79 upper extremity.mp. (7676)
- 80 rotator cuff.mp. (3556)
- 81 rotator cuff/ (2261)
- 82 exp bursitis/ (2450)
- 83 bursitis.mp. (2096)
- 84 shoulder dislocation/ (3115)
- 85 shoulder dislocation.mp. (3161)
- tennis elbow/ (805)
- 87 tendinitis.mp. (1301)
- tennis elbow.mp. (925)
- 89 tendinitis/ (2523)
- 90 tenosynovitis/ (1781)
- 91 tenosynovitis.mp. (2189)
- 92 hip/ (5304)
- 93 hip.mp. (62677)
- 94 exp leg/ (43626)
- 95 lower limb.mp. (9967)
- 96 exp musculoskeletal diseases/ (570057)
- 97 cumulative trauma disorders/ (2339)
- 98 exp respiratory tract diseases/ (727565)
- 99 ACCIDENTS/ (10269)
- 100 illness\$.mp. (189100)
- 101 disorder?.mp. (855475)
- 102 sick\$.mp. (57850)
- 103 sick#leave/ (0)
- 104 sick leave/ (1529)
- 105 sick-leave.mp. (2658)
- 106 absenteeism/ (5522)
- 107 presenteeism.mp. (54)
- 108 productivity.mp. (13136)
- 109 REHABILITATION/ (9879)
- 110 therap\$.mp. (1328564)
- 111 Accidents, Occupational/ (11476)
- 112 re?employment.mp. (66)
- 113 injur\$.mp. (428011)
- 114 occupational diseases/ (61290)
- 115 functional limitation.mp. (552)
- 116 physical capacity.mp. (666)
- 117 work#capacity.mp. (0)
- 118 work capacity.mp. (6425)
- 119 work-capacity.mp. (6425)
- 120 work?capacity.mp. (0)

- 121 work limitation?.mp. (67)
- 122 work#related.mp. (0)
- 123 work?related.mp. (2)
- 124 work related.mp. (5155)
- 125 work-related.mp. (5155)
- 126 time#on#benefit?.mp. (0)
- 127 time?on?benefit?.mp. (0)
- 128 time-on-benefit.mp. (0)
- 129 time on benefit.mp. (0)
- 130 benefit?.mp. (223976)
- 131 lost#workday?.mp. (0)
- 132 lost?workday?.mp. (0)
- 133 lost workday?.mp. (115)
- 134 lost-workday?.mp. (115)
- 135 wage#replacement.mp. (0)
- 136 wage?replacement.mp. (0)
- 137 wage replacement.mp. (24)
- 138 wage-replacement.mp. (24)
- 139 risk/ (74992)
- 140 or/35-139 (5563473)
- 141 cost?.mp. (222371)
- 142 expense?.mp. (15111)
- 143 saving?.mp. (26764)
- 144 economic.mp. (65526)
- 145 financial.mp. (42408)
- 146 los#reduction.mp. (1)
- 147 payback.mp. (146)
- 148 internal#rate#of#return.mp. (0)
- 149 internal?rate?of?return?.mp. (0)
- 150 internal rate of return.mp. (34)
- 151 internal-rate-of-return.mp. (34)
- 152 return#on#investment.mp. (0)
- 153 return?on?investment.mp. (0)
- 154 return on investment.mp. (317)
- 155 return-on-investment.mp. (317)
- 156 pay?back?.mp. (162)
- 157 medical care.mp. (22365)
- 158 or/141-157 (334000)
- 159 osteoporosis/ (22047)
- 160 osteoarthritis/ (19956)
- 161 arthritis/ (18094)
- 162 child/ (994498)
- 163 exp Guillain-Barre Syndrome/ (1488)
- 164 exp hospitalization/ (100054)
- 165 sports/ (15139)
- 166 congenital.mp. (142577)
- 167 exp "Legal Cases [Publication Type]"/ (7698)

- 168 exp Guillain-Barre Syndrome/ (1488)
- 169 exp Fetus/ (84181)
- 170 exp Skin Diseases/ (558812)
- 171 exp Neoplasms/ (1784465)
- 172 exp Diabetes Mellitus, Experimental/ or exp Diabetes Insipidus,
- Nephrogenic/ or exp Diabetes Mellitus, Lipoatrophic/ or exp Diabetes
- Mellitus, Type 2/ or exp Diabetes Insipidus/ or exp Diabetes Mellitus,
- Type 1/ or exp Diabetes, Gestational/ or exp Diabetes Insipidus,

Neurogenic/ or exp Diabetes Complications/ or exp Diabetes Mellitus/ (197578)

- 173 Pregnancy/ (531852)
- 174 exp Horses/ (44080)
- 175 exp Renal Dialysis/ (69884)
- 176 exp Arthroscopy/ (9165)
- 177 or/159-176 (3898536)
- 178 5 and 34 and 140 and 158 (14564)
- 179 178 not 177 (9807)
- 180 limit 179 to (humans and english language) (7447)
- 181 limit 180 to yr="1990 2006" (6568)
- 182 from 181 keep 1 (1)

Appendix D

Title and abstract selection guidelines

Question	Include	Exclude
#1 Does the title/abstract refer to an intervention study?	 Intervention studies: ergonomic interventions return-to-work interventions health promotion programs directed at reducing work-related illness/injury other interventions focused on work-related injury/illness prevention 	 observational data studies where no change has been implemented
#2 Does the title/abstract imply/refer to a workplace setting ?	If setting is: • workplace • worksite • work environment • firm / company • employment / job • workstation • employer-based • farm If subjects are: • workers / employees • labourers • include regardless of categories of paid employment	If subjects are: homemakers volunteers self-employed unpaid family help (farm or other business) If setting is: outside the workplace an army or naval base
#3 Does the title/abstract refer to primary or secondary prevention (i.e., reduce work- related injuries/illnesses or minimize the impact of injury/illness on work disability)?	 If objectives are to reduce the following: the incidence or severity of any work-related injury/illness for primary prevention, work-related 	 If outcomes are: smoking, drinking, illegal drug use, level of physical activity or other health-related behaviours for primary

Question	Include	Exclude
FLAG Note whether the study is on primary or secondary prevention	 injury/illness for primary prevention, mental health outcomes caused by work exposure for secondary prevention, disability arising from any injuries/illnesses for secondary prevention, mental health even if it is due to exposure outside of work 	prevention, exclude mental health due to exposure outside of work
#4 Does the title/abstract refer to (or suggest) an economic evaluation or costing study? **FLAG** Literature reviews Methods papers Comments/Letters referring to other papers (not a candidate study, but may be used as source of references, etc.)	 Economic evaluations: cost-minimization, cost- benefit, cost- effectiveness, cost- utility, cost analysis studies If both costs and consequences are considered Include studies that look at outcomes measured in term of dollars (e.g., cost saving, cost reductions in health care, insurance, etc.) Include studies that consider productivity (e.g., reduced cost absenteeism) 	 If title/abstract makes no reference to costs, savings, or application of economic evaluation methodology

Appendix E

Quality assessment tool

Overarching questions that frame the purpose of the study and the nature of the intervention

1) Was the conceptual basis of, and/or the need for the intervention explained and sound?- there should be some description of why the intervention is being considered and evaluated, both a motivation for undertaking the intervention and the choice of the intervention

- related to this, is a well-defined question posed in an answerable form?

- this may be based on theory, previous studies in the field, and/or previous experience

- this may also be based on evident problems (as opposed to theory) and factual evidence, such as analysis of injury statistics, risk factors assessment, etc.

- information about this should generally be found in the introduction or literature review section, though it may not be expressly stated as a hypothesis statement

1 (there is no indication of why the intervention was undertaken)
5 (there was a clear articulation of the conceptual basis for undertaking the intervention)

2) Was the intervention clearly described?

- a detailed description of the intervention is required to be able to assess its merits

- also, to appropriately apply the intervention in another setting, the details of intervention need to be articulated such as program content, process issues, duration

1 (few details about the nature of the intervention are provided)
5 (the intervention is clearly described)

3) Were the study population and context clearly described?

- external validity or generalizability can only be assessed if the key variables are described so that reader can assess transferability to other settings

- key sociodemographic characteristics include age, gender, experience, occupation, experience

- key factors that are important to present data on include industry, firm size, company performance characteristics (injury/illness experiences, profitability and growth), company commitment to OHS, and major trends and patterns (prior to the intervention) related to outcomes and contextual factors of interest

1 (the study population and context are poorly described)
5 (the study population and context are clearly described)

Study design and issues related to evaluation the intervention's effectiveness

4) Rank the means by which selection and confounding are controlled for through study design?

- consider the strengths and weaknesses of different designs

- experimental design possibilities— the key characteristics are randomization and having a control group

- cohort-control assignment random (at individual, team, or workplace level)—there should be measurement of baseline differences and the analysis may control for these differences through regression modelling

- quasi-experimental design possibilities—the key characteristic is having a control group - cohort-control with assignment not randomized (N.B. It is not possible to have case-control design, since an intervention requires a planned exposure change which is then evaluated in terms of outcomes compared to one or more alternatives. With a case-control design, one starts with differences in outcomes then looks back at exposures.)

- measurement and control for baseline differences in key characteristics, possibly by matching key characteristics at baseline or controlling for these characteristics through regression modelling

- non-experimental design possibilities—the key characteristic is not having a control group i) interrupted time series – there are multiple measures of explanatory characteristics and outcomes of interest prior to and after exposure with differences in explanatory characteristics possibly controlled for through regression modelling— this design type was put into quasiexperimental design category by Shannon et al. (1999)

ii) before-after without control—measurement of differences in explanatory characteristics and outcomes before and after exposure

iii) post-only one-group design— measurement is only taken after the intervention iv) non-equivalent dependent variable—a different outcome measure not thought to be affected by exposure is evaluated before and after the intervention along with the key outcome variable this design type was put into quasi-experimental design category by Shannon et al. (1999)

1 (the study design does not adequately address confounding)
 5 (the study design adequately address confounding)

5) Were appropriate statistical analyses conducted?

- at a minimum, statistical methods should be clearly described

- statistics provide information on the significance of observed differences in outcomes

- it also allows one to control for differences between control and intervention groups

- statistical adjustment allows one to control confounding factors within each group, including individual and contextual characteristics

- statistics can also be used to address temporal sequencing issues

- the statistical approach should be congruous with the nature of the underlying phenomenon being studied (e.g., time in a certain state is usually modelled with duration modelling approaches), and the characteristics of the data (e.g., for an outcome that is an integer, it is customary to use a Poisson regression model)

1 (the statistical analyses were not appropriate)
5 (the statistical analyses were appropriate)

6) Are exposure, involvement, and intensity of involvement in the intervention appropriate?
- is the exposure, involvement and intensity of involvement in the intervention appropriate?
- in a clinical setting, this would be interpreted as compliance with the treatment regime, whereas in the workplace setting, factors such as an active ergonomics change team, actual changes implemented, and use of new equipment/procedures would be indicative of involvement, intensity of involvement, and exposure

- one needs to keep in mind the purpose of the study

- a key factor may be the measurement time frame, which needs to be long enough to be able to have an impact on outcomes and be effective on a longer-term basis (i.e., sustainable)
- it requires information on the proportion of sample affected by intervention and the details of their involvement

- need to make a distinction between a poorly reported and executed intervention versus a wellexecuted one that is not effective—in this question we are focusing on what actually happens in the intervention (clear reporting is important, but not the focus of this question)

1 (exposure is not described and/or is not appropriate)
5 (exposure is appropriate)

7) Are the outcomes included in the analysis appropriate?

- one needs to keep in mind the purpose of the study

- a key factor may be the measurement time frame, which needs to be long enough to be able to clearly assess effectiveness and sustainability (if applicable) of the intervention for the outcome being considered (e.g., an intervention to address cumulative trauma injury cannot be measured evaluated over a six-month period; it needs to be longer for changes to the outcome to surface) - it may be appropriate to consider more than one outcome if it is difficult to accurately measure the outcome of interest, e.g., implementation outcomes, intermediate outcomes, final outcomes, unintended outcomes

- other factors also bear on the quality of outcome measures used—e.g., are they self-reported, questionnaires, objective measures, review of charts, administrative database, blinded or unblended outcome assessment?

- if intermediate outcomes are considered, the authors need to substantiate their choices and demonstrate that they are related to final outcomes of interest (i.e., injuries and illnesses)

1 (the outcomes included in the analysis are not appropriate)
5 (the outcomes included in the analysis are appropriate)

Measurement and analytic issues related to the economic evaluation

8) Were all relevant comparators explicitly considered?

- did the study involve comparison of one or more alternatives?
- was the comparator(s) explicitly stated?
- were these alternatives reasonable, and were any important alternatives omitted?
- the status quo may be an implied comparator

1 (no comparator explicitly considered)
5 (all relevant comparators were explicitly considered)

9) Was the study perspective explicitly stated and appropriate?

- the study perspective may be explicitly stated, implied or not clear

- the perspective taken can be that of the firm, worker, workers' compensation board, society or multiple perspectives

- in some studies the perspective may be implied (e.g., firm perspective may be implicit by the nature of the types of costs and consequences considered)

- consistent measurement of costs and consequences with the perspective is considered later in the quality assessment

- was the chosen perspective appropriate given the study objectives, distribution of resulting costs and consequences, etc?

- a related issue is the kind of economic evaluation undertaken- e.g., doing CBA from the perspective of an not-for-profit public insurer seems less appropriate than CEA or CUA

1 (perspective is not explicitly stated and not appropriate)
5 (the perspective is explicitly stated and is appropriate)

10) Were all important costs and consequences considered in the analysis, given the perspective?

- perspective is important to consider, since it will determine the relevant costs and consequences

- it is also important that the analytic time frame is defined appropriately (i.e., it considers the lifetime of the intervention)

- were future costs and future consequences considered (this would be appropriate whenever applicable – e.g., for ongoing interventions/programs)?

1 (a number of important costs and consequences were overlooked)
 5 (all important costs and consequences were included in the analysis)

11) Are the measures of costs and consequences appropriate?

- accurate valuation of costs and consequences can present some critical challenges

- it is important to identify prices that correctly reflect the value of resources embodied in the costs and consequences under consideration

- it is also important to identify prices that are consistent with the perspective taken

- it is also important to measure incremental costs and consequences attributable to an intervention, rather than the total costs incurred and consequences realized

- in valuing costs, studies may simply take "sticker price" at face value, without questioning whether they reflect the true costs

- it is important to ensure there is no double counting in the measurement of different cost and consequence components of the intervention

- also, were future costs and possible future consequences appropriately

identified/measured/valued (whenever applicable – e.g., for ongoing interventions/programs)? - the evaluations of adjustments for inflation and time preference are treated separately below

1 (costs and consequences were not well measured)
5 (all costs and consequences were well measured)

12) Was there appropriate adjustment for inflation and time preference?

- there should be clear indication that monies from different years were adjusted for the consumer price index and discounted for time preference

1 (time preference and inflation were not considered)
 5 (there was appropriate adjustment for inflation and time preference)

13) Was there appropriate use of assumptions and treatment of uncertainty?

- consider assumptions made in projecting costs and consequences into the future, assumptions made about the relationship between intermediate and final health outcomes, assumptions made about values of proxy measures and any other assumptions

- any assumptions made should be tested for their impact on the robustness of results

- the assumptions should be justified and tested through sensitivity analysis

1 (assumptions were not justified and sensitivity analysis was not undertaken)
 1 (assumptions were not justified and sensitivity analysis was not undertaken)
 5 (there was appropriate use of assumptions and treatment of uncertainty)

Discussion and interpretation of results

14) *Did the presentation and discussion of study results include all issues of concern?* - was there an appropriate interpretation of statistical results?

- were the conclusions of the analysis based on some overall index or ratio of cost to consequences?

- were the statistical results appropriately interpreted and were proper conclusions/inferences made (given the study design, data and measurement quality, statistical power, etc.)?

- were the results compared to those of others who have investigated the same question (if applicable)?

- did the authors discuss important factors that could not be measured or events that could not be integrated into the analysis?

- did the study consider limitations of the data, measurement or analysis, or alternate interpretations?

- did the study consider (or fail to discuss) ambiguous results or "unexpected" findings?

- do they discuss the generalizability of the results to other settings?

- were other important issues discussed, such as the distribution of costs and consequences and ethical issues?

- did the study discuss issues of implementation?

Overall Ranking

15) Rank the overall quality of the study.

- consider the 14 items above and any other aspect of the study that you feel is pertinent to the overall study quality

□ 1 (low quality) □ □ □ □ 5 (high quality)

Appendix F

Guide to the Data Extraction Form for the Systematic Review of Workplace-based OHS Interventions with Economic Evaluations

Please read this guide before beginning the data extraction. It may be helpful to print this guide and have it available to refer to while doing the data extraction. Please extract the data from the articles you review by completing the form in the Excel spreadsheet and entering text in the provided areas.

Please read the questions carefully, especially the instructions in italics which provide details on how to enter the data. In the table below, the blue text provide some additional instructions that will help to ensure that the answers from different reviewers are consistent – please read this before beginning the data extraction. Also the text in red font provides some examples to illustrate specific responses.

All of the questions in the Excel spreadsheet should have an answer when you are

complete. If an article does not have the information necessary to answer a particular question, then enter "**NA**" for not provided in the text box for that question. It is important that all questions have answers because we will not know if an article did not have the information or a reviewer forgot to enter it if we allow blank answers. Remember, try not to interpret or extrapolate just provide the data that is presented in the article.

General Information

1. Reviewer:

Use first and last initials (CO, RD, ET)

2. Refman ID #

insert number use to track article

3. Short Reference

last name of first author, calendar year

4. Refer to the quality assessment questions and related guidelines for the next set of items, which are on inclusion and quality assessment.

Data Extraction Questions and Guidelines

1a. State the motivation for the intervention.

Please use the exact wording from the article or enter "not provided"

1b Identify the motivation category.

Use the number from the list provided.

1b. State the research question/objective

Please use the exact wording from the article or enter "not provided"

2. List the jurisdiction where the study was completed

(*Provide information regarding the country, region, province, city, etc. where the study was carried out - type "Not Provided" where applicable*) Country

Province/State/Region e.g., Mid-western USA

State

City

Enter "not provided" in all comment boxes where information is not available in article.

3. What Industry/Sector was the study conducted in?

(Check the one that applies)

http://www.statcan.ca/english/Subjects/Standard/naics/2002/naics02-menu.htm

0

Not provided

1 Agriculture, Forestry, Fishing and Hunting

2

Mining and Oil and Gas Extraction

3

Utilities

4 Construction

5

Manufacturing and Warehousing

6

Wholesale Trade 7 **Retail Trade** 8 Transportation 9 Information and Cultural Industries 10 Finance and Insurance 11 Real Estate and Rental and Leasing 12 Professional, Scientific and Technical Services 13 Management of Companies and Enterprises 14 Administrative and Support, Waste Management and Remediation Services 15 **Education Services** 16 Health Care and Social Assistance 17 Arts, Entertainment and Recreation 18 Accommodation Food Services 19 Other Services (Except Public Administration) 20

Public Administration

21 Multiple Sectors

Provide details in text form. Please refer to the NAICS 2002 classification system so that all reviewers are responding to this question in the same way. Use the two-digit category *http://www.statscan.ca/english/Subjects/Standard/naics/2002/naics02-menu.htm*.

4. Describe the job titles of the participants involved in the study.

Use text/prose to describe. Provide the level of detail given in the study or enter "not provided."

5. What type of prevention did the study investigate?

(Choose only one) 0 not clear

1

Primary

2 Second

Secondary

3 Both

Dot

4

Other

Indicate whether the study evaluated a primary, secondary or both types of prevention. If you choose other please provide details.

6. What was the intervention evaluated? (Check all that apply)

0 not provided

1

ergonomics

2

part ergonomics

3 return-to-work

4

train-the-trainer ergonomics program

5

not provided

7. Describe the Intervention

(*Provide details in the text box about the intervention type*)

Provide all details about the intervention that you feel are important (e.g., is it multi site, are there aspects that are not workplace based).

8. What is the study design?

(Choose only one) 0 not provided

1 randomized controlled

2 longitudinal (interrupted time series) controlled

3 before-after with control

4

longitudinal (interrupted time series) uncontrolled

5 before-after uncontrolled

6 post-only one group design

7

non-equivalent dependent variable

8

other

If other, please describe the unique characteristics verbatim about the study design in the comment boxes beside the choice you make.

9. List the inclusion and exclusion criteria used to select individuals into the event and control samples.

List inclusion and exclusion criteria, clearly indicating each by beginning with Inclusion: ... Exclusion:

Exclusion: ...

10. Indicate the calendar year in which the intervention began.

11. What is the duration of the intervention in months?

Duration of intervention in months (from start of intervention to last month of measurement)-- assume 6 months for start year if not otherwise specified.

12. What was the measurement time frame in months (for the component relevant to the economic evaluation)?

Measurement time frame is from the start of the measurement period (which could be before the beginning of the intervention) to the time of the last follow-up measurement.

13. What is the analytic time frame in months (for the component relevant to the economic evaluation)?

Analytic time frame is from the start of the measurement period to the end of the in which measurement and/or projections are made. It may be the same or longer than the measurement time period.

14. Describe the <u>Intervention</u> Group.

(*Provide answers for each category and identify what intervention each group received - use "Not Provided" where applicable)* Sample Size (in the statistical model) Group 1 = , Group 2 = , ...

Number of Individuals Targeted Group 1 = , Group 2 = , ...

Enter "not provided" in all comment boxes where information is not available in article.

15. Describe the <u>Referent</u> Group

(*Provide answer for each category and identify which intervention group each referent group was matched to - use "Not Provided" where applicable*) Sample Size (in the statistical model) Group 1 = , Group 2 = , ...

Number of Individuals Targeted Group 1 = , Group 2 = , ...

Enter "not provided" in all comment boxes where information is not available in article.

16. Describe overall (study) group - Answer only if paper did not provide information needed to answer questions 17 and 18.

(*Provide answer for each category - use "Not Provided" where applicable*) Sample Size Group 1 = , Group 2 = , ...

Number of Individuals Targeted Group 1 =, Group 2 =, ...

Place "not provided" in all comment boxes where information is not available in article. If this information is provided in questions 13 & 14 then enter "see Q13 & 14" in <u>EACH</u> comment box.

17. Were measures of involvement or exposure to the intervention presented and or used in the modeling?

0

No

1 Yes

Provide details in the comment box.

18. Describe the final outcomes considered in the economic evaluation.

0

not provided

1

absence

2

injuries

3

workers' compensation costs

4

productivity

8 other

Describe the final outcome measure in prose.

18a. **Data source.** 0 not provided 1 administrative

2 primary data collection (questionnaire, observation)

3 primary and administrative data

4 other

Describe the data source in prose.

18b. Unit of analysis.0not provided

1 individual

2 work group

3 department

4 plant/firm

5 other

If other, describe.

18c. **Periodicity.** 0 not provided

1 single point

2 before/after

3 weekly

4 monthly

5 yearly 6 other

If other, describe.

If there is more than one outcome of interest please number and identify them. Use a separate row on the spreadsheet for each outcome. Note, also fill out a unique number at the beginning of the row for that study and outcome.

19. Describe the intermediate outcomes considered in the economic evaluation.

0

not provided

1 absence

2 injuries

3 workers' compensation costs

4 productivity

8 other

Describe the intermediate outcome measure in prose.

19a. Data source for the intermediate outcomes.

0 not provided

1 administrative

2

primary data collection (questionnaire, observation)

3 primary and administrative data

4 other Describe the data source in prose.

19b. Unit of analysis for the intermediate outcomes.
onot provided
1
individual
2
work group
3
department
4
plant/firm
5
other

If other, describe.

19c. Periodicity of the intermediate outcomes.

0 not provided

1 single point

2 before/after

3 weekly

4 monthly

5 yearly

6

other

If other, describe.

If there is more than one intermediate outcome of interest please number and identify them. Use a separate row on the spreadsheet for each outcome. Note, also fill out a unique number at the beginning of the row for that study and outcome.

20. Please check the types of analysis done for testing the observed effect of the intervention from the list below and provide details about the analysis in the comment box.

(You should select the one that represents the final test not the preliminary analyses.)

not provided

1 difference analysis

2 anova/ ancova/ manova

3 regression modeling

4 other

> This question refers to the effectiveness analysis that feeds into the economic evaluation. Also describe in text form.

21. Describe the observed effect including its magnitude if provide.

(*Be brief and concise, i.e., enter "effect size", "risk ratio", "rate differences," mean differences" etc, the actual number and associated outcome*)

If there is more than one outcome of interest please number and identify them. Use a separate row on the spreadsheet for each outcome. Note, also fill out a unique number at the beginning of the row for that study and outcome.

22. What type(s) of economic evaluation was undertaken?

0 not clear

1 CBA 2 CEA 3 CUA 4 CMA

5 partial or other

If partial or other, describe.

If there is more than one economic evaluation of interest, please number and identify them. Use a separate row on the spreadsheet for each. Note, also fill out a unique number at the beginning of the row for that study and evaluation type.

23. List the key consequences measure used in the economic evaluation.

0 not clear

- 1 human capital
- 2 willingness-to-pay

3 statistical value of human life

4 quality adjusted life years

5 natural units

Describe in prose.

24. List the comparators considered in the economic evaluation.

1st comparator describe

2nd comparator describe

3rd comparator describe

4th comparator describe

24a. Are the alternatives explicitly stated?

0

no

1 yes

25. What is the perspective taken?

Perspective

0 not clear

1 societal

2

system (e.g., workers' compensation, public sector agency)

3

industry

4

firm

5

work

6

multiple

7 other

If other, describe.

25a. Is the perspective stated explicitly?

- 0
- no

1

yes

26a. Type of non-monetary consequences.

0

not clear

1

injuries

2

pain

3

days away from work due to injury

4

other

Describe in prose.

26b. Monetary consequences. productivity

(yes=1/no=0), describe.

insurance (yes=1/no=0), describe.

other (yes=1/no=0), describe.

consequences mentioned but not measured describe.

did the study consider all major consequence components of the intervention, given the perspective? (yes=1/no=0)

list missing consequence components describe.

N.B. Treat WC as an insurance expense unless study expressly refers to it as a proxy for productivity consequence based on it being a proxy for the value of human capital

26c. Monetary costs.

capital equipment (yes=1/no=0), describe.

external services (yes=1/no=0), describe.

internal staff time (yes=1/no=0), describe.

other (yes=1/no=0), describe.

costs mentioned but not measured describe.

did the study consider all major cost components of the intervention, given the perspective? (yes=1/no=0)

list missing cost components describe.

27. Were future costs and consequences taken into consideration?
0
1
yes
28. Was there discounting of funds from different time periods?
0
no
1
yes

28a. List the principal discount rate used in the analysis.

28b. Was inflation included in the discount rate?
0
no
1
yes

29. Was there adjustment for inflation?

no

1 yes

30. List the type of summary measure used.

0 not applicable

1

cost-benefit ratio

2

net present value (incl. the one without discounting)

3 cost-effectiveness/utility ratio

4

other

If other, describe.

31. Provide details about the results (numeric).

- 32. Was sensitivity analysis undertaken?
- 0
- no

1 yes

Describe the types of sensitivity analysis undertaken.

33. Describe critical assumptions implicit or explicit in the analysis (not conclusions).

34. Describe critical details.
Appendix G

Best Evidence Synthesis Guidelines

Quality Scores

High Quality: 3.5 - 5 Medium Quality: 2.5 - 3.4 Low Quality: 1 - 2.4

Best Evidence Synthesis Guidelines

Strong Evidence

 Minimum Study Quality:
 High

 Minimum Number of Studies:
 3

 1) If there are only three high quality studies, all studies must report consistent findings.

 2) The majority (≥3/4) of high and medium quality studies must concur with the findings.

 If the above criteria are not met, then the criteria for establishing moderate evidence are applied.

Moderate Evidence

Minimum Study Quality: Medium
Minimum Number of Studies: 2 high quality studies, or 3 of medium and high quality
1) The 2 high quality studies must agree, or the 3 studies constituting a mixture of medium and high quality must agree.
2) If there are four or more studies of medium and high quality, more than two thirds (>2/3) of all studies must report consistent findings.

If the above criteria are not met, then the criteria for establishing limited evidence are applied.

Limited Evidence

Minimum Study Quality: Minimum Number of Studies: Medium 1 high quality study, 2 medium quality studies, or 2 studies one of which is medium quality and the other high quality

1) If there are 2 studies, the studies must agree.

2) The majority (>50%) of medium and high quality studies must report consistent findings. *If the above criteria are not met, then there is no evidence or mixed evidence.*

Mixed Evidence

Findings from medium and high quality studies are contradictory.

Insufficient/No Evidence

No high quality studies One or no medium quality studies Any number of low quality studies

Appendix H



Title and abstract search results

*some of these 67 studies had multiple interventions, so that 72 interventions were examined in total

Appendix I

Characteristics of included studies





Appendix J

Summary of evidence by intervention study stratum

1) Accommodation and Food Services

- **Multi-faceted Interventions**
- 2 interventions
- 1 medium quality, 1 low quality
- insufficient/no evidence

2) Administrative and Support

Ergonomics and Other MSK Injury Prevention Interventions

- 8 interventions
- 2 high quality, 1 medium quality, 5 low quality
- moderate evidence

3) Educational Services

Ergonomic and Other MSK Injury Prevention Interventions

- 1 intervention
- 1 low quality
- insufficient/no evidence

4) Health Care

Occupational Disease Prevention Interventions

- 5 interventions
- 3 medium quality, 2 low quality
- moderate to limited evidence

Ergonomic and Other MSK Injury Prevention Interventions

- 11 interventions
- 4 medium quality, 7 low quality
- moderate evidence

Disability Management Interventions

- 5 interventions
- 1 medium quality, 4 low quality
- insufficient/no evidence

Multi-faceted Interventions

- 3 interventions
- 3 low quality
- insufficient/no evidence

Interventions to Reduce Violence in the Workplace

- 1 intervention
- 1 low quality
- insufficient/no evidence

5) Information and Culture

Ergonomic and Other MSK Injury Prevention Interventions

- 1 intervention
- 1 medium quality
- insufficient/no evidence

6) Manufacturing and Warehousing

Ergonomic and Other MSK Injury Prevention Interventions

- 9 interventions
- 3 high quality, 2 medium quality, 4 low quality
- strong evidence

Disability Management Interventions

- 3 interventions
- 1 medium quality, 2 low quality
- insufficient/no evidence

Multi-faceted Interventions

- 4 interventions
- 2 medium quality, 2 low quality
- limited evidence of negative findings to mixed evidence

7) Mining and Oil and Gas Extraction

Ergonomic and Other MSK Injury Prevention Interventions

- 1 intervention
- 1 medium quality
- insufficient/no evidence

Disability Management Interventions

- 2 interventions
- 1 medium quality, 1 low quality
- insufficient/no evidence

8) Multiple Sectors

Ergonomic and Other MSK Injury Prevention Interventions

- 1 intervention
- 1 low quality
- insufficient/no evidence
- •

Disability Management Interventions

- 5 interventions
- 4 high quality, 1 low quality
- strong evidence

Health Promotion Interventions

- 1 intervention
- 1 medium quality
- insufficient/no evidence

9) Public Administration

Ergonomic and Other MSK Injury Prevention Interventions

• 2 interventions

- 2 low quality
- insufficient/no evidence

Disability Management Interventions

- 1 intervention
- 1 low quality
- insufficient/no evidence

Health Promotion Intervention

- 1 intervention
- 1 low quality
- insufficient/no evidence

10) Retail and Trade

Érgonomic and Other MSK Injury Prevention Interventions

- 1 intervention
- 1 medium quality
- insufficient/no evidence

11) Transportation

Ergonomic and Other MSK Injury Prevention Interventions

- 3 interventions
- 1 high quality, 2 medium quality
- moderate evidence

12) Utilities

Disability Management Interventions

- 1 intervention
- 1 medium quality
- insufficient/no evidence

Appendix K Tables for Accommodation and Food Services

Table 1: Accommodation and Food Services, Description of Intervention (clustered by type of intervention and sorted by quality score)

Study reference	Motivation	Location	Industry details	Type of intervention	Description of intervention
Multi-faceted Interven	tions				
Landstad (2002)	high number of	Sweden	Health Care and Social Assistance	multiple (primary and secondary prevention)	An intervention consisting of group development, leadership development, massage, improved cleaning methods, training in floor
study quality: 3.0	injuries	County of Jämtland	hospital		care, lectures, fitness activities, development of the suggested activities, working out a work environment program, and development
multiple: ergonomics, training and health promotion program			cleaning personnel		of cooperation with other authorities.
cost-benefit analysis					
Landers (2004)	high cost of injuries	United States	Accommodation and Food Services	multiple (primary and secondary prevention)	An intervention consisting of ergonomics (modification of work environment); training (didactic classroom and practical on-the-job
study quality: 2.2	-	Nevada	hotel		education, practice and testing); and disability management (light duty program).
multiple: ergonomics, training and disability management program cost-benefit analysis		Las Vegas	guest room attendants, housekeeping supervisors, house persons		
			F		

Table 2: Accommodation and Food Services, Effectiveness Analysis (clustered by type of intervention and sorted by quality score)

Study reference	Start year	Exposure duration in months	Number of workers	Study design	Details of analysis	Information on uptake/ involvement	Effectiveness outcome measure	Observed effect including magnitude, if provided
Multi-faceted Inte	rventions	5						
Landstad (2002) study quality: 3.0 multiple: ergonomics, training and health promotion program cost-benefit analysis	NA	8	Treatment group: 97 Control group: 30	before-after with control	use of regression analysis to model change in total time-loss expenses at the individual level (ordinary least squares is assumed but not explicitly stated)		change in total time-loss expenses at the individual level (difference between expenses in 1985 and expenses in 1987)	 According to the human resources costing and accounting (HRCA) model, the intervention counteracted a rise in time-loss expenses at the company level, giving an average net effect of 266.5 Euros per person (full-time working) during an 8-month period. Using an analogue statistical analysis (regression modelling), the contribution of the intervention counteracted a rise in time-loss expenses at the company level giving an average net effect of 283.2 Euros (not significant at conventional levels). In the younger group, the intervention resulted in net contributions of 605.6 Euros (significant at 10% level), while the net contributions in the older group were 45.4 Euros (not significant at conventional levels).
Landers (2004) study quality: 2.2 multiple: ergonomics, training and disability management program cost-benefit analysis	1996	24	Treatment group: 395 Control group: 473	before-after uncontrolled	before-after comparison of medical expenses (comparison of medical expenses pre- intervention with medical expenses in each year post- intervention)	information provided on attendance for the training sessions, but no information on ongoing exposures	total claims, direct medical expenses, lost work days, reduced work days	 There was a reduction in total injury claims, total medical expenses, total lost work and total restricted duty time with the intervention. 1) Total injury claims decreased from 98 claims in 1995 to 68 and 37 claims in 1996 and 1997, respectively. 2) Direct medical expenses decreased from \$136,336 in 1995 to \$23,041 and \$16,197 in 1996 and 1997, respectively. 3) Total lost work time decreased from 718 days in 1995 to 97 and 25 days in 1996 and 1997, respectively. 4) Total restricted duty decreased from 2,079 days in 1995 to 521 and 913 days in 1996 and 1997, respectively.

Table 3: Accommodation and Food Services, Economic Analysis (clustered by type of intervention and sorted by quality score)

	Moneta	ary consequer	nces		Monetary	y costs		Other details			
Study reference	Productivity changes	Insurance and health- care savings	Other	Capital equipment expenditures	External services	Internal staff time	Other	Discounting	CPI adjustment	Sensitivity analysis	
Multi-faceted Interventions											
Landstad (2002)	yes						yes	NA	NA	yes	
study quality: 3.0											
multiple: ergonomics, training and health promotion program											
cost-benefit analysis											
Landers (2004)			yes				yes				
study quality: 2.2											
multiple: ergonomics, training and disability management program											
cost-benefit analysis											

Study reference	Alternatives considered	Perspective of analysis	Details of analysis	Outcome(s) used in economic analysis	Description of economic analysis results
Multi-faceted Inte	rventions				
Landstad (2002) study quality: 3.0	status quo	employer	payback period	time-loss expenses	Costs of the intervention: The cost of the intervention (for the 8- month period) was 139,534 Euros (no details provided on what this value includes).
multiple: ergonomics, training and health promotion program					Consequences of the intervention: Savings from the intervention over an 8-month period were 24,100 Euros (85.1 FTEs x 283.2 Euros per person). This includes savings obtained with time-loss expenses (difference between productive value time-loss due to absence before and after the intervention).
cost-benefit analysis					Result: The payback period (excluding interest costs) was 46.4 months (5.8 x 8-month periods).
Landers (2004)	status quo	employer	cost-benefit analysis	direct medical expenses	Costs of the intervention: Costs of management and implementation of the program were \$26,350 (USD).
study quality: 2.2 multiple: ergonomics					Consequences of the intervention: Saving of direct medical expenses over two years were \$233,434 (USD).
training and disability management program					Result: The benefit-to-cost ratio obtained was 8.86.
cost-benefit analysis					

Table 4: Accommodation and Food Services, Economic Analysis (clustered by type of intervention and sorted by quality score)

Appendix L Tables for Administrative and Support, Waste Management and Remediation Services

Table 1: Administrative and Support, Waste Management and Remediation Services, Description of Intervention (clustered by type of intervention and sorted by quality score)

Study reference	Motivation	Location	Industry details	Type of intervention	Description of intervention
Ergonomic and other MS	K Injury Preve	ntion Intervention	ons		
Amick (2003); DeRango (2003)	high number of injuries	United States	Administration	ergonomics (primary prevention)	Highly adjustable chair and a one-time office ergonomic training workshop with a series of educational follow-ups conducted concurrently with the chair distribution
study quality: 3.6	njanoo		services	provontion	
ergonomic program			office workers		
cost-benefit analysis					
Lahiri (2005)	high number of	United States	Manufacturing	ergonomics (primary	Lumbar pads and backrests were made available to employees to reduce back discomfort. Back school workshops were also conducted.
study quality: 3.5	injuries		automotive supplier	prevention)	
ergonomic program			office workers: secretaries, engineers, engineering		
cost-benefit analysis			technicians, managers, salespersons		
Rempel (2006)	high number of	United States	Health Care and Social Assistance	ergonomics (primary	Four workplace interventions compared:
study quality: 2.8	injuries			prevention)	Intervention A: ergonomic training
ergonomic program			call centre		Intervention B: trackball and ergonomic training Intervention C: forearm and support board (armboard) and ergonomic
cost-benefit analysis			customer service workers at call centre (either registered nurses or health-care specialists)		training Intervention D: forearm support board (armboard), trackball, and ergonomic training.
Bradley (1996)	high number of	United States	Administration	ergonomics (primary and	Ergonomic program consisting of training and workstation redesign.
study quality: 2.2	injuries and high costs	Florida	electric transmission and distribution	secondary prevention)	
ergonomic program	of injuries		employees working with	. ,	
cost-benefit analysis			computers		
Kemmlert (1996)	high costs of injuries	Sweden	Administration	ergonomics (primary	Ergonomic program consisting of workplace assessment and redesign: new chair, manuscript support, wrist support, change in workplace
study quality: 2.2	,		public administration department	prevention)	layout to reduce reaching and viewing distances; ergonomic training; more frequent breaks and pauses for variation.
ergonomic program			computer operators		
cost-benefit analysis					

Table 1 (continued): Administrative and Support, Waste Management and Remediation Services, Description of Intervention (clustered by type of intervention and sorted by quality score)

Study reference	Motivation	Location	Industry details	Type of intervention	Description of intervention
Ergonomics and Other MSK In	jury Preventior	Interventions	(continued)		
Tadano (1990)	high number of injuries	United States	Administration	multiple (primary	Ergonomic program consisting of training, workstation redesign, and health promotion (exercises and mini-breaks).
study quality: 2.0			telecommunications	prevention)	
multiple: ergonomics and health promotion program			employees working with computers		
cost-benefit analysis					
Wahl (1998)	not provided or not clear	United States	Administration	ergonomics (secondary	Workstation evaluation which consisted of an interview (to determine tasks performed and gauge workers' understanding of risk factors for
study quality: 1.9		Colorado	clerical class	prevention)	cumulative trauma), observation of workers performing their regular duties: explanation of risk factors for cumulative trauma, and
ergonomic program			office workers/clerks		adjustment of workstation.
cost-benefit analysis					
Lewis (2002)	high number of injuries	United States	Administration	ergonomics (primary	Training program for proper computer use.
study quality: 1.9	,	New Jersev	petrochemical research and development	prevention)	
ergonomic program		,			
partial economic analysis			computers (VDT users)		

Table 2: Administrative and Support, Waste Management and Remediation Services, Effectiveness Analysis (clustered by type of intervention and sorted by quality score)

Study reference	Start year	Exposure duration in months	Number of workers	Study design	Details of analysis	Information on uptake/ involvement	Effectiveness outcome measure	Observed effect including magnitude, if provided
Ergonomics and	Other MS	K Injury Prev	ention Intervention	S				
Amick (2003); DeRango (2003) study quality: 3.6 ergonomic program cost-benefit analysis	2001	12	Intervention groups: 1) 88 in chair with training group 2) 61 in training only group Control group: 59	before-after with control	 total effects model, estimated with both fixed and random effects regression modeling, where the dependent variable was productivity per effective day health-mediated model estimated with a two-step approach (fitted values of changes in pain used as explanatory variables to estimate productivity changes) 	no	sick leave hours per month, productivity per effective day	 Neither intervention had an impact on sick leave hours; The health-mediated model found training alone did not have a statistically significant effect on pain levels, whereas the chair-with-training intervention significantly reduced pain (5.95 to 6.23 points for the fixed and random effects models respectively); The second step of the approach found improved productivity effects which were significant (a one point improvement in pain was associated with a \$13.25 and \$19.14 increase in production per effective workday for the fixed and random effects models, respectively).
Lahiri (2005) automotive supplier case study study quality:3.5 ergonomic program cost-benefit analysis	NA	144	637	before-after uncontrolled	before-after comparison of back pain cases, sick days due to low-back pain, and productivity changes	annual average number of employees subject to intervention (out of total number of employees)	 cases of low- back pain; sick days due to low-back pain; medical care costs (incl. for no-lost time cases); productivity 	1) total back pain cases: reduction from 41 to 12; acute back pain cases: reduction from 3 to 2; annual average number of sick days due to back pain: reduction from 20 to 0; 2) avoided lost time costs from work due to low back of \$4,800 (annual); avoided medical care costs of \$96 (annual); 3) total annual productivity gain: \$66,384 (\$3,984 in avoided productivity loss + \$62,400 in productivity enhancement)

Table 2 (continued): Administrative and Support, Waste Management and Remediation Services, Effectiveness Analysis (clustered by type of intervention and sorted by quality score)

Study reference	Start year	Exposure duration in months	Number of workers	Study design	Details of analysis	Information on uptake/ involvement	Effectiveness outcome measure	Observed effect including magnitude, if provided	
Ergonomics and Other MSK Injury Prevention Interventions (continued)									
Rempel (2006) study quality: 2.8	2002	12	Group A: ergonomic training only – 46	randomized controlled trial	Cox regression modelling	no	incidence of neck/shoulder disorders	For the armboards, the hazard rate was 0.49 of incident neck/shoulder disorders (95% Cl 0.24 to 0.97). The armboards reduced the risk of incident	
ergonomics			Group B: ergonomic training					neck-shoulder disorder by approximately one half.	
cost-benefit analysis			and trackball – 45						
			Group C: ergonomic training and armboard – 46						
			Group D: ergonomic training, trackball, and armboard – 45						
Bradley (1996)	1992	30	NA	before-after	before-after comparison of	no	number and	There were 5 serious RSIs prior to the intervention and 35 early reported	
study quality: 2.2				uncontrolled	repetitive strain injuries (RSIs)		RSIs	cases after the intervention with no time loss associated with them.	
ergonomic program									
cost-benefit analysis									
Kemmlert (1996)	NA	NA	60	before-after	before-after comparison of sick leave and associated	no	value of sick	There was a 5% reduction in sick	
study quality: 2.2				uncontrollod	expenses / savings		absenteeism (associated	reflected in savings of \$40,603 US per vear. There were also savings due to	
ergonomic program							losses and expenses	reduced training of new recruits of \$3,980 US per year based on reduced	
cost-benefit analysis								overtime of \$22,839 US per year based on absenteeism requiring 1 hour of overtime per day off and 50% premium on overtime; savings due to reduced recruitment of employees of \$5,846 US per year based on 1 less recruitment per year; and finally, savings due to reduced training of new recruits of \$7,647 US per year based on reduced turnover.	

Table 2 (continued): Administrative and Support, Waste Management and Remediation Services, Effectiveness Analysis (clustered by type of intervention and sorted by quality score)

Study reference	Start year	Exposure duration in months	Number of workers	Study design	Details of analysis	Information on uptake/ involvement	Effectiveness outcome measure	Observed effect including magnitude if provided		
Ergonomics and (Ergonomics and Other MSK Injury Prevention Interventions (continued)									
Tadano (1990)	1988	6	500	before-after uncontrolled	before-after comparison of number of RSI cases	no	number of RSI claims	There was a reduction in the number of reported RSI cases from 49 to 28.		
study quality: 2.0										
multiple: ergonomics and health promotion program										
cost-benefit analysis										
Wahl (1998)	1995	24	Intervention group:	post-only with control	odds ratio of a claim becoming an LT claim based on whether	no	status of the claim (LT or	The odds of a claim becoming a LT claim was 3.06:1 if the individual did		
study quality: 1.9			72, consisting of 5 lost-time (LT)		or not the individual received the intervention		NLT); workers' compensation	not receive the intervention compared to if the individual received it.		
ergonomic program			and 67 non lost- time (NLT) claims				expenses associated with the claim			
cost-benefit analysis			Control group							
			129, consisting of 24 LT and 105 NLT claims							
Lewis (2002)	1995	48	292 (number of individuals	before-after uncontrolled	before-after comparison of injury rates for computer-	no	injury rates and workers'	The average injury rate was reduced from 16.8 per 1,000 employees to		
study quality: 1.9			taking training, which differs		related MSK claims		compensation expenses	6.94 per 1,000 employees (number of claims was 12 before and 18 after the		
ergonomic program			from the number of individuals represented in				associated with computer- related MSK	intervention).		
partial economic analysis			the effectiveness analysis)				claims			

 Table 3: Administrative and Support, Waste Management and Remediation Services, Economic Analysis (clustered by type of intervention and sorted by quality score)

Monetary consequences					Monetary	/ costs		Other details		
Study reference	Productivity changes	Insurance and health- care savings	Other	Capital equipment expenditures	External services	Internal staff time	Other	Discounting	CPI adjustment	Sensitivity analysis
Ergonomics and Other MSK	njury Preventio	n Interventions		•				•		
Amick (2003); DeRango (2003)	yes			yes	yes	yes				yes
study quality: 3.6										
ergonomic program										
cost-benefit analysis										
Lahiri (2005)	yes	yes		yes	yes	yes		yes	yes	yes
study quality: 3.5										
ergonomic program										
cost-benefit analysis										
Rempel (2006)		yes		yes				NA	NA	
study quality: 2.8										
ergonomics										
cost-benefit analysis										
Bradley (1996)		yes		yes		yes				
study quality: 2.2										
ergonomics										
cost-benefit analysis										
Kemmlert (1996)	yes	yes	yes	yes		yes		NA	NA	
study quality: 2.2										
ergonomic program										
cost-benefit analysis										

Table 3 (continued): Administrative and Support, Waste Management and Remediation Services, Economic Analysis (clustered by type of intervention and sorted by quality score)

	Mone	tary consequen	ces		Monetary	y costs			Other details	
Study reference	Productivity changes	Insurance and health- care savings	Other	Capital equipment expenditures	External services	Internal staff time	Other	Discounting	CPI adjustment	Sensitivity analysis
Ergonomics and Other MSK Injury Prevention Interventions (continued)										
Tadano (1990)			yes		yes			NA	NA	
study quality: 2.0										
multiple: ergonomics and health promotion program										
cost-benefit analysis										
Wahl (1998)		yes				yes				
study quality: 1.9										
ergonomic program										
cost-benefit analysis										
Lewis (2002)		yes					-	NA	yes	
study quality: 1.9										
ergonomic program										
partial economic analysis										

Table 4: Administrative and Support, Waste Management and Remediation Services, Economic Analysis (clustered by type of intervention and sorted by quality score)

Study reference	Alternatives considered	Perspective of analysis	Details of analysis	Outcome(s) used in economic analysis	Description of economic analysis results
Ergonomics and o	other MSK Injury Prevention Interve	ntions			
Amick (2003); DeRango (2003) study quality: 3.6 ergonomic program	Alternative A: chair with training Alternative B: training only Alternative C: status quo	employer	cost-benefit analysis	value of productivity per year	Costs of the intervention: Total costs per worker were \$1,032. This includes cost of the chair (\$800 per person), trainers' time and travel expenses (\$200 per worker), and labour costs of the 90- minute training session (\$32 per worker) (USD). Consequences of the intervention: The increase in taxes collected per worker per year (based on the health mediated model) was \$25,398.12 (USD). There was no change in absenteeism.
cost-benefit analysis					Result: The benefit-cost ratio was 24.61.
Lahiri (2005) automotive supplier case study study quality:3.5 ergonomic program cost-benefit analysis	status quo	employer	cost-benefit analysis	 medical care costs associated with low- back pain cases; value of lost work time due to sick leave (productivity); productivity loss due to low-back pain at work; productivity enhancements due to intervention 	Costs of the intervention: Costs per year were \$839 which include equipment, internal labour costs (likely including installation and maintenance; internal training and other time costs), and cost of back school workshops. Consequences of the intervention: Savings per year were \$71,280 which include avoided medical care costs, avoided loss in work time due to sick leave, productivity losses (averted) due to low- back pain and discomfort while at work (before intervention), and productivity enhancements due to intervention. Results: Net savings per year were \$70,441 with savings per worker of \$111. The benefit-to-cost ratio was 84.9 and the payback period was 0.5 months (all 2002 dollars).
Rempel (2006) study quality: 2.8 ergonomics cost-benefit analysis	Alternative A: ergonomic training Alternative B: trackball and ergonomic training Alternative C: forearm support board (armboard) and ergonomic training Alternative D: forearm support board (armboard), trackball, and ergonomic training	employer	cost-benefit analysis	workers' compensation expenses	Costs of the intervention:: Estimated retail cost of the armboard intervention plus installation was \$75 per operator. Consequences of the intervention: Savings in workers' compensation expenses associated with neck/shoulder injuries were estimated to be \$11,540 per neck/shoulder injury. Result: The payback period was 10.6 months, based on the assumption that the incidence of accepted claims for neck/shoulder injuries among customer service operators at the company is 0.0144 and the neck/shoulder injury reduction from the intervention is 49% (taken from the estimated hazard rate).

Table 4 (continued): Administrative and Support, Waste Management and Remediation Services, Economic Analysis (clustered by type of intervention and sorted by quality score)

Study reference	Alternatives considered	Perspective of analysis	Details of analysis	Outcome(s) used in economic analysis	Description of economic analysis results				
Ergonomics and C	Ergonomics and Other MSK Injury Prevention Interventions (continued)								
Bradley (1996)	status quo	employer	partial economic	workers' compensation	Costs of the intervention: No intervention costs considered.				
study quality: 2.2			analysis	expenses associated with	Consequences of the intervention: Savings in workers' compensation expenses associated with RSIs.				
ergonomic				RSIs	Beauty The total easts for the Elegand ware \$62,629,000 and for				
program					the 35 cases were \$2 886 25. Savings were estimated to be				
partial economic analysis					\$442,515.61 based on the assumption that the 35 cases could have been as costly as the 5 prior to intervention (USD).				
Kemmlert (1996)	status quo	employer	cost-benefit		Costs of the intervention: Costs were \$19,316 (USD): this				
study quality: 2.2		employer	analysis		includes the costs with education and the acquisition of chairs and wrist and manuscript supports				
Study quality. 2.2					what and manuscript supports.				
ergonomic program					Consequences of the intervention : Benefits were \$76,935 (USD) (benefits for a one-year period); this includes gains with				
cost-benefit analysis					reduced sick leave, reduced overtime, reduced recruitment and reduced introduction of new employees.				
unuryolo					Result: The payback period was estimated at 3 months.				
Tadano (1990)	status quo	employer	cost-benefit analysis	workers' compensation	Costs of the intervention: Costs were \$10,000 which includes the therapist hired (USD).				
study quality: 2.0			,	expenses					
multiplo:				associated with RSI	Consequences of the intervention: The reduction in claims from				
ergonomics and				Ciairis	total savings of \$63,053.34 (USD).				
program					Result: The net savings were \$53,053.34 over a 6-month period				
cost-benefit analysis					(000).				

Table 4 (continued): Administrative and Support, Waste Management and Remediation Services, Economic Analysis (clustered by type of intervention and sorted by quality score)

Study reference	Alternatives considered	Perspective of analysis	Details of analysis	Outcome(s) used in economic analysis	Description of economic analysis results
Ergonomics and (Other MSK Injury Prevention Inte	rventions (continu	ed)		
Wahl (1998) study quality: 1.9	status quo	system	cost-benefit analysis	workers' compensation expenses per claim	Costs of the intervention: Costs include \$95 per visit for each workplace assessment visit by a prevention specialist. This includes wage, benefits, and overhead (USD).
ergonomic program cost-benefit analysis				NB: all cases were either closed or had reserves assigned to them so that the expenses reflected full cost of claims	Consequences of the intervention: The average workers' compensation expense per claim decreased from \$4,652 before the intervention to \$2,959 after for a savings of \$1,693 per claim (USD). Result: The benefit-cost ratio was 17.8.
Lewis (2002)	status quo	not clear	cost savings	workers'	Costs of the intervention: No intervention costs considered.
study quality: 1.9			of VDT-related WC claim	expenses per claim	Consequences of the intervention: Savings from decreased average expenses per workers' compensation claim.
ergonomic program					Result: The average workers' compensation expense per claim
partial economic analysis					per capita decreased from \$185 to \$3 (USD 1998).

Appendix M Tables for Educational Services

 Table 1: Educational Services, Description of Intervention (clustered by type of intervention and sorted by quality score)

Study reference	Motivation	Location	Industry details	Type of intervention	Description of intervention
Ergonomic and Othe	er MSK Injury P	revention Interve	entions		
Feuerstein (2000)	high iniuries	United States	Education Services	training (primary and secondary prevention)	A multi-component intervention consisting of eleven 1.5 hr group meetings designed to reduce the impact of work on upper-extremity
study quality: 2.3	,	New York	school	···· , , , · · · , ,	symptoms/disorders and lost time.
training program		Rochester	sign-language interpreters		
partial economic analysis					

Study reference	Start year	Exposure duration in months	Number of workers	Study design	Details of analysis	Information on uptake/ involvement	Effectiveness outcome measure	Observed effect including magnitude, if provided
Ergonomic and O	ther MSK	Injury Prever	ntion Intervent	ions				
Feuerstein (2000)	1991	48	53	before-after uncontrolled	before-after comparison of the number of		number of upper-extremity problems, work	 There was a 69% reduction in the number of upper-extremity cases reported in the three years following the intervention.
study quality: 2.3					upper extremity		demands (measured by	2) Following the intervention, the number of interpreting hours (work demands) increased while
training program					problems and work		total hours of interpreting	the number of workers remained fairly constant.
partial economic analysis					demands		services)	

Table 2: Educational Services, Effectiveness Analysis (clustered by type of intervention and sorted by quality score)

Table 3: Educational Services.	Economic Analysis (clus	stered by type of intervention	on and sorted by quality score)

	Monet	ary conseque	nces		Monetary	y costs			Other details	
Study reference	Productivity changes	Insurance and health- care savings	Other	Capital equipment expenditures	External services	Internal staff time	Other	Discounting	CPI adjustment	Sensitivity analysis
Ergonomic and Other MSI	K Injury Preventi	on Interventio	ns							
Feuerstein (2000)	yes		yes							
study quality: 2.3										
training program										
partial economic analysis										

Study reference	Alternatives considered	Perspective of analysis	Details of analysis	Outcome(s) used in economic analysis	Description of economic analysis results
Ergonomic and Ot	ther MSK Injury Preventic	on Interventions			
Feuerstein (2000)	status quo	not clear	partial economic analysis	workers' compensation time-	Costs of the intervention: No intervention costs considered.
study quality: 2.3				loss and health-care expenses	Consequences of the intervention: Savings from workers' compensation time-loss and health-care expenses.
training program				•	
partial economic analysis					Result: In the three years following the intervention, the time-loss expenses were reduced by 64% and were maintained over the following 2 years. Health-care expenses followed a similar pattern, although with a smaller magnitude of change.

Table 4: Educational Services, Economic Analysis (clustered by type of intervention and sorted by quality score)

Appendix N Tables for Health Care

Study reference	Motivation	Location	Industry details	Type of intervention	Description of intervention
Occupational Disease Prev	ention Interve	entions			
Laufer (1994)	high number of	United States	Health Care and Social Assistance	occupational disease prevention	Needlestick injury prevention program consisting of safety syringes, recessed needles, and use of needleless intravenous
study quality: 3.4	injuries	New York	hospital	(primary prevention)	access systems.
occupational disease prevention program			nurses are used as an		
cost-effectiveness analysis			care workers are also affected		
Yassi (1995)	high	Canada	Health Care and Social	occupational disease	Needlestick injury prevention program consisting of a
study quality: 2.7	injuries	Manitoba	Tertiary-care teaching	(primary prevention)	necucies intravenous access system.
occupational disease		Winnipeg	hospital		
provontion program			Health-care workers		
cost-benefit analysis					
Orenstein (1995)	multiple: high	United States	Health Care and Social Assistance	occupational disease prevention	Needlestick injury prevention program consisting of safety syringe and the components of a needleless IV system.
study quality: 2.6	injuries and high cost of	Virginia	hospital	(primary prevention)	
occupational disease prevention program	injuries		nurses		
cost-effectiveness analysis					
Korniewicz (2005)	multiple: high	United States	Health Care and Social Assistance	occupational disease prevention	Conversion from powdered latex gloves to powder-free latex gloves.
study quality: 2.3	number of injuries and		university hospital	(primary prevention)	-
occupational disease prevention program	high cost of injuries		operating room personnel:		
cost-consequence analysis	-		registered nurses, operating room or surgical technicians, surgeons, anaesthesiologists		

Study reference	Motivation	Location	Industry details	Type of intervention	Description of intervention
Occupational Disease Prev	ention Interve	ntions (continued	i)		
Cameron (1997)	high cost of injuries	Canada	Health Care and Social Assistance	occupational disease prevention	Conversion from powdered latex gloves to powder-free latex gloves.
study quality: 1.6		Ontario	hospital	(primary prevention)	
occupational disease prevention program		Hamilton	health-care workers		
cost-minimizing analysis					
Ergonomic and Other MSK	Injury Prevent	ion Interventions	5		
Collins (2004)	high number of	United States	Health Care and Social Assistance	multiple (primary prevention)	A musculoskeletal injury prevention program consisting of mechanical lifts and repositioning aids, a zero lift policy, and
study quality: 3.4	injunes		nursing home		worker training on lift usage.
ergonomic program			nurses		
cost-benefit analysis					
Chhokar (2005)	high number	Canada	Health Care and Social Assistance	ergonomics (primary prevention)	Introduction of mechanical ceiling lifts and training.
study quality: 3.1	injuries	British Columbia	long-term care facility		
ergonomic program			nurses and nurses' aides		
cost-benefit analysis					
Gundewall (1993)	high number of	Sweden	Health Care and Social Assistance	health promotion (primary prevention)	An exercise program with training/supervision and advice on back problems.
study quality: 2.7	injuries	Kungsbacka, suburb of	geriatric hospital	(p	
exercise program		Gothenburg	purses and purses' sides		
cost-benefit analysis			nurses and nurses aldes		
Evanoff (1999)	high number of	United States	Health Care and Social Assistance	participatory ergonomics (primary prevention)	Introduction of a participatory ergonomic team.
study quality: 2.5	injuries		medical centre		
participatory ergonomic program			hospital orderlies		
cost-consequence analysis					

Study reference	Motivation	Location	Industry details	Type of intervention	Description of intervention
Ergonomic and Other MSK	Injury Prevent	ion Interventions	(continued)		
Engst (2005)	high	Canada	Health Care and Social	ergonomics	Introduction of mechanical ceiling lifts and training.
study quality: 2.4	number of injuries	British Columbia	Assistance	(primary prevention)	
ergonomic program		e e la maina			
cost-benefit analysis			nurses and nurses' aides		
Li (2004)	high	Unites States	Health Care and Social	ergonomics	Introduction of mechanical patient lifts and training.
	number of		Assistance	(primary prevention)	
study quality: 2.3	injuries	Missouri	community bospital		
ergonomic program		St Louis	community hospital		
		011 200.0	nursing personnel: nurses,		
partial economic analysis			nursing assistants, and patient-care technicians		
Ore (2003)	high	Australia	Health Care and Social	training	35-hour manual handling training provided by an ergonomist,
atudu quality: 2.2	number of		Assistance	(primary prevention)	involving on-site assessment of manual handling tasks, training
Study quality. 2.5	linjunes		long-term care services for		on specific techniques, and equipment design and correct use.
education program			the disabled		
cost-benefit analysis			disability services workers		Interchantion of a direct lifting and and and a first star
Bropny (2001)	multiple:	United States	Assistance	ergonomics	introduction of patient-lifting equipment and a five-step
study quality: 2.2	number of	New York	Assistance	(primary prevention)	(1) create a resident transfer evaluation team:
	injuries and		nursing home		(2) establish an accident review committee;
ergonomic program	high cost of				(3) mandatory ergonomic training for new nursing aides;
aget hanafit analysis	injuries		nursing aides		(4) regular maintenance checks for lifting equipment;
cost-benefit analysis					(b) direct access to the management and budget process.
Kemmlert (1996)	high cost of	Sweden	Health Care and Social	ergonomics	The ergonomic intervention consisted of workplace assessment
study quality: 2.2	injuries		Assistance	(primary prevention)	and redesign and included: increase in workspace by means or reducing patient admissions by 15%, thus allowing proper use
Study quanty. 2.2			nursing home		of electric hoists; old hoist repairs and wheel replacements, and
ergonomic program			5		purchase of new hoists; training courses on lifting techniques;
			nurses' assistants		electing a back health representative to monitor the ergonomic
cost-benefit analysis					situation.
Charney (1991)	multiple:	United States	Health Care and Social	ergonomics	A lifting team to reduce the number of lifts performed by nurses
	high injuries		Assistance	(primary prevention)	by 95%.
study quality: 1.8	and high	West Coast	la a custa l		
eraonomic program	COST OT		nospital		
	injuneo		registered nurses, licensed		
cost-benefit analysis			vocational nurses		

Study reference	Motivation	Location	Industry details	Type of intervention	Description of intervention
Ergonomic and Other MSH	(Injury Preven	tion Intervention	s (continued)		
Guthrie (2004)	high number of	United States	Health Care and Social Assistance	ergonomics (primary prevention)	Introduction of patient-lifting equipment and other mechanical equipment, a back school, and a lift team.
study quality: 1.6	injuries	Minnesota	community-based level one		
ergonomic program		Robbinsdale	trauma centre		
partial economic analysis			nurses		
Disability Management Int	erventions				
Linton (1992)	not clear	Sweden	Health Care and Social Assistance	multiple (secondary prevention)	Five-week physical and behavioural preventive intervention consisting of: 1) physical therapy, including ergonomic education
study quality: 2.7			hospital		in the form of a 'low-back school', practising high-risk manoeuvres on the job; 2) behaviour therapy - to help workers learn to better
multiple: back injury					control their pain and maintain "healthy," low risk lifestyles, which
program that included			licensed practical nurses and nursing aids		control lifestyle management risk analysis and training on pain
ergonomic education, and					training (practising strategies learned during training sessions, at
behavioural therapy					work and at home).
cost-benefit analysis					
Yassi (1995)	multiple: hiah	Canada	Health Care and Social Assistance	disability management (secondary prevention)	Disability management pilot program consisting of prompt assessment, treatment and rehabilitation through modified work.
study quality: 2.0	number of	Manitoba		()	
disability management	injuries and	Winninea	teaching hospital		
program	injuries	Winnpeg	registered nurses		
partial economic analysis					
Bernacki (2003)	high cost of	United States	Health Care and Social	disability management	Integrated workers' compensation claims management system to
study quality: 1.9	injunes	Maryland	Assistance	(secondary prevention)	nursing providers to collaborate in a process of preventing
disability management		Baltimore	teaching hospital and university		accidents and expeditiously assessing, teaching, and returning individuals to productive work.
program					
partial economic analysis			all workers		

Study reference	Motivation	Location	Industry details	Type of intervention	Description of intervention
Disability Management	t Interventions	(continued)			
Koviack (2004)	multiple: high	United States	Health Care and Social Assistance	disability management (secondary prevention)	An accommodation program to support workers during their period of work-related or personal injury or illness, to promote healing, and to
study quality: 1.5	number of injuries and		clinical research facility		facilitate their return to work.
disability management program	systems level initiative		nurses		
partial economic analysis	milative				
Tracz (1992)	high number of	Canada	Health Care and Social Assistance	disability management (secondary prevention)	Early intervention and occupational rehabilitation program to identify and assess factors that might delay recovery. Also assists the injured
study quality: 1.5	injuries	British Columbia	hospital	, , , , , , , , , , , , , , , , , , ,	worker in recovery and return to work earlier than might otherwise be achieved. The occupational health nurse explains the program;
disability management program		Kamloops	nurses		determines how the worker is progressing and provides counselling during recovery; establishes an expected date for return to work;
partial economic analysis					for the worker to attend a hospital back-care program.
Multi-faceted Intervent	ions				
Davis (2004)	high number of	Canada	Health Care and Social Assistance	multiple (both primary and	Program that combines three components: (1) primary prevention;
study quality: 2.0	injuries	British Columbia	acute- and tertiary-care	secondary prevention)	 (2) early intervention (prompt follow-up of injured workers, targeted workplace modifications, and clinical treatment, when
multiple: MSK injury prevention and		Vancouver	teaching hospital		required); (3) extensive evaluation.
disability management program			all hospital staff		
partial economic analysis					
Collins (1990)	high number of	Australia	Health Care and Social	multiple (both primary and	Major components of the intervention are risk identification, assessment and control strategies, education and training strategies
study quality: 1.8	injuries	Queensland	hospital	secondary prevention)	and injury management strategies.
multiple: risk assessment, education, and disability management program		Brisbane	nurses		
partial economic analysis					

Motivation	Location	Industry details	Type of intervention	Description of intervention							
Multi-faceted Interventions (continued)											
high cost of injuries	Canada	Health Care and Social Assistance	multiple (both primary and	Comprehensive program consisting of health promotion, disease prevention, and disability management.							
	Ontario	hospital	secondary prevention)								
	Tillsonburg										
		all hospital staff									
Violence in the	e Workplace										
multiple: high	United States	Health Care and Social Assistance	education and training (primary prevention)	Development of a team approach to aggression management and education of all staff in verbal and physical management of the							
number of injuries and	Pennsylvania	department of psychiatric		potential and/or actual aggressive patient using the team approach.							
high cost of injuries		nursing at a teaching hospital									
,											
		nurses, nursing assistants,									
		therapists, social workers and unit secretaries									
	Motivation high cost of injuries Violence in the multiple: high number of injuries and high cost of injuries	Motivation Location high cost of injuries Canada Ontario Tillsonburg Violence in the Workplace multiple: United States high Pennsylvania injuries and High cost of high cost of Pennsylvania	Motivation Location Industry details high cost of injuries Canada Health Care and Social Assistance Ontario hospital Tillsonburg all hospital staff wultiple: United States high cost of injuries and high cost of injuries United States Health Care and Social Assistance Multiple: United States Health Care and Social Assistance number of injuries and high cost of injuries Pennsylvania Injuries nurses, nursing assistants, physicians, occupational therapists, social workers and unit secretaries	Motivation Location Industry details Type of intervention ntions (continued)							

Study reference	Start year	Exposure duration in months	Number of workers	Study design	Details of analysis	Information on uptake/ involvement	Effectiveness outcome measure	Observed effect including magnitude, if provided		
Occupational Disease Prevention Interventions										
Laufer (1994) study quality: 3.4 occupational disease prevention program	1990	6	NA	before-after uncontrolled	before-after comparison of needlestick injuries decision tree analysis for outcome		number of needlestick injuries	 For registered nurses, the reduction in time-loss per worker year was between 27% and 40%. For health science professionals the reduction in time-loss per worker year was between 37% and 67%. For facility support services, the reduction in time-loss per worker year was between 8% and 		
cost-effectiveness analysis					evaluation			13%.		
Yassi (1995) study quality: 2.7	1992	12	approx. 6,000 workers	before-after uncontrolled	before-after yearly comparison of number of needlestick injuries		number of needlestick injuries	Overall reduction of 43.4% of needlestick injuries (from 281 to 159).		
occupational disease prevention program										
cost-benefit analysis										
Orenstein (1995) study quality: 2.6 occupational disease prevention program cost-effectiveness analysis	1992	6	NA	before-after uncontrolled	before-after comparison of needlestick injuries	compliance with the use of needleless IV system components was 50%	number of needlestick injuries prevented (IV related; 3 ml syringe related; disposal related; other)	 There were 33 needlestick injuries before and 14 after (difference of 19). The overall rate of needlestick injuries was reduced by 61% in the intervention unit, from 0.785 to 0.303 needlestick injuries per 100 health- care worker days (significant at 5%). NB: No statistically significant reduction could be directly attributed to the protective devices since the needlestick injury rate decreased for the intervention group, but also for a control group that was not used directly in the statistical analysis. 		
Korniewicz (2005) study quality: 2.3 occupational disease prevention program cost-consequence analysis	2002	21	103 (82 completed the entire study)	before-after uncontrolled	before-after comparison of symptoms	-	number of reporting symptoms	Prior to glove conversion, nearly one-half of the operating room staff reported symptoms related to natural rubber latex exposure. At the end of the 14-month data collection period, only 27% reported symptoms related to natural rubber latex exposure.		

Study reference	Start year	Exposure duration in months	Number of workers	Study design	Details of analysis	Information on uptake/ involvement	Effectiveness outcome measure	Observed effect including magnitude, if provided		
Occupational Disease Prevention Interventions (continued)										
Cameron (1997)	NA	NA	2000	before-after uncontrolled	before-after comparison		no outcome measures	No consequences were considered since the study was a cost minimization analysis.		
study quality: 1.6							cost-			
occupational disease prevention program							analysis			
cost-minimizing analysis										
Ergonomic and Other	MSK Inju	ury Preventio	n Interventions							
Collins (2004)	1998	36	NA	longitudinal (interrupted	Poisson regression	number of hours in training and training	number of claims per	1) There was a significant reduction in resident handling injury incidence and lost workday injuries		
study quality: 3.4				time series) uncontrolled	model with generalized	intensity	1,000 hours worked; rate of	after the intervention. 2) The number of claims per 1,000 hours was		
ergonomic program					estimating equations		assaults	0.39 based on workers' compensation claims data, 0.54 based on OSHA 200 logs, and 0.65		
cost-benefit analysis								based on first reports of worker injury data. 3) The rate of post-intervention assaults on caregivers during resident transfers was down 72%, 50%, and 30% based on workers' compensation, OSHA, and first reports of injury data, respectively.		
Chhokar (2005)	1998	36	108	before-after uncontrolled	Poisson regression		incidence and days lost from	1) Significant reductions were found with lifting/ transferring claims, and with days lost from lifting/		
study quality: 3.1					modelling		lifting/ transferring/	transferring claims. 2) No significant reductions were found for		
ergonomic program							repositioning claims	repositioning claims or days lost from repositioning claims.		
cost-benefit analysis										
Gundewall (1993)	NA	13	Intervention group: 28	randomized controlled trial	before-after comparison of	average length of training program,	incidence and duration of lost	 The intervention group had lower incidence and duration of work absences due to back 		
study quality: 2.7			Control		lost work days; post-only	average number of sessions per	work days cases due to	problems after the intervention than the control group.		
exercise program			group: 32		difference analysis	month, and number of months of	back problems	2) The intervention group also had less back complaints, lower pain intensity, and greater back		
cost-benefit analysis					between intervention and control group	Intervention were recorded		muscle strength than the controls.		

Study reference	Start year	Exposure duration in months	Number of workers	Study design	Details of analysis	Information on uptake/ involvement	Effectiveness outcome measure	Observed effect including magnitude if provided		
Ergonomic and Other MSK Injury Prevention Interventions (continued)										
Evanoff (1999) study quality: 2.5 participatory ergonomic program cost-consequence analysis	1996	24	100-110	before-after with control for effectiveness analysis before-after without control for economic analysis	before-after comparison of injury rate/lost workday injury rate per 100 FTE (injury rates/lost workday injury rates adjusted for time trends based on control)		relative risk of injury and lost workday injury	The relative risk (before/after) for injury was 0.64, while for lost workday injury it was 0.40 (both significant at 5%).		
Engst (2005) study quality: 2.4 ergonomic program cost-benefit analysis	2001	21	34	before-after uncontrolled	before-after comparison of workers' compensation cost	self-report on the most preferred method of transferring and repositioning patients was recorded before and after the intervention	number of lifting/ transferring/ repositioning injuries	 There were 5 lifting/transferring injuries before and 5 after. There were 7 repositioning injuries before and 5 after. 		
Li (2004) study quality: 2.3 ergonomic program partial economic analysis	2001	26	138	before-after adjusted by trend in non- intervention groups for effectiveness analysis before-after without control for economic analysis	before-after comparison of injury rate/lost workday injury rate per 100 FTE (injury rates/lost workday injury rates adjusted for time trends based on control)	data from mechanical counter on lifts were compared to the expected usage; implementation of a lift compliance survey	relative risk for lost workday injury	The relative risk (before/after) was 0.5 for injury, while for lost workday injury it was 0.35 (both significant at 5%).		

Study reference	Start year	Exposure duration	Number of workers	Study design	Details of analysis	Information on uptake/	Effectiveness outcome measure	Observed effect including magnitude if provided	
		in months		-	-	involvement		•	
Ergonomic and Other MSK Injury Prevention Interventions (continued)									
Ore (2003)	1998	12	Intervention aroup: 351	post-only with control group	difference between		number of manual handling injuries	 Training in manual handling methods significantly reduced the risk of injury by as much 	
study quality: 2.3			Control	3	intervention group and		per 100 FTEs by age, sex, injury	as 42%, with an average rate of 49.6 per 100 FTE (95% CI 44.4-55.0) among the intervention group	
education program			group: 351		control group in		type, length of service in the	compared with 84.8 per FTE (95% CI 76.0-94.1) among the control group.	
cost-benefit analysis					intervention time period		agency, and job category	2) The risk differentials between intervention and control group were consistent across gender, age group, length of service, and job classification (significant at 1%). However, in two injury categories (client lift/transfer and general manual handling), the intervention group had a marginally higher risk.	
Brophy (2001)	1994	60	NA	before-after	before-after	all new nursing	number of injuries	1) The number of injuries per year was 30 before and 21.5 after (significant at 5%)	
study quality: 2.2				uncontrollou	yearly average	required to	of injuries per 100	2) The number of injuries per 100 full-time nursing assistants was 15.7 before and 11.0 after	
ergonomic program					or injunice	ergonomic	assistants, yearly	(significant at 5%).	
cost-benefit analysis	NA	NA	20	h-6			lost workdays, number of lost workdays per FTE, lost workdays per injury	 a) The yearly average number of lost workdays was 1,476 before and 625.4 after (significant at 5%). b) The number of lost workdays per full-time nursing assistant was 7.8 before and 3.0 after (significant at 5%). c) The number of lost workdays per injury was 50 before and 29.4 after (not significant). 	
Kemmlert (1996)	NA	NA	20	before-after uncontrolled	before-after comparison of		value of sick leave/ absenteeism	20 workers) which was reflected in savings of	
study quality: 2.2					sick leave and associated		(associated losses and expenses	\$51,744 US per year. Also, there were savings due to reduced recruitment of \$3,487 US per year	
ergonomic program					expenses/ savings		averted)	based on per-year savings of 3 employees working 5 days for 8 hours, and savings due to	
cost-benefit analysis					, and the second s			reduced training of new recruits of \$3,980 US per year based on reduced turnover.	
Charney (1991)	1989	12	NA	before-after uncontrolled	comparison of accident rate		rate of back injuries per 1.000	 The rate of back injury per 1,000 person years was 39 before and 2.4 after the intervention. 	
study quality: 1.8					per thousand		FTEs	2) The firm expected 16 lost-time accidents in day shift but only had 1	
ergonomic program					two years prior				
cost-benefit analysis					of intervention				

Study reference	Start year	Exposure duration in months	Number of workers	Study design	Details of analysis	Information on uptake/ involvement	Effectiveness outcome measure	Observed effect including magnitude, if provided		
Ergonomic and Other MSK Injury Prevention Interventions (continued)										
Guthrie (2004)	2002	6	NA	before-after uncontrolled	before-after comparison of	at the end of Dec 2002,	number of lifting- related injuries	A dramatic increase in injuries occurred in 2001 followed by a decline in 2002.		
study quality: 1.6					injuries	95% of the orthopedic and				
partial economic						nursing staff				
analysis						back school				
Disability Management	t Intervent	tions								
Linton (1992)	NA	24	36	longitudinal (interrupted	1) difference analysis on		number of days sick-listed for	The <i>actual</i> reduction in number of days sick-listed was 6.7 days (difference between the number of days a characteristic the 18 month period prior to		
				uncontrolled	before and after;		pain	days absent in the 18-month period prior to intervention and the 18-month follow-up period) and was not statistically significant. The reduction in number of days sick-listed of 76.5 days is derived using the <i>predicted</i> number of absence days in the 18-month follow-up period if the intervention had not occurred.		
multiple: back injury program that included physical therapy, ergonomic education, and behavioural					2) regression analysis of data from before and after to predict the number of sick days with and without the intervention					
cost-benefit analysis										
Yassi (1995)	NA	24	131	before-after with control	before-after	distinction	number of reported	1) The number of reported back injuries dropped from 17.2 to 13.3 per 100.000 hours paid in the		
study quality: 2.0				with control	injuries between	those who consented	100,000 hours	study wards, compared to an increase from 4.5 to 6 4 per 100 000 hours paid in the control wards		
disability management program					wards and control wards	refused, were ineligible and confounded	per 100,000 hours paid	 (significant at the 1% level). 2) Total time-loss per 100,000 paid hours dropped by 29% in the study wards, compared to 51% 		
partial economic analysis								increase in the control wards.		
Bernacki (2003)	1992	132	NA	post-only one aroup desian	trends analysis of iniuries		number of lost-time claims per 1.000	1) The lost-time claim rates decreased from 22 per 1.000 workers in 1992 to 6 per 1.000 in 2002.		
study quality: 1.9				9 p 9. ·	or injunes		workers, medical-	 2) The medical-only claim rates decreased from 155 to 61 per 1,000 workers. 3) Temporary total days paid decreased from 163 days per 100 insured to 37 days per 100 insured. 		
disability management program							1,000 workers, temporary total days paid per 100			
partial economic analysis							insured workers			
Study reference	Start year	Exposure duration in months	Number of workers	Study design	Details of analysis	Information on uptake/ involvement	Effectiveness outcome measure	Observed effect including magnitude if provided		
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Disability Management	Intervent	tions (continu	ied)							
Koviack (2004)	1999	36	147	not clear if it is before-after	estimated value of time spent in		number of hours of temporary work	There were 25,382 hours of temporary work assignments completed over the three-year time		
study quality: 1.5				or after only	temporary assignments		assignments over a three-year period	period.		
disability management program										
partial economic analysis										
Tracz (1992)	1988	30	NA	post only with comparison	comparison of days lost by		number of days lost to back pain	The average number of days lost per back injury decreased from 40 days per injury to 23 days. This		
study quality: 1.5				to industry average	injured individuals			compares to an average of 45 days lost per claim due to back injury in health-care industry, during		
disability management program					receiving benefits from			the 1988-1990 time period.		
partial economic analysis					the program with days lost by injured individuals in the industry					
Multi-faceted Interventi	ons									
Davis (2004)	2002	12	332	longitudinal (interrupted	before-after comparison of	number of eligible	number of lost-time MSK iniuries	1) Registered nurses experienced a reduction in time-loss per person year between 27% and 40%.		
study quality: 2.0				time series) controlled	injuries; Poisson regression	workers accessing the		2) Health science professionals experienced a reduction in time-loss per person year between 37%		
multiple: MSK injury prevention, and disability management program					modelling; Cox regression modelling	program and distribution of the types of services provided were		 and 67%. 3) Facility support service staff experienced a reduction in time-loss per person year between 8% and 13%. 		
partial economic analysis						recorded				

Study reference	Start year	Exposure duration in months	Number of workers	Study design	Details of analysis	Information on uptake/ involvement	Effectiveness outcome measure	Observed effect including magnitude if provided
Multi-faceted Intervent	ions							
Collins (1990) study quality: 1.8 multiple: Risk assessment, education, and disability management program partial economic analysis	1987	24	NA	before-after uncontrolled	trends analysis of claims costs		frequency, duration and incidence of lost- time back injuries	 For three years prior to the intervention, the frequency of lost-time back injuries was 13.7, 19.1 and 12.8. For the two years after the intervention, the frequency was 16.6 and 13.6. For three years prior to the intervention, the average duration (in days) was 17.2, 14.4 and 18.5. For the two years after the intervention, the frequency was 15.3 and 11.5. For three years prior to the intervention the incidence was 1:39, 1:29 and 1:41. For the two years after the incidence was 1:33 and 1:40. Though duration decreased, it is not clear if frequency and incidence have decreased.
Caulfield (1996) study quality: 1.7 multiple: health promotion, disease prevention, and disability management program partial economic analysis	1992	27	NA	before-after uncontrolled	before-after comparison of costs of year prior with each of the two years post		sick days (number and rate); days lost to workers' compensation; healthcare only and lost-time workers' compensation claims	 Number of sick days taken decreased from 17,777 in 1992 to 15,000 in 1994; Sick day rate decreased from 8.47 in 1991 to 7.8 in 1994, compared to an increase from 9.51 to 9.81 in the Ontario hospital sector. Days lost to workers' compensation claims decreased from 226 in 1991 to 35 in 1994; Healthcare only workers' compensation claims decreased from 14 in 1991 to 6 in 1994; Lost-time workers' compensation claims decreased from 9 in 1991 to 3 in 1994.
Intentions to Reduce V	/iolence i	n the Workpla	се					
Martin (1995) study quality: 2.3 education program partial economic analysis	1992	24	NA	before-after uncontrolled	trends analysis of injuries		frequency and severity of injuries	 Although the frequency of injury changed only slightly, the results indicate that there was a decrease in the severity of aggression-related staff injuries after the institution of the formal program, as well as a reduction in time missed from work. The occurrence of staff injuries improved only in the second year after the program's development. The number of injuries resulting in missed work time remained the same over all three years.

	Monetary consequences					y costs		Other details		
Study reference	Productivity changes	Insurance and health- care savings	Other	Capital equipment expenditures	External services	Internal staff time	Other	Discounting	CPI adjustment	Sensitivity analysis
Occupational Disease F	Prevention Interv	entions								
Laufer (1994)	yes		yes				yes	yes	yes	yes
study quality: 3.4										
occupational disease prevention program										
cost-effectiveness analysis										
Yassi (1995)	yes		yes		yes		yes			yes
study quality: 2.7										
occupational disease prevention program										
cost-benefit analysis										
Orenstein (1995)					yes	yes	yes	NA	NA	
study quality: 2.6										
occupational disease prevention program										
cost-effectiveness analysis										
Korniewicz (2005)		yes				yes				
study quality: 2.3										
occupational disease prevention program										
cost-consequence analysis										

	Monetary consequences					y costs		Other details		
Study reference	Productivity changes	Insurance and health- care savings	Other	Capital equipment expenditures	External services	Internal staff time	Other	Discounting	CPI adjustment	Sensitivity analysis
Occupational Disease P	Prevention Interve	entions (conti	nued)							
Cameron (1997)				yes		yes	yes	NA	NA	
study quality: 1.6										
occupational disease prevention program										
cost-minimizing analysis										
Ergonomic and Other M	ISK Injury Prever	ntion Intervent	ions	•				•		
Collins (2004)		yes		yes		yes				
study quality: 3.4										
ergonomic program										
cost-benefit analysis										
Chhokar (2005)		yes		yes						yes
study quality: 3.1										
ergonomic program										
cost-benefit analysis										
Gundewall (1993)	yes					yes		NA	NA	
study quality: 2.7										
exercise program										
cost-benefit analysis										

	Moneta	ary conseque	nces		Monetary	y costs			Other details		
Study reference	Productivity changes	Insurance and health- care savings	Other	Capital equipment expenditures	External services	Internal staff time	Other	Discounting	CPI adjustment	Sensitivity analysis	
Ergonomic and Other MSI	K Injury Preventi	on Interventic	ons (continued	<u>I)</u>				•			
Evanoff (1999)		yes		yes		yes					
study quality: 2.5											
participatory ergonomic program											
cost-consequence analysis											
Engst (2005)		yes	yes	yes		yes					
study quality: 2.4											
ergonomic program											
cost-benefit analysis											
Li (2004)		yes									
study quality: 2.3											
ergonomic program											
partial economic analysis											
Ore (2003)		yes				yes		NA	NA		
study quality: 2.3											
education program											
cost-benefit analysis											
Brophy (2001)	yes	yes		yes				NA			
study quality: 2.2											
ergonomic program											
cost-benefit analysis											

	Moneta	ary consequer	nces		Monetary	y costs		Other details		
Study reference	Productivity changes	Insurance and health- care savings	Other	Capital equipment expenditures	External services	Internal staff time	Other	Discounting	CPI adjustment	Sensitivity analysis
Ergonomic and Other MSK In	jury Prevention I	nterventions ((continued)	•				•		
Kemmlert (1996)	yes	yes	yes	yes		yes	yes	NA	NA	
study quality: 2.2										
ergonomic program										
cost-benefit analysis										
Charney (1991)		yes				yes		NA	NA	yes
study quality: 1.8										
ergonomic program										
cost-benefit analysis										
Guthrie (2004)	yes							NA		
study quality: 1.6										
ergonomic program										
partial economic analysis										
Disability Management Interv	entions									
Linton (1992)	yes				yes		yes			yes
study quality: 2.7										
multiple: back injury program (physical therapy, ergonomic education, and behavioural therapy)										
cost-benefit analysis										
Yassi (1995)		yes								
study quality: 2.0										

program

disability management

partial economic analysis

Table 3	3 (continued):	Health Care	Economic A	nalvsis (clustered	l by type of i	ntervention and	sorted by	quality score)
	()-							1

	Moneta	ary consequer	nces		Monetar	y costs			Other details		
Study reference	Productivity changes	Insurance and health- care savings	Other	Capital equipment expenditures	External services	Internal staff time	Other	Discounting	CPI adjustment	Sensitivity analysis	
Disability Management Inter	ventions (continu	ued)									
Bernacki (2003)		yes						NA			
study quality: 1.9											
disability management program											
partial economic analysis											
Koviack (2004)	yes										
study quality: 1.5											
disability management program											
partial economic analysis											
Tracz (1992)	yes										
study quality: 1.5											
disability management program											
partial economic analysis											
Multi-faceted Interventions	·			•				·			
Davis (2004)		yes						NA		yes	
study quality: 2.0											
multiple: MSK injury prevention and disability management program											
partial economic analysis											

	nces		Monetary	y costs		Other details				
Study reference	Productivity changes	Insurance and health- care savings	Other	Capital equipment expenditure s	External services	Internal staff time	Other	Discounting	CPI adjustmen t	Sensitivity analysis
Multi-faceted Interventions (co	ontinued)									
Collins (1990)		yes						NA		
study quality: 1.8										
multiple: Risk assessment,										
training, and disability										
management program										
partial economic analysis										
Caulfield (1996)		yes								
study quality: 1.7										
multiple: health promotion, disease prevention, and										
disability management										
program										
partial economic analysis										
Intentions to Reduce Violence	in the Workplace	9								
Martin (1995)		yes						NA		
study quality: 2.3										
education program										
partial economic analysis										

Study reference	Alternatives considered	Perspective of analysis	Details of analysis	Outcome(s) used in economic analysis	Description of economic analysis results
Occupational Dise	ease Prevention Intervention	าร			
Laufer (1994) study quality: 3.4 occupational disease prevention program cost- effectiveness analysis	Alternative A: status quo Alternative B: needlestick prevention device A: injection equipment Alternative C: needlestick prevention device B: recessed needles Alternative D: needlestick prevention device C: needleless IV systems	employer	cost- effectiveness analysis	number of needlestick injuries	 Costs of the intervention: Costs include annual implementation costs of program at hospital. Specifically, annual injection equipment costs were \$18,857, recessed needle equipment costs were \$23,240, and needless IV costs \$26,700. Consequences of the intervention: Non-monetary consequences consist of the number of needlestick injuries averted. Monetary consequences were \$363 per needlestick injury averted, which includes \$184 for the reporting of the incident and initial testing and any treatment and follow-up for HBV, and \$179 for the initial evaluation, follow-up, and prophylactic treatment (if any) for HIV infection. Results: The cost-effectiveness ratio obtained for injection equipment compared to status quo was \$1,574 per injury averted; for needleless IV systems compared to status quo was \$1,877 per injury averted; and for recessed needles compared to needleless IV systems was \$790 per injury averted (1992 US dollars).
Yassi (1995) study quality: 2.7 occupational disease prevention program cost-benefit analysis	status quo	employer	cost-benefit analysis	expenses associated with treatment of needlestick injuries	 Costs of the intervention: The one-year net cost for the introduction of the new system was \$47,756. This includes costs with needles, syringe-needle combinations, non-interlink injection caps, intravenous sets and interlink products. The net cost for sharps containers disposal was \$13,234. Consequences of the intervention: The total savings obtained was estimated to range from \$10,142 to \$68,214 for the 122 needlestick injuries avoided during the intervention period. These values include savings in personnel time (wage value of worker time away from workplace to receive testing and initial care), reduced expenses of virus testing, vaccine for HBV, and counselling (includes personnel time, laboratory expenses, primary and secondary prophylaxis); workers' compensation expenses not included. Results: The estimated net present value (NPV) to the hospital for the needleless access system ranged from an additional expense of \$24,380 to a saving of \$33,692.

Study reference	Alternatives considered	Perspective of analysis	Details of analysis	Outcome(s) used in economic analysis	Description of economic analysis results
Occupational Dise	ease Prevention Interventio	ons (continued)			
Orenstein (1995) study quality: 2.6	status quo	employer	cost- effectiveness analysis	cases of needlestick injuries	Costs of the intervention : Costs include needlestick injury evaluations (\$260 per evaluation); costs of protective devices and additional needles and syringes (for 6 months before the intervention these costs were \$2,444 and for six months after were \$22,558).
occupational disease prevention program					Consequences of the intervention: The number of needlestick injuries decreased from 33 for a six-month period to 14 with the intervention.
cost- effectiveness analysis					Results : The direct cost per needlestick injury prevented was \$789.
Korniewicz (2005)	status quo	employer	before-after comparison of costs and	workers' compensation expenses	Costs of the intervention : Costs include personnel hours required for glove storage and handling. These costs were lower than before the intervention by \$10,070. Incremental costs of the gloves were not considered.
study quality: 2.3 occupational disease			consequences		Consequences of the intervention: There were no changes in workers' compensation expenses.
prevention program					Results : The lack of changes in workers' compensation expenses can be compared to the reduced personnel hours required for storage and handling in the amount of \$10,070.
cost- consequence analysis					
Cameron (1997) study quality: 1.6	status quo	employer	cost-minimizing analysis	consequences not considered since cost minimization	Costs of the intervention : Consists of seed money for project; set-up costs for allergy clinic; Latex Allergy Task Force time; occupational health costs; Infection Control Department costs; education costs; purchasing costs; and nursing time costs for allergy clinic.
occupational disease prevention				study	Consequences of the intervention: Consequences not considered.
cost-minimizing analysis					\$197,000 to \$167,500, a reduction of \$32,500. This was due to the hospital's review of the entire glove stock, the elimination of wastage, and the streamlining of ordering to a smaller menu of more appropriate gloves.

Study reference	Alternatives considered	Perspective of analysis	Details of analysis	Outcome(s) used in economic analysis	Description of economic analysis results
Ergonomic and O	ther MSK Injury Prevention	Interventions			
Collins (2004)	status quo	employer	cost-benefit analysis	workers' compensation expenses	Costs of the intervention : Costs were \$158,556, which include \$143,556 for capital investment and \$15,000 for worker training.
				(medical and	Consequences of the intervention: Savings from reduced workers' compensation
ergonomic				indemnity	expenses were \$164,609.40, estimated by comparing the direct workers'
program				payments)	compensation expenses for 129 injuries related to resident handling for the pre-
aget honofit				related to	intervention period (\$411,670.11) and the 56 injuries post-intervention (\$277,060.71).
analysis				handling injuries	Results : The payback period was slightly less than 3 years.
Chhokar (2005)	status quo consisting of use of portable lifts and	employer	cost-benefit analysis	workers' compensation	Costs of the intervention: Costs were \$344,323, which include capital equipment.
study quality: 3.1	manual lifting/ transferring/repositioning			expenses	Consequences of the intervention : Savings from reduced workers' compensation expenses for the three years post intervention. These savings were estimated based
ergonomic program					on two assumptions: 1) expenses would remain at the previous level, and 2) expenses would continue to increase at the same rate as previous years in the
cost-benefit analysis					upper-bound estimate is \$1,257,605.
					Results : These upper- and lower- bounds estimates translate into a payback period of 2.50 years and 0.83 years, for the lower and upper bounds respectively (1998 Canadian dollars).
Gundewall (1993)	status quo	not clear	cost-benefit analysis	value of absence days	Costs of the intervention : Costs consist of physiotherapist time (specific amount not provided).
study quality: 2.7				due to lower	
exercise program				back pain	Consequences of the intervention : Consequences consist of the value of averted lost days due to low-back pain (specific amount not provided).
cost-benefit analysis					Results : 1.3 work days were gained by the training group for every hour of physiotherapist time. The benefit-cost ratio is almost 10 (no detail was provided on how this value was obtained).

Study reference	Alternatives considered	Perspective of analysis	Details of analysis	Outcome(s) used in economic analysis	Description of economic analysis results
Ergonomic and Of	ther MSK Injury Prevention	Interventions (co	ntinued)		
Evanoff (1999) study quality: 2.5	status quo	employer	cost- consequence analysis	workers' compensation expenses	Costs of the intervention : Costs over the 2-year period were \$5,000 which include equipment and wages for time spent on team activities.
participatory			,	·	Consequences of the intervention: Workers' compensation savings over the two years adjusted for overall trends at the hospital were \$22,758.
program					Results : Total workers' compensation expenses for orderlies was \$24,443 pre- intervention (\$237 per FTE) and \$34,207 post-intervention (\$139 per FTE),
cost- consequence analysis					representing a 41% decrease in expenses per worker, or total savings of \$22,758. These savings can be compared to the \$5,000 costs incurred over 2 years.
Engst (2005)	status quo	employer	cost-benefit analysis	workers' compensation	Costs of the intervention : Costs were \$284,297 which includes purchasing and installing the intervention and hiring a program coordinator.
ergonomic program				expenses	Consequences of the intervention: Direct and indirect savings for "all resident handling" were \$9,835 and \$19,670, respectively. Direct and indirect savings for only 'lifting and transferring tasks' were \$14,493 and \$28,986, respectively.
cost-benefit analysis					Results : The payback period was 9.6 years if all resident handling claims are considered in the estimation of consequences, and 6.5 years if only lifting and transferring claims are considered.
Li (2004)	status quo	employer	before-after	workers'	Costs of the intervention: No intervention costs considered.
study quality: 2.3			annual workers' compensation	expenses	Consequences of the intervention: Savings in workers' compensation expenses considered.
ergonomics			expenses per FTE		Results: Annual workers' compensation expenses for nursing personnel in the
partial economic analysis					intervention units averaged \$484 per FTE pre-intervention and \$151 post-intervention.
Ore (2003)	status quo	employer	cost-benefit analysis	average (per claim)	Costs of the intervention : Costs consist of an estimate of training cost per trainee (specific amount not provided).
study quality: 2.3				workers' compensation	Consequences of the intervention: The control group had an average workers'
education program				expenses	compensation claims expense of \$11,354, or 4.2 times that of the intervention group (\$2,658).
cost-benefit analysis					Results : The cost benefit ratio was \$5.80 per dollar invested.

Study reference	Alternatives considered	Perspective of analysis	Details of analysis	Outcome(s) used in economic analysis	Description of economic analysis results
Ergonomic and Ot	ther MSK Injury Prevention	Interventions (co	ontinued)		
Brophy (2001) study quality: 2.2	status quo	employer	cost-benefit analysis	total expenses of low-back injury (consisting of	Costs of the intervention : Costs were \$163,910 which include the price of lifts and cost of replaceable parts, such as slings.
ergonomic program				compensation, and	before the intervention were \$201,100 and decreased to \$91,800 during the 5-year period after the intervention (significant at 5%).
cost-benefit analysis				replacement wages expenses)	Results : Total savings during the 5 years following the intervention were \$546,500. This is more than three times the total cost of lifting equipment and associated items which were \$163,910.
Kemmlert (1996) study quality: 2.2	status quo	employer	cost-benefit analysis	value of sick leave / absenteeism	Costs of the intervention : Costs were \$4,992 US (1988 dollars), which include equipment (new wheels, electric hoist) costs, internal time costs of ergonomic training, and costs of reconstruction of (patient) toilet rooms (to accommodate equipment
ergonomic program				associated losses and expenses	Consequences of the intervention : Savings (benefits) for a one-year period were \$59,211 US (1988 dollars), which include savings due to reduced sick leave, reduction
cost-benefit analysis				averted)	in insurance expenses due to reduced sick leave, and reduced turnover and lower related recruitment and training expenses.
Charney (1991)	status quo	employer	cost-benefit analysis	workers' compensation	Costs of the intervention : Costs were \$70,000 per year, which consists of salary costs of the lifting team.
study quality: 1.8				expenses	Consequences of the intervention: Savings in workers' compensation expenses were \$135,000 per year
program					Results : The net present value of the intervention for one year was \$65,000.
cost-benefit analvsis					
Guthrie (2004)	status quo	employer	before-after trends analysis	replacement and salary	Costs of the intervention: No intervention costs considered.
study quality: 1.6			of work-related injury expenses	expenses for staff unable to	Consequences of the intervention: Savings in the orthopedic and neurology units from replacement and salary expenses.
ergonomic program				work due to a work-related	Results : In the year before the intervention (2001), the orthopedic and neurology
partial economic analysis				jury	injury were \$48,220, while in the year the intervention was introduced (2002) these expenses declined to \$2,560.

Study reference	Alternatives considered	Perspective of analysis	Details of analysis	Outcome(s) used in economic analysis	Description of economic analysis results
Disability Manage	ement Interventions				
Linton (1992) study quality: 2.7 multiple: back injury program that included physical therapy, ergonomic education, and behavioural therapy cost-benefit analysis	a) pre-intervention baseline; b) status quo - counterfactual based on continuing upward trend	unclear	cost-benefit analysis	wage value of sick days due to pain	 Costs of the intervention: Costs were \$4,000 USD (25,000 krona) per person plus \$225 (1,375 krona) out-of-pocket worker costs. Consequences of the intervention: The number of actual days averted was based on data from 18 months before compared to 18 months after the intervention, and the estimated reduction in sick days were based on regression modelling (accounting for existing trend). The range of savings values for averted absences due to musculoskeletal pain less cost of program are as follows: At value of \$127/day, the savings for actual days averted is \$851, and savings for estimated days averted is \$9,715; At value of \$206/day, the savings for actual days averted is \$1,380 and savings for estimated days averted is \$15,759; At value of \$400/day, the savings for actual days averted is \$2,680 and savings for estimated days averted is \$30,600; At value of \$52/day, the savings for actual days averted is \$348 and savings for estimated days averted is \$3,978. The first three values are estimates of daily absenteeism savings for the employer based on published data from different sectors. The last one is for daily absenteeism savings in terms of GNP. Results: If it assumed that the trend for an increase in sick-listing would have continued, then employers would save at least twice the costs of the program (\$9,715, or 61,198 krona).
Yassi (1995) study quality: 2.0 disability management program partial economic analysis	status quo	employer	comparison of workers' compensation expenses between intervention and control groups	workers' compensation expenses	Costs of the intervention: No intervention costs considered. Consequences of the intervention: Savings in workers' compensation expenses. Results: Expenses per injury were 32% lower and 34% lower per lost-time injury in the intervention group compared to the control group (\$608 versus \$893 per injury and \$2,662 versus \$4,052 per lost-time injury). The higher overall medical expenditures for injured workers in the program (\$262 versus \$171 per injury and \$773 versus \$696 per lost-time injury) were more than offset by the lower wage replacement compensation expenses (\$346 versus \$722 per injury and \$1,890 versus \$3,356 per lost-time injury). Total workers' compensation expenses for all back injuries decreased by 5% per 100,000 paid hours in the intervention group (\$13,553 to \$12,870) compared to an increase of 49% for the control group (\$4,992 to \$7,437).

Study reference	Alternatives considered	Perspective of analysis	Details of analysis	Outcome(s) used in economic analysis	Description of economic analysis results
Disability Manage	ement Interventions (o	continued)			
Bernacki (2003) study quality: 1.9 disability management program	status quo	employer	before-after trends analysis of workers' compensation expenses	workers' compensation expenses	Costs of the intervention: No intervention costs considered. Consequences of the intervention: Savings from workers' compensation expenses. Results: Total workers' compensation expenses decreased from \$0.81 to \$0.37 per \$100 payroll. The medical expense component decreased from \$0.27 to \$0.15. The temporary total indemnity component decreased from \$0.18 to \$0.07. The permanent
partial economic analysis					partial indemnity component decreased from \$0.19 to \$0.07. The administrative expense component decreased from \$0.16 to \$0.09 (all decreases per \$100 of payroll).
Koviack (2004)	status quo	employer	post only	value of time	Costs of the intervention: No intervention costs considered.
study quality: 1.5 disability			savings	temporary assignments rather than on	Consequences of the intervention: Savings obtained with the employment of accommodated staff and with workers' compensation expenses.
management program				disability	Results : There were 25,382 hours of temporary work assignments completed over the three-year time period which, if valued at \$28.83 per hour, amounts to a total savings of \$731,763. There were also savings in workers' compensation expenses of
partial economic analysis					\$112,537, \$80,301, and \$77,282 in calendar year 2000, 2001 and 2002 respectively.
Tracz (1992)	status quo	employer	post only analysis of	wage value of time off work	Costs of the intervention: No intervention costs considered.
study quality: 1.5			savings obtained	due to back	Consequences of the intervention: Savings in time off work due to back injury.
disability management program			associated with intervention		Results : Estimated saving of \$3,135 (49% of the expense per back injury) based on a comparison of absences at the hospital with absences in the industry.
partial economic analysis					

Study reference	Alternatives considered	Perspective of analysis	Details of analysis	Outcome(s) used in economic analysis	Description of economic analysis results
Multi-faceted Inte	rventions				
Davis (2004) study quality: 2.0 multiple: MSK injury prevention and disability management program partial economic analysis	status quo	employer	before-after comparison (of workers' compensation expenses) of each of three years before the intervention with one year of the intervention	workers' compensation expenses	Costs of the intervention: No intervention costs considered. Consequences of the intervention: Savings in workers' compensation expenses. Results: Savings in workers' compensation expenses for registered nurses between \$309,474 and \$143,796 (reduction in expenses per person-year of between 27% and 44%). Savings in workers' compensation expenses for health science professionals between \$42,920 and \$128,180 (reduction in expenses per person-year between 48% and 73%). Savings in workers' compensation expenses for facility support services was between \$32,900 and \$105,280, (ireduction in expenses per person-year between 8% and 21%).
Collins (1990) study quality: 1.8 multiple: risk assessment, education, and disability management program partial economic analysis	status quo	employer	before-after trends analysis of workers' compensation claims expenses for all strains and back injuries	workers' compensation expenses	 Costs of the intervention: No intervention costs considered. Consequences of the intervention: Savings from rebates on workers' compensation premiums. Results: Claims expenses in the second year of the program (1988/89) were the lowest recorded over the five-year period for nurses' strains, and also for nurses' back injury claims expenses. As a result of these savings, the hospital earned rebates on their workers' compensation premiums of \$105,000 at the end of the first year of the intervention and a further \$177,000 at the end of the second year. Prior to that, the maximum rebate received had been \$4,000.
Caulfield (1996) study quality: 1.7 multiple: health promotion, disease prevention, and disability management program partial economic analysis	status quo	employer	before-after comparison of workers' compensation and sick time replacement expenses	workers' compensation expenses and sick time replacement expenses	Costs of the intervention: No intervention costs considered. Consequences of the intervention: Savings from rebates on workers' compensation premiums and sick-time replacement expenses. Results: Before the intervention (1992) the hospital received an \$18,000 surcharge from the workers' compensation insurer. Since then, they have received rebates of \$39,000, \$28,000, and \$18,000. Workers' compensation insurance assessment rates were reduced from \$225,000 to \$190,000 for the hospital, and were fixed until mid- 1995. Sick-time replacement expenses before the intervention were \$214,918 and were \$179,236 in 1994. Total savings from the program are estimated at \$200,000 or 1.6% of total salary budget.

Study reference	Alternatives considered	Perspective of analysis	Details of analysis	Outcome(s) used in economic analysis	Description of economic analysis results
Intentions to Redu	ce Violence in the Workpl	lace			
Martin (1995)	status quo	employer	before-after comparison of	injury expenses	Costs of the intervention: No intervention costs considered.
study quality: 2.3			injury expenses	(medical and indemnity	Consequences of the intervention: Savings from reduced medical and indemnity expenses, and sick time.
education				expenses,	
program				wage value of sick time)	Results : Medical, indemnity, and sick time expenses were \$173,960 the year before the intervention, and \$2,478 and \$2,414 for each of the two years after the intervention.
partial economic analysis				- ,	This represents a savings of \$171,482 and \$171,546 in the first and second year, respectively.

 Table 1: Information and Cultural Industries, Description of Intervention (clustered by type of intervention and sorted by quality score)

Study reference	Motivation	Location	Industry details	Type of intervention	Description of intervention					
-			-		·					
Ergonomic and Other	Ergonomic and Other MSK Prevention Interventions									
Hocking (1991)	high	Australia	Information and	ergonomics (primary)	An intervention consisting of workplace ergonomic assessments and					
	number of		Cultural Industries		the introduction of new equipment and training. Three teams of					
study quality: 3.4	injuries and				engineers were trained in ergonomics, and then progressively					
	high cost of		telecommunications		assessed and improved the equipment and associated work practices					
ergonomic program	injuries		provider		for a range of projects, which were subsequently released in the field					
cost-benefit analysis			external plant staff		with instructions, presentations, and publicity.					

Table 2: Information and Cultural Industries, Effectiveness Analysis (clustered by type of intervention and sorted by quality score)

Study reference	Start year	Exposure duration in months	Number of workers	Study design	Details of analysis	Information on uptake/ involvement	Effectiveness outcome measure	Observed effect including magnitude, if provided
Ergonomics and	Other MS	K Prevention	Interventions					
Hocking (1991)	1985	48	21,294.5	before-after with control	before-after comparison of	a questionnaire and field visits were used	manual handling	1) Accident rates per 1,000 workers in 1981/82 and 1988/89 for the manual handling injuries were 93
study quality: 3.4				(set of injuries not associated	number of manual	to establish a 75% or more take-up of	accidents	and 87, while for the non-manual handling injuries they were 195 and 189.
ergonomic				with manual	handling	improved agents (new		Accident rate ratios for the intervention and
program				handling)	accidents, rate of accidents.	safety equipment/products) in		control injuries between 1981/82 and 1988/89 were 0.89 and 1.04. The difference was not statistically
cost-benefit					ratio of accident	the field		significant (5% level), indicating that the
analysis					rates between the intervention and the control groups' injuries (statistical significance tested)			intervention was not effective. 3) Focusing specifically on back injuries, there were 479 back injuries in 1981/82 and 497 in 1988/89 (22% and 29% of all injuries in the manual handling group). The author concludes that there was no evidence that manual handling projects reduced back injuries.

 Table 3: Information and Cultural Industries, Economic Analysis (clustered by type of intervention and sorted by quality score)

Monetary consequences					Monetary	y costs		Other Details		
Study reference	Productivity changes	Insurance and health- care savings	Other	Capital equipment expenditures	External services	Internal staff time	Other	Discounting	CPI adjustment	Sensitivity analysis
Ergonomics and Other MS	SK Prevention In	terventions								
Hocking (1991)	yes	yes		yes		yes		yes		
study quality: 3.4										
ergonomic program										
cost-benefit analysis										

Table 4: Information and Cultural Industries, Economic Analysis (clustered by type of intervention and sorted by quality score)

Study reference	Alternatives considered	Perspective of analysis	Details of analysis	Outcome(s) used in economic analysis	Description of economic analysis results
Ergonomic and O	ther MSK Prevention Interventi	ons			
Hocking (1991) study quality: 3.4 ergonomic program cost-benefit analysis	Alternative 1: status quo – level of manual handling injuries in the pre-period Alternative 2: non-manual handling injuries (reference group)	employer	net present value (NPV)	manual and non-manual handling accidents expenses	 Costs of the intervention: Costs of the intervention were \$11,247,000 (USD). This includes research and development, materials, general development, and general overhead. Consequences of the intervention: Savings from the intervention were \$29,731,000, which consisted of a gross savings of \$40,869,000 (all from increases in productivity attributable to the plastic pits), less a taxation effect of \$11,138,000 (USD).
					Result: The net present value was \$3,995,000 (USD). Although the Telecom project was apparently ineffective in reducing injury, paradoxically it was economical (note that the individual costs and consequences provided in the study do not add up correctly).

Appendix PTables for Manufacturing and Warehousing

Study reference	Motivation	Location	Industry details	Type of intervention	Description of intervention
Ergonomic and Oth	er MSK Injury Pre	vention Interve	ntions		
Lanoie (1996)	high number of injuries	Canada	Wholesale Trade	participatory ergonomics (primary)	A participatory ergonomic intervention to reduce back disorders at an alcohol distributor. Six principal problems were
study quality: 3.9		Quebec	warehousing and distribution of alcoholic beverages		addressed by the joint worksite safety committee.
participatory		Quebec City			
ergonomic program			warehouse workers and truck drivers		
cost-benefit					
analysis					
Lahiri (2005)	high number of injuries	United States	Manufacturing	ergonomics (primary prevention)	Engineering controls and workstation modifications were instituted following ergonomic evaluations. New equipment
study quality: 3.5			wood-processing manufacturing plant		introduced included adjustable chairs, conveyors, lift tables, anti-fatigue matting, grabbers, and catwalks to minimize the
ergonomic program			labourers and assemblers:		use of ladders.
cost-benefit			forklift, crane, and machine		
analysis			operators; technicians; and		
			utility/general production workers		
Lahiri (2005)	high number of injuries	United States	Manufacturing	ergonomics (primary prevention)	A number of engineering controls were implemented. Ergonomic dollies were redesigned (to reduce the amount of
study quality: 3.5			manufacturer of truck and automotive bodies and engines		bending), lift and tilt tables were installed (to allow adjustment of workstation heights), and mechanical lift assists, and
ergonomic program			assemblers in different		various platforms and risers were introduced (to reduce loads and awkward back postures).
cost-benefit			assembly lines		
analysis					
Abrahamsson (2000)	multiple: low productivity	Sweden	Manufacturing	participatory ergonomics (primary prevention)	Development of new ladle service department by a consultant company, which used different participatory and pedagogical
. ,	(and high	Lulea	steel foundry		methods in the process of designing the new department. The
study quality: 3.3	absenteeism), high turnover.		ladle operators and foremen		intervention addressed issues related to environment, climate factors, the role of the ladle service in the steelworks.
participatory	poor working				transport routes and production flows. The new ladle service
ergonomic program	conditions				department had an advanced climate and ventilation system that kept the heat and smoke from the ladles out of the
cost-benefit					working area.
analysis					

Study reference	Motivation	Location	Industry details	Type of intervention	Description of intervention
Ergonomic and Othe	r MSK Injury Pr	evention Interver	ntions (continued)		
Halpern (1997)	high number	United States	Manufacturing	participatory	A participatory ergonomic program was introduced based on a
study quality: 2.5	or injuries	Mountain West region	automobile products and accessories manufacturer	primary and secondary prevention)	included a number of engineering changes and related training to use new tools/equipment, a stretching program, return-to-work
participatory ergonomic program			sewing machine operators		activities (e.g. increased use of modified duty program), and an awareness education effort. Steering committee, design committee, and medical and claims management committee worked together
partial economic analysis					with top management participation at the implementation stage.
Kemmlert (1996)	high cost of	Sweden	Manufacturing	ergonomics	The ergonomic intervention consisted of workplace assessment and
study quality: 2.2	injury		radiator industry	(primary prevention)	redesign and included mechanization of manual tasks consisting of wiring and stretching spirals about once every minute.
ergonomic program			mechanics		
cost-benefit analysis					
Kemmlert (1996)	high cost of	Sweden	Manufacturing	ergonomics	The ergonomic intervention consisted of workplace assessment and redesign and included purchase and introduction of more shallow
study quality: 2.2	nijary		metal industry	(prinary prevention)	and less heavy hampers with more comfortable working height,
ergonomic program			material handlers		electrical adjustable hoist, as well as reorganization of work so that workers rotated between several jobs.
cost-benefit analysis					
Moore (1998)	high number	United States	Manufacturing	participatory	A corporate participatory ergonomic program was introduced that
study quality: 2.0	or injunes		red meat packing (slaughtering and processing) plant	prevention)	correction, prevention, and control, 3) medical management, and 4) training and education.
participatory ergonomic program			workers in slaughtering and		
partial economic analysis			processing plants		

Study reference	Motivation	Location	Industry details	Type of intervention	Description of intervention
Ergonomic and Othe	r MSK Injury Preve	ention Interven	tions (continued)		
Ridyard (2000)	multiple	United States	Manufacturing	participatory ergonomics (both primary and	A multi-disciplinary participatory ergonomic team was given training by an external consultant.
study quality: 1.8		Northeast	beverage packaging facility	secondary prevention)	
participatory ergonomic program partial economic			all workers, primarily those working in filling, packing and warehouse		
analysis					
Disability Manageme	ent Interventions				
Hochanadel (1993)	high cost of injury	United States	Manufacturing	disability management (secondary prevention)	On-site industrial physical therapy program for all injuries, both work-related and not. Services include evaluation,
study quality: 2.9		South	research and manufacturing for the US Department of		treatment, physical therapy referrals, and education in the form of a back school.
disability management		Central US	Energy		
program			all workers		
cost-benefit analysis					
Goodman (1992)	high number of injuries	United States	Manufacturing	disability management (secondary prevention)	Intervention consisted of surgical release of cases with carpal tunnel syndrome followed by an aggressive return-to-work
study quality: 2.4		Arkansas			program.
disability management program					
partial economic analysis					
Perry (1996)	high cost of	United	Retail and Trade	disability management	A return-to-work program, called the REACH program
study quality: 1.9	injunes	Sidles	department store	(secondary prevention)	consisting of temporary employment at the regular place of employment if possible or in "spattand workshops" until the
disability management program		Midwest	warehouse workers, furniture delivery workers		worker is able to resume regular duties.
partial economic analysis					

Study reference	Motivation	Location	Industry details	Type of intervention	Description of intervention
Multi-faceted and Oth	er Interventions				
Kjellen (1997)	legislative reguirement	Norway	Manufacturing	other: occupational health and safety	Safety, health and environment (SHE) management systems based on internal control (IC) principles. This included
study quality: 2.6			aluminium plant	management system	clarification of SHE responsibilities, especially related to order and housekeeping, improved reporting of accidents and pear
other: occupational health and safety management system program cost-consequence analysis			aluminium plant workers (specific occupations unclear)	(primary prevention)	accidents and for safety inspections, establishment of safety committees, defining and following-up on yearly goals, development of improved OHS policies and procedures. The intervention included education and training for various personnel, as well as hiring new SHE personnel and external consultants to assist in development of new SHE program, and investment in equipment for the emergency squad.
Lemstra (2003)	systems level	Canada	Manufacturing	multiple (both primary and	1) Occupational management protocol for primary and secondary prevention. Primary prevention strategies included
study quality: 2.5	initiativo	Saskatchewan	meat industry	secondary prevention)	worker rotation schedules, reduced lifting loads and ergonomic redesign of tasks. Secondary prevention strategies consisted of
multiple: 1) work reorganization and ergonomic program, and disability management program; 2) disability management program partial economic analysis	high cost of	United States	all workers	multiple	redesign of tasks. Secondary prevention strategies consisted of independent on-site management of injuries with a physical therapist that included reassurance of good prognosis, encouragement to resume normal activities, simple exercises, and recommendation to resume work as soon as safely possible on either full duties or time-limited modified or light duties. 2) Early Intervention Program. Rapid and expanded rehabilitation services to injured workers to facilitate their return to the workplace. Injured workers are required to immediately participate in expanded physical therapy and work-hardening programs. If worker not at work at 6 weeks, broader secondary or tertiary treatment protocols are initiated (following a multidisciplinary assessment) that include psychosocial intervention.
Bunn (2001) study quality: 2.4 multiple: ergonomics, disability management, and health promotion program partial economic analysis	high cost of injury	United States, Canada and Mexico	Manufacturing manufacturing of medium- and heavy-duty trucks, buses, and diesel engines workers in truck assembly, engine assembly, foundry/metal- working operations, as well as engineering, information technology, and various corporate functions	multiple (both primary and secondary prevention)	Included ergonomics, disability management, and health promotion. A health, safety and productivity group was given the task of expanding the management of safety, workers' compensation, disability, absenteeism, medical services, preventive care and disease management, and indirect costs of the loss of health and productivity.

Study reference	Motivation	Location	Industry details	Type of intervention	Description of intervention
Multi-faceted and Oth	er Interventions	(continued)			
Melhorn (1999) study quality: 2.3 other: program of risk assessment of new recruits cost-benefit analysis	high cost of injury	United States	Manufacturing aircraft manufacturer sheet metal mechanic	other: risk assessment of new recruits (primary prevention)	A musculoskeletal injury risk management program in which new hires are assessed for their risk of injury based on an individual risk-assessment instrument. New hires are assigned to a specific group of risk-reduction strategies based on their risk assessment category.

Study reference	Start year	Exposure duration in months	Number of workers	Study design	Details of analysis	Information on uptake/ involvement	Effectiveness outcome measure	Observed effect including magnitude, if provided
Ergonomic and Othe	er MSK Inju	Iry Prevention	Interventions					
Lanoie (1996) study quality: 3.9 participatory ergonomic program cost-benefit analysis	1990	57	approximate ly 90 workers	longitudinal (interrupted time series) uncontrolled	Poisson regression model, where the dependent variable is the number of back injuries	in the regression, intensity of exposure measured with a count variable for each year the intervention was active; a department thought to be most affected was identified with an interaction term with the intervention variables	back injuries resulting in a workers' compensation claim	The coefficient on the variable that identifies the ergonomic intervention was significant at the 10% level. From the regression results, it is estimated that the intervention reduced the number of back injuries by 6 in 1991, by 11 in 1992, and by 15 in 1993.
Lahiri (2005) wood-processing plant case study study quality:3.5 ergonomic program cost-benefit analysis	NA	36	123	before-after uncontrolled	before-after comparison of back-pain cases, sick days due to low-back pain, and productivity changes	annual average number of employees subject to intervention (out of total number of employees)	 cases of low- back pain; sick days due to low-back pain; medical care costs (incl. for no-lost time cases); productivity 	1) acute back pain cases: reduction from 6 to 0 - hence, medical costs of \$1,010 avoided (annually); 2) sick days due to low-back pain remain at 0; 3) total annual productivity gain: \$81,200 (\$2,160 in avoided productivity loss + \$79,040 in productivity enhancement)
Lahiri (2005) truck, auto body, engine manufacturer case study study quality:3.5 ergonomic program cost-benefit analysis	NA	48	1500	before-after uncontrolled	before-after comparison of back pain cases, sick days due to low-back pain, and productivity changes	annual average number of employees subject to intervention (out of total number of employees)	 cases of low-back pain; sick days due to low-back pain; medical care costs (incl. for no-lost time cases); productivity 	1) annual average number of acute back pain cases: reduction from 11 to 3.3; annual average number of chronic cases: reduction from 4 to 0; annual average number of sick days due to back pain: reduction from 693 to 1; 2) avoided medical care costs: \$16,280, avoided sick leave costs: \$121,792; 3) total reported annual gain in productivity: \$2,708,992

Study reference	Start year	Exposure duration in months	Number of workers	Study design	Details of analysis	Information on uptake/ involvement	Effectiveness outcome measure	Observed effect including magnitude, if provided	
Ergonomic and Other MSK Injury Prevention Interventions (continued)									
Abrahamsson (2000) study quality: 3.3 participatory ergonomic program cost-benefit analysis	1990	36	30	before-after uncontrolled	before-after comparison of absenteeism, working environment measures as well as production quality and efficiency		 absenteeism due to illness and occupational injuries; measures of quality and efficiency of production 	 Absenteeism due to illness fell substantially and, after the first year of operation, was 2.5% lower than the average for the whole steelworks. Work environment has improved considerably. The most harmful work movements and positions have been reduced from 20% of the work time at the old workplace to 1% at the new workplace. Other strenuous movements and positions have been reduced from 34% to 13%. Improvements in production quality and efficiency: fewer breakdowns (annual reduction by 10 major breakdowns), less production disturbances, improved production planning reliability, reduced need for maintenance, reduction of returned steel by 35%, and reduced need for mechanical repair and the use of incidental materials. 	
Halpern (1997) study quality: 2.5 participatory ergonomic program partial economic analysis	1993	36	approximately 250 employees	before-after uncontrolled	before-after comparison of workers' compensation claims		number of workers' compensation claims (total and musculoskeletal injury related claims)	Total number of workers' compensation claims (all operations) rose by 21% from 106 in 1992-93 (one year prior to intervention) to 128 in 1995-96 (third year of intervention). The number of MSK claims (sewing operations) fell from 13 to 2 in the same time period. The number of employees over this time period rose from 514 to 700	
Kemmlert (1996) radiator industry case study study quality: 2.2 ergonomic program cost-benefit analysis	NA	NA	4	before-after uncontrolled	before-after comparison of sick leave and associated expenses / savings		value of sick leave / absenteeism (associated losses and expenses averted)	There was a 5% reduction in sick leave (across 4 employees) which was reflected in savings of \$3,010 US per year. Also, there were savings due to reduced overemployment of \$9,025 US per year based on 5% reduction in absenteeism (sick leave); reduced recruitment of \$207 US per year based on 70% reduced turnover and ensuing savings in personnel manager time; reduced training costs of new employees of \$570 US due to reduced turnover; and reduced staff cost of \$45,126 US due to one less FTE required to perform the task.	

Study reference	Start year	Exposure duration in months	Number of workers	Study design	Details of analysis	Information on uptake/ involvement	Effectiveness outcome measure	Observed effect including magnitude, if provided
Ergonomic and Othe	er MSK Inju	ury Preventior	n Interventions ((continued)				
Kemmlert (1996) metal industry case study study quality: 2.2 ergonomic program cost-benefit analysis	NA	NA	4	before-after uncontrolled	before-after comparison of sick leave and associated expenses / savings	-	value of sick leave / absenteeism (associated losses and expenses averted)	There was a 10% reduction in sick leave (across 4 employees) which was reflected in savings of \$5,055 US per year. Also, there were savings due to reduced overemployment of \$15,044 US per year based on 10% reduction in absenteeism (sick leave); reduced recruitment of \$53 US per year based on 10% reduced turnover and ensuing savings in personnel manager time; reduced training costs of new employees of \$56 US due to reduced turnover.
Moore (1998) study quality: 2.0 participatory ergonomic program partial economic analysis	1986	90	NA	post-only one group design	percentage change in workers' compensation claims and expenses		workers' compensation total claim incidence rate (per 100 workers), lost- time incidence rate (per 100 workers), workers' compensation expenses (total and per capita)	 Increase in total incidence rate (by 7% relative to baseline: 1987 level); decrease in lost-time incidence rate (by 89% relative to baseline: 1984); decrease in the percentage of recordable disorders related to musculoskeletal risk factors (from 66% in 1987 to 46% in 1993); overall 84% decrease in total annual WC costs between 1987 and 1993; overall 73% decrease in per-capita WC costs between 1987 and 1993.
Ridyard (2000) study quality: 1.8 participatory ergonomic program partial economic analysis	1996	24	140	before-after uncontrolled	before-after trends analysis of MSK injuries and associated lost days from work		number of MSK injuries and associated lost days from work	 MSK injuries decreased from 82 pre- intervention (1995) to 78 during intervention (1996) to 73 post-intervention (1997) and associated days lost declined from 2,407, to 1,317 and to 272 respectively. Number of severe injuries (with long-term absences) also fell from 8 (1995) to 5 (1996) to 2 (1997) as did the average number of lost workdays associated with severe injuries (fell from 134 in 1995, 166 in 1996, and 76 in 1997).

Study reference	Start year	Exposure duration in months	Number of workers	Study design	Details of analysis	Information on uptake/ involvement	Effectiveness outcome measure	Observed effect including magnitude, if provided
Disability Manageme	nt Interve	entions						
Hochanadel (1993) study quality: 2.9 disability management program cost-benefit analysis	1982	120	2900	before-after uncontrolled	before-after comparison of the mean absence rate	number of evaluations, referrals and treatment courses; number of clinical visits (average by body part treated) and treatment procedures	absences / time away from work (disability and time spent seeking treatment)	 the absence rates were significantly lower after the intervention (declined from almost 19% in 1978 pre-intervention to consistently below 3% following the intervention, 1982-1986); previously treated employees who attended the Back School (compared to treated employees who did not attend the Back School) reported in a questionnaire: having less pain, better ability to control pain without medication, having lost less work time.
Goodman (1992)	1982	84	treatment	post-only	difference in time		days off work	1) The average time off work for treatment and
study quality: 2.4			group: 44 control	controlled	off work and cost per case between		per case, proportion of cases resulting	 control group was 6.25 days and 29.285 days per carpal tunnel release, respectively. 2) 22% and 33% of releases respectively
disability management program			group : 23		intervention and control groups		in disability, number of	resulted in permanent partial impairment; 3) One patient in each group had a recurrence of
partial economic analysis							number failing to return to work, workers' compensation costs per claim	 4) One patient in the treatment group and three in the control group failed to return to work. 5) (Workers' compensation) cost per release was \$4,020.59 and \$7,715.33 for treatments and controls, respectively.
Perry (1996)	1993	24	NA	before-after	before-after	30 employees from	temporary total	There was a dramatic reduction (66%) in
study quality: 1.9				uncontrolled	trends in	centres had	expenses,	workers from 1991 to 1994, after REACH had been
disability management					disability payments and	REACH since its introduction and	compensation expenses	for REACH participants were included in the TTD payment totals for the first year).
program					changes in	have averaged 3 weeks in the		With respect to workers' compensation expenses,
partial economic analysis					workers' compensation expenses	REACH program		the department store as a whole showed a reduction of 28%, compared to 59% at the distribution centres where REACH was in place.

Study reference	Start year	Exposure duration in months	Number of workers	Study design	Details of analysis	Information on uptake/ involvement	Effectiveness outcome measure	Observed effect including magnitude if provided
Multi-faceted and Otl	her Interve	entions						
Kjellen (1997) study quality: 2.6 other: occupational health and safety management system cost-consequence analysis	1989	66	405	before-after uncontrolled	trends analysis		lost-time injuries, sick leave hours, count of accidents, count of reclaims	 Lost-time injuries per one million hours of work have decreased overall from 33 in 1985-86 to 4 in 1994. Severity rate (# of lost work days due to accidents per million hours of work) fell from 285 in 1988 to 30 in 1994. Number of lost work days per accident dropped from 8 in 1985 to 2 in 1994 (not including three fatalities from 1988). Sickness leave (absences) as a percentage of total working hours fell from 6.4% in 1985-86 to 4.5% in 1994. Number of reclaims was reduced by a factor three from 1985-86 to 1994
Lemstra (2003) study quality: 2.5 multiple: 1) work reorganization and ergonomic program, and disability management program; 2) disability management program partial economic analysis	2000	12	treatment group: 285 for Company A (Occupational Management), 232 for Company B (Early Intervention Program) control group: 185 Company A (Standard Care)	before-after comparison with control <i>and</i> before-after uncontrolled	 Standard care in company A compared to early intervention program in company B; before-after comparison of occupational management protocol with standard care in company A; occupational management protocol in company A compared to early intervention program in company B 		upper extremity, back, and all/total claims and their duration	 Occupational management resulted in lower injury claim incidence (for upper extremity, back, and all claims), duration, and costs than standard care, which, in turn, was superior to the early intervention program (on the same indicators). All time-loss claims incidence: 3.2, 7.9 and 21.8/22.4 respectively, work-related upper-extremities MSK time-loss claims incidence: 0.6, 2.3, 8.9/7.3 respectively; back time-loss claims incidence: 0.6, 2.6, 5.4/4.0 respectively; total days lost: 66.1, 220.4 and 1129.2/1224.8 respectively, work-related upper-extremities MSK days lost: 12.3, 138.5, 662.6/731.6 respectively; back days lost: 1.1, 60.9, 280.1/141.0 respectively (all per 100,000 hours worked).

Study reference	Start year	Exposure duration in months	Number of workers	Study design	Details of analysis	Information on uptake/ involvement	Effectiveness outcome measure	Observed effect including magnitude if provided
Multi-faceted and Ot	her Interv	entions (conti	nued)					
Bunn (2001) study quality: 2.4 multiple: ergonomics, disability management, and health promotion program partial economic analysis	1997	48	18,000	before-after uncontrolled	trends analysis	audit scores used to measure compliance and safety systems management (a safety performance measure); for the Health Promotion program authors looked at activity level of site committees, awareness rates, and participation rates (not used in econ. eval.)	incidence frequency rate per 100 employees for all cases and lost-time cases, number of long- term disability cases, controllable absenteeism as a percentage of all time off, workers' compensation expenses, disability (STD & LTD) expenses, medical expenses / health-care costs saved	 Reduction in incidence frequency rate from 21.5 (3-year average in 1996) to 16.3 per 100 employees in 1999. Reduction in lost-time case rate from 6.5 (3-year average in 1996) to 4.3 per 100 employees in 1999. Workers' compensation expense per worker was reduced from \$687.60 (3-year average in 1996) to \$596.30 in 1999. Long-term disability total cases decreased from 350 in 1996 to 241 in 2000 (active cases decreased from 207 in 1996 to 142 in 2000, while retiree cases dropped from 143 in 1996 to 99 in 2000); LTD cost per worker fell from \$172.57 in 1996 to \$135.46 in 1999; STD cost per worker fell from \$514.86 to \$460.57 in 1999. An overall decrease in controllable absenteeism as a percentage of all time off from 4.7 in 1997 to 4.3 in 2002.
Melhorn (1999) study quality: 2.3 other: program of risk assessment of new recruits cost-benefit analysis	1995	48	3152	before-after uncontrolled	before-after comparison of workers' compensation claims and expenses	distribution of risk score across sample group, and transitional work guides for different risk levels	lost-time claims incident rate per 200,000 hours, lost-time claims severity rate per 200,000 hours; workers' compensation expenses (per worker)	 Significant reduction in lost-time claims incident rate per 200,000 hours (71% decrease during program implementation period of 1995 to 1998). Significant reduction in lost-time claims severity rate per 200,000 hours (88% reduction from 1995 to 1998). Workers' compensation expenses per worker dropped to \$356, \$346, \$258, and \$252 from 1995 to 1998 (previous five years had high of \$472 and low of \$415).

	Mone	tary consequen	ces		Monetar	y costs			Other details	
Study reference	Productivity changes	Insurance and health- care savings	Other	Capital equipment expenditures	External services	Internal staff time	Other	Discounting	CPI adjustment	Sensitivity analysis
Ergonomic and Other M	SK Injury Prever	ntion Intervention	ons							
Lanoie (1996)	yes	yes		yes		yes	yes	yes	yes	yes
study quality: 3.9										
participatory ergonomic program										
cost-benefit analysis										
Lahiri (2005)	yes	yes		yes	yes	yes		yes	yes	yes
study quality: 3.5										
ergonomic program										
cost-benefit analysis										
Abrahamsson (2000)	yes			yes	yes			yes		
study quality: 3.3										
participatory ergonomic program										
cost-benefit analysis										
Halpern (1997)		yes								
study quality: 2.5										
participatory ergonomic program										
partial economic analysis										
Kemmlert (1996)	yes	yes	yes	yes		yes		NA	NA	
study quality: 2.2										
ergonomic program										
cost-benefit analysis										

 Table 3: Manufacturing and Warehousing, Economic Analysis (clustered by type of intervention and sorted by quality score)

	Mone	tary consequen	ces		Monetar	y costs			Other details		
Study reference	Productivity changes	Insurance and health- care savings	Other	Capital equipment expenditures	External services	Internal staff time	Other	Discounting	CPI adjustment	Sensitivity analysis	
Ergonomic and Other M	SK Injury Preve	ntion Interventio	ons (continue	d)							
Moore (1998)		yes									
study quality: 2.0											
participatory ergonomic program											
partial economic analysis											
Ridyard (2000)		yes	yes								
study quality: 1.8											
participatory ergonomic program											
partial economic analysis											
Disability Management	Interventions										
Hochanadel (1993)	yes	yes				yes	yes				
study quality: 2.9											
disability management program											
cost-benefit analysis											
Goodman (1992)	yes	yes						NA	NA		
study quality: 2.4											
disability management program											
partial economic analysis											

Table 3: Manufacturing and Warehousing, Economic Analysis (clustered by type of intervention and sorted by quality score)

Table 3: Manufacturing and Wa	arehousing, Economic	Analysis (clustered b	y type of intervention	and sorted by quality score)
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	Mone	tary consequer	Monetary costs				Other details			
Study reference	Productivity changes	Insurance and health- care savings	Other	Capital equipment expenditures	External services	Internal staff time	Other	Discounting	CPI adjustment	Sensitivity analysis
Disability Management Interventions (continued)										
Perry (1996)		yes						NA		
study quality: 1.9										
disability management program										
partial economic analysis										
Multi-faceted and Other Interventions										
Kjellen (1997)	yes	yes	yes	yes	yes	yes	yes		yes	
study quality: 2.6										
other: occupational health and safety management system										
cost-consequence analysis										
Lemstra (2003)		yes								
study quality: 2.5										
multiple: 1) work reorganization and ergonomic program, and disability management program; 2) disability management program										
partial economic analysis										

	Monetary consequences				Monetary costs				Other details		
Study reference	Productivity changes	Insurance and health- care savings	Other	Capital equipment expenditures	External services	Internal staff time	Other	Discounting	CPI adjustment	Sensitivity analysis	
Multi-faceted and Other Interventions (continued)											
Bunn (2001)		yes									
study quality: 2.4											
multiple: ergonomics, disability management, and health promotion program											
partial economic analysis											
Melhorn (1999)		yes				yes					
study quality: 2.3											
other: program of risk assessment of new recruits											
cost-benefit analysis											
Study reference	Alternatives considered	Perspective of analysis	Details of analysis	Outcome(s) used in economic analysis	Description of economic analysis results						
--	----------------------------	----------------------------	--------------------------	--	--						
Ergonomic and Of	ther MSK Injury Prevention	Interventions									
Lanoie (1996) study quality: 3.9 participatory ergonomic program cost-benefit analysis	status quo	employer	net present value	direct and indirect expenses associated with back- related injuries	Costs of the intervention: Costs were \$164,529.44 for the duration of the intervention, and were estimated to be \$227,318.31 for the period which included a projection of costs for 5 years into the future (CAD). These values include costs with training, time devoted to activities related to the intervention, automatic pallet distributor, pallet truck, stuck boxes, trucks, wrapper and trucks. Consequences of the intervention: Consequences were \$156,546.79 for the duration of the intervention (consisting of direct and indirect expenses), and were estimated to be \$415,019.12 for the period that included a projection of benefits for 5 years into the future (CAD). Result: The net present value for the duration of the intervention was (-\$7,982.64) and						
					over the time period that included future projections was \$187,700.79. The net present value becomes positive in the year following the measured intervention time period (all values are in 1989 Canadian dollars).						
Lahiri (2005) wood-processing plant case study study quality: 3.5 ergonomic program cost-benefit analysis	status quo	employer	cost-benefit analysis	 medical care costs associated with low-back pain cases; value of lost work time due to sick leave (productivity); productivity; productivity loss due to low- back pain at work; productivity enhancements 	Costs of the intervention: Costs per year were \$5,338, which include equipment, physical therapists' time, internal labour costs (likely including installation and maintenance; internal training and other time costs). Consequences of the intervention: Savings per year were \$82,210, which include medical care costs avoided, avoided loss in work time due to sick leave, productivity losses (averted) due to low-back pain and discomfort while at work (before intervention), and productivity enhancements due to intervention. Results: Net savings per year were \$76,872, with savings per worker of \$625. The benefit-to-cost ratio was 15.40 and the payback period was 5.3 months (all 2002 dollars).						
				intervention							

Study reference	Alternatives considered	Perspective of analysis	Details of analysis	Outcome(s) used in economic analysis	Description of economic analysis results
Ergonomic and Ot	her MSK Injury Prevention	Interventions (co	ntinued)		
Lahiri (2005) truck, auto body, engine manufacturer case study study quality:3.5 ergonomic program cost-benefit analysis	status quo	employer	cost-benefit analysis	 medical care costs associated with low-back pain cases; value of lost work time due to sick leave (productivity); productivity; productivity loss due to low- back pain at work; productivity enhancements due to intervention 	 Costs of the intervention: Costs per year were \$512,657, which include equipment, ergonomic redesign, installation, internal labour costs (likely including maintenance and internal training costs). Consequences of the intervention: Savings per year were \$2,847,066, which include medical care costs avoided, avoided loss in work time due to sick leave, productivity losses (averted) due to low-back pain and discomfort while at work (before intervention), and productivity enhancements due to intervention. Results: Net savings per year were \$2,334,409, with savings per worker of \$1,556. The benefit-to-cost ratio was 5.5 and the payback period was 3.3 months (all 2002 dollars).
Abrahamsson (2000) study quality: 3.3 participatory ergonomic program cost-benefit analysis	status quo	employer	cost-benefit analysis	value of absenteeism, production quality, and production efficiency	 Costs of the intervention: The present value of costs was SEK 13,580,000 (Swedish Krona), which include investment (equipment) costs and consultant services. Consequences of the intervention: The present value of total savings over 10 years was SEK 25,633,000, which include improved production quality and efficiency, namely: fewer breakdowns, less slag handling, less returned steel, reduced maintenance and materials consumption, reduced need for manpower, as well as reduced absenteeism due to illness and occupational injury. Results: The Net Present Value was SEK 12,053,000. The internal interest rate (internal rate of return) was 36%, the pay-off time (payback period) was 2.2 years, while the profit (using the annuity method) was SEK 2,732,000.

Study reference	Alternatives considered	Perspective of analysis	Details of analysis	Outcome(s) used in economic analysis	Description of economic analysis results
Ergonomic and Ot	her MSK Injury Prevention	Interventions (co	ntinued)		
Halpern (1997) study quality: 2.5 participatory ergonomic program partial economic analysis	status quo	employer	before-after comparison of workers' compensation expenses	workers' compensation expenses	Costs of the intervention: No intervention costs considered. Consequences of the intervention: Savings in workers' compensation expenses. Results: The number of employees at the plant over the study period rose from 514 to 700. 1) For sewing operations: workers' compensation expenses related to MSK disorders fell from \$414,000 to \$100,000, \$54,000, and \$11,000 respectively each year following the introduction of the intervention (overall decrease of 97%), while the per MSK claim expenses fell from \$31,846 to \$5,500 during the same period. 2) For all operations: total workers' compensation expenses decreased from \$723,000 before the intervention to \$420,000 in the third year of the intervention (overall decrease in total expenses of 42%), while workers' compensation expenses per claim fell from \$6,821 to \$3,281 (a 52% decrease).
Kemmlert (1996) radiator industry case study study quality: 2.2 ergonomic program cost-benefit analysis	status quo	employer	cost-benefit analysis	value of sick leave / absenteeism (and associated losses and expenses averted)	 Costs of the intervention: Costs were \$21,368 US (1988 dollars), which include equipment (machinery) costs and costs of internal consultations (internal staff time costs). Consequences of the intervention: Savings (benefits) for a one-year period were \$57,938 US (1988 dollars), which include savings due to reduced sick leave and related reduced need for over-employment, productivity increases due to mechanization, reduction in insurance expenses due to reduced sick leave, and reduced turnover and lower related recruitment and training expenses. Results: The payback period was 4 months.
Kemmlert (1996) metal industry case study study quality: 2.2 ergonomic program cost-benefit analysis	status quo	employer	cost-benefit analysis	value of sick leave / absenteeism (and associated losses and expenses averted)	 Costs of the intervention: Costs were \$5,043 US (1988 dollars), which include equipment costs (trays, truck) and internal time costs of training for job rotation. Consequences of the intervention: Savings (benefits) for a one-year period were \$20,208 US (1988 dollars), which include savings due to reduced sick leave and related reduced need for over-employment, reduction in insurance expenses due to reduced sick leave, and reduced turnover and lower related recruitment and training expenses. Results: The payback period was 3 months.

Study reference	Alternatives considered	Perspective of analysis	Details of analysis	Outcome(s) used in economic analysis	Description of economic analysis results
Ergonomic and O	ther MSK Injury Prevention	Interventions (co			
Moore (1998) study quality: 2.0 participatory ergonomic program partial economic analysis	status quo	employer	percentage change in workers' compensation expenses from baseline year	workers' compensation expenses	 Costs of the intervention: No intervention costs considered. Consequences of the intervention: Savings in workers' compensation expenses. Results: Following the introduction of intervention (1986), there was an 84% decrease in workers' compensation expenses between 1987 and 1993 (values adjusted for inflation). Per capita workers' compensation expenses declined by 73% between 1987 and 1993 (per capita expenses not adjusted for inflation).
Ridyard (2000) study quality: 1.8 participatory ergonomic program partial economic analysis	status quo	employer	trends analysis of workers' compensation indemnity and medical expenses	workers' compensation expenses	Costs of the intervention: No intervention costs considered. Consequences of the intervention: Savings in workers' compensation expenses. Results: 1) Direct savings in workers' compensation indemnity and medical expenses for 1996: \$76,330 in indemnity expenses and \$30,000-\$38,000 in medical expenses (total of \$106,330-\$114,330). 2) Direct savings in workers' compensation indemnity and medical expenses for 1997: \$83,600 in indemnity expenses and \$40,000-\$45,000 in medical expenses (total of \$123,600 to \$182,600) 3) Indirect savings at 3 times direct gives a maximum total savings of \$425,320 for 1996 and \$515,320 for 1997.
Disability Manage	ement Interventions				
Hochanadel (1993) study quality: 2.9 disability management program cost-benefit analysis	status quo	employer	cost-benefit analysis	wage value of reduced disability time	 Costs of the intervention: Costs over the 10-year period were \$940,000, which include labour and fringe costs of staff in physical therapy clinics, as well as maintenance, operating costs, materials, and supplies. Consequences of the intervention: Total savings were \$9.3M, which include treatment cost savings of \$3.2M, evaluation cost savings of \$0.5M, savings from reduced treatment time of \$2.4M, and savings from reduced disability time of \$3.2M. Results: Net savings were \$8.3M. The benefit-to-cost ratio was 9:1.

Study reference	Alternatives considered	Perspective of analysis	Details of analysis	Outcome(s) used in economic analysis	Description of economic analysis results
Disability Manage	ment Interventions (continu	ied)			
Goodman (1992)	status quo	employer and worker	partial economic	workers' compensation	Costs of the intervention: Unclear what is regarded cost and what is consequence.
study quality: 2.4			analysis	expenses per claim	Consequences of the intervention : Unclear what is regarded cost and what is consequence.
disability management program partial economic analysis					 Results: 1) The cost per carpal tunnel release was \$4,020.59 for individuals in the treatment group and \$7,715.33 for individuals in the control group. The average time off work was shorter for the treatment group by 23.035 days, suggesting the incremental wage replacement cost of \$1842.80 per average case in the control group before return to work. Therefore, the average cost of treatment/recovery before return to work in the control group is \$9558.13, while in the treatment group it is \$4020.59 (58% less than with traditional treatment). 2) The worker/patient is financially better off following the aggressive RTW program by getting higher income (\$408.89 for the average 23.035-day earlier return to work), compared to patients in the control group who receive capped workers' compensation.
Perry (1996)	status quo	employer	before-after comparison of	temporary total disability	Costs of the intervention: No intervention costs considered.
study quality: 1.9 disability			trends in temporary total disability	payments (workers'	Consequences of the intervention : Savings in temporary total disability and medical payments.
management program			payments and percentage change in	expenses)	Results : The temporary total disability (TTD) payment trend for fiscal years 1991 to 1994 showed a dramatic reduction in payments to injured workers. There was a 4% increase in TTD payment averages at the distribution centres from fiscal years 1991 to
partial economic analysis			workers' compensation expenses		1992. In 1993, the average TTD payment per claim decreased 19% compared to the 1991 value. In 1994, after REACH had been implemented at all four distribution centres, there was a 66% decrease from the fiscal year 1991 (wages for REACH participants were included in the TTD payment totals for the first year).
					With respect to workers' compensation expenses, the department store as a whole showed a reduction of 28%, compared to 59% at the distribution centres where REACH was in place.

Multi-faceted and Other Interventions Kjellen (1997) status quo employer cost- consequence analysis / trends analysis value of lost work hours (absenteeism), accidents, and Costs of the intervention: Changes in safety, health and environment (SHE) costs per ton of aluminium produced in Norwegian Krone (NOK) (adjusted for inflation)	
Kjellen (1997)status quoemployercost- consequence analysis / trends analysisvalue of lost work hoursCosts of the intervention: Changes in safety, health and environment (SHE) costs per ton of aluminium produced in Norwegian Krone (NOK) (adjusted for inflation)study quality: 2.6analysis / trends analysis(absenteeism), accidents, andcosts of the intervention: Changes in safety, health and environment (SHE) costs per ton of aluminium produced in Norwegian Krone (NOK) (adjusted for inflation) relative to the 1985/86 average for 1989-1994 respectively were 66, 70, 50, 25, 11, and 24 (intervention introduced in 1989). These costs include hiring consultants to	
other: reclaims support the development of the SHE program, providing SHE courses for all personnel, courses for process operators, training emergency squad, personnel tim for the SHE department and time of maintenance personnel, as well as equipment for the SHE department and time of maintenance personnel, as well as equipment for the SHE department and time of maintenance personnel, as well as equipment for the SHE department and time of maintenance personnel, as well as equipment for the SHE department and time of maintenance personnel, as well as equipment for the SHE department and time of maintenance personnel, as well as equipment for the SHE department and time of maintenance personnel, as well as equipment for the SHE department and time of maintenance personnel, as well as equipment for the SHE department and time of maintenance personnel, as well as equipment for the SHE department and time of maintenance personnel, as well as equipment for the SHE department and time of maintenance personnel, as well as equipment for the SHE department and time of maintenance personnel, as well as equipment for the SHE department and time of maintenance personnel, as well as equipment for the SHE department and time of maintenance personnel, and the department and time of maintenance personnel, and the respective due to the low costs to the company of SHE-relate losses? cost- (costs) have significantly increased. 1) Maintenance, personnel, and total operation costs (per ton of aluminium produce in relation to the baseline level in 1985 have decreased over the ten-year period an error of this may he detribution to SHE.	costs n) , 11, s to el time lent for s (in average les health activities have not c-related duced) id and

Study reference	Alternatives considered	Perspective of analysis	Details of analysis	Outcome(s) used in economic analysis	Description of economic analysis results
Multi-faceted and	Other Interventions (continu	ued)			
Lemstra (2003) study quality: 2.5 multiple: 1) work reorganization and ergonomic program, and disability management program; 2) disability management program partial economic analysis	occupational management protocol early intervention program status quo (standard care)	perspective unclear	comparison of workers' compensation expenses per 100,000 hours worked (for all time-loss claims, upper extremity and back time-loss claims before/after and between two companies with different interventions)	workers' compensation claim expenses (per 100,000 hours worked)	 Costs of the intervention: No intervention costs considered. Consequences of the intervention: Savings in worker's compensation expenses: wage replacement and medical/rehabilitation compensation related to upper-extremity MSK disorders, back disorders, and all injury claims. Results: Occupational management resulted in lower injury claim incidence, duration, and costs (all per 100,000 hours worked) than standard care, which, in turn, was superior to the early intervention program (on the same indicators). 1) Occupational Management [OC] (company A in 2000) vs. Early Intervention Program [EIP] (company B in 2000): total workers' compensation expenses under OC were \$6,028 vs. \$120,459 under EIP; workers' compensation expenses for upper-extremity MSK injury claims under OC were \$597 vs. \$73,136 under EIP; workers' compensation expenses for back disorders under OC were \$287 vs. \$29,737 (all per 100,000 hours worked). 2) Occupational Management [OC] (company A in 2000) vs. Standard Care [SC] (company A in 1999): from 1999 to 2000, total time-loss workers' compensation expenses reduced from \$25,878 to \$6,028, upper-extremity time-loss expenses reduced from \$15,777 to \$597, and back time-loss expenses reduced from \$8,713 to \$287 per 100,000 hours worked. 3) Standard Care [SC] (company A in 1999) vs. Early Intervention Program [EIP] (company B in 1999): under SC total time-loss workers' compensation expenses were \$15,777 vs. \$80,816; back time-loss expenses were \$8,713 vs. \$12,296 (all per 100,000 hours worked).
Bunn (2001) study quality: 2.4 multiple: ergonomics, disability management, and health promotion program partial economic analysis	status quo (baseline level in 1996)	employer	trends analysis of per- employee workers' compensation, short-and long- term disability expenses	workers' compensation expenses per worker, long- and short-term disability expenses per worker	 Costs of the intervention: No intervention costs considered. Consequences of the intervention: Savings in workers' compensation and disability expenses. Results: Workers' compensation expenses per worker were reduced from \$687.60 (3-year average in 1996) to \$596.30 in 1999. Long-term disability expenses per worker fell from \$172.57 in 1996 to \$135.46 in 1999. Short-term disability expenses per worker fell from \$514.86 to \$460.57 in 1999. Overall, an integrated Health, Safety, and Productivity strategy was reported to show at least a two-fold return on investment.

Study reference	Alternatives considered	Perspective of analysis	Details of analysis	Outcome(s) used in economic analysis	Description of economic analysis results
Multi-faceted and	Other Interventions (contin	ued)			
Melhorn (1999) study quality: 2.3 other: program of risk assessment of new recruits cost-benefit analysis	status quo	employer	cost-benefit analysis	workers' compensation expenses	 Costs of the intervention: Costs of the intervention per year were \$76,118 (\$304,470 over the 4 years). These costs include: costs of individual risk assessment (\$122,928), costs of repeated assessments after transitional work (\$29,679), costs of transitional work related to intervention protocols (\$142,350), costs of educational classes and instructor (\$2,028), and administrative costs related to managing the program, including physician and staff time (\$7,485). Consequences of the intervention: Workers' compensation expenses per worker dropped to \$356, \$346, \$258, and \$252 between 1995 and 1998 (post-implementation years), respectively. Employer-estimated savings in direct workers' compensation expenses per year between 1995 and 1998 were \$469,990, \$678,337, \$1,936,105, and \$1,995,759, respectively. Results: Savings in workers' compensation expenses translate into a benefit-to-cost ratio of 6 in the first year (6:1), 9 in the second year (9:1), 25 in the third year (25:1), and 26 in the fourth year (26:1).

Appendix Q Tables for Mining and Oil and Gas Extraction

 Table 1: Mining and Oil and Gas Extraction, Description of Intervention (clustered by type of intervention and sorted by quality score)

Study reference	Motivation	Location	Industry details	Type of intervention	Description of intervention		
Ergonomic and Other MSK	Injury Preven	tion Interventions	6				
Maniscalco (1999)	high number of	United States	Mining and Oil and Gas Extraction	health promotion (primary prevention)	A wellness program was established with the goal of reducing the number of work-related injuries, especially back injuries. It		
study quality: 3.0	injuries	Louisiana	offshore oil exploration		focused on risk factors that might be modifiable through planned interventions: namely nutrition and exercise. It		
health promotion program					included a health assessment, fitness programs, education		
cost-benefit analysis			Job types: production operator and platform repairmen - mechanical, electrical, and automation		programs, and incentives.		
Disability Management Inte	rventions						
Greenwood (1990)	high cost of injuries	United States	Mining and Oil and Gas Extraction	disability management (secondary prevention)	Very Early Intervention (VEI), a form of a disability management program, consisting of health and psychosocial		
study quality: 3.0		West Virginia	underground coal mining		evaluation post-injury (8 days after injury) and recovery management / case management.		
disability management program			coal mine workers				
cost-consequence analysis							
Ryan (1995)	high cost of iniuries	Australia	Mining and Oil and Gas Extraction	disability management (secondary prevention)	The intervention had multiple components and consisted of education of the entire workforce, acute back care by first aid		
study quality: 1.9	quality: 1.9 Queensland			()	officers, early referral to a general practitioner and facilitation of		
disability management			coal mines		early return to work as well as attention to psychosocial perceptions of the work environment.		
program			coal mine workers				
partial economic analysis							

Study reference	Start year	Exposure duration in months	Number of workers	Study design	Details of analysis	Information on uptake/ involvement	Effectiveness outcome measure	Observed effect including magnitude, if provided
Ergonomic and Other	MSK Injur	y Prevention	Interventions					
Maniscalco (1999) study quality: 3.0 health promotion program cost-benefit analysis	1992	63	147	before-after uncontrolled	before-after trends analysis, multiple regression used to test the statistical significance of observed differences in outcomes	1) frequency of times the wellness program was offered (every 12 vs. 18 months); 2) percentage of employees eligible for the program (100% prior to 1995, 50% from 1995 onwards); 3) introduction of mandatory participation in the Back Power program and nutrition counselling (1995)	no-lost workday injuries (back injuries), lost workday injuries (back injuries) disck injuries), first aid cases, and levels of cholesterol, nutrition and fitness	1) The number of back injuries decreased from an average of 5 to 6 per year pre-intervention to an average of 1 to 2 post-intervention (threefold decrease). 2) The total number of all injuries declined from 22 in 1990 (2 years before intervention) to 9 in 1997 (6 years post-intervention). 3) Lost workday injuries declined from an average of 7.2 per year over the 1986-1991 period to an average of 2.7 per year over the 1992-1997 period. No-lost workday injuries decreased 12-fold from a total of 36 cases in the 1986-1991 period to a total of 3 cases in the 1986-1991 period. A) First aid cases fell from a total of 44 in the 6-year pre-intervention period to a total of 19 in the 6-year post-intervention period (2.3-fold reduction). 5) There were improvements in levels of cholesterol, nutrition and fitness post-intervention. 6) The annual rate of decrease in injury rates for the Offshore Business Unit was greater than that for the entire Amoco Corporation (though not statistically significant).
Disability Management	t Intervent	ions						
Greenwood (1990) study quality: 3.0	1985	27	Intervention group: 117	randomized controlled trial	before-after analysis testing between-group differences in		number of days off work, disability and medical	 No statistically significant difference was found between the intervention and control groups in the number of days off work and disability benefits paid. Medical benefits paid were actually higher in
disability management program			Control group: 161		outcomes: two- tailed Student t test used for disability		benefits paid, number of permanent	the intervention group (significant at 10%), but this was driven by the incremental costs of the very early intervention program (VEI) (the significance
cost-consequence analysis					days, disability benefits paid, medical benefits paid; permanent total disability awards and litigated cases reported as percentages; Chi- squared tests used on return-to-work and hospitalization rates		disability awards and litigated cases, number of claimants still off work at 18 months follow- up, and number of hospitalizations and operations	of this difference disappears when the VEI costs are excluded). 2) The intervention group had fewer extreme (lengthy and expensive) cases than the control group (low statistical significance). The authors suggest this may be some indication that intervention is beneficial. 3) The number of permanent partial disability awards, the number of claimants still off work at 18 months follow-up, and the number of hospitalizations and operations were all similar (not statistically significantly different) between the two groups.

Table 2: Mining and Oil and Gas Extraction, Effectiveness Analysis (clustered by type of intervention and sorted by quality score)

Table 2 (continued): Mining and Oil and Gas Extraction, Effectiveness Analysis (clustered by type of intervention and sorted by quality score)

Study reference	Start year	Exposure duration in months	Number of workers	Study design	Details of analysis	Information on uptake/ involvement	Effectiveness outcome measure	Observed effect including magnitude if provided
Disability Management In	nterventi	ons (continue	ed)					
Ryan (1995) study quality: 1.9 disability management program partial economic analysis	1980	72	NA	post-only with control group	difference analysis, where nonparametric analysis was used to compare the differences in average expenses per claim and the number of claims between the two mines, and where life table analysis was used to evaluate time to return to work		claims per 100 workers, average workers' compensation claims expenses per year, number of days to return to work	1) The number of claims per 100 workers was significantly less (P<0.01) in the intervention site compared to control site (on a year-to-year basis over a 6-year period). 2) The median time to return to work after injury was 10 days, and no worker was off more than 60 days during the 6- year period (authors conclude "avoidance of chronicity"). 3) The authors report that in the intervention mine, one worker returned to work to lighter duties and that only six workers needed referral to an orthopedic surgeon.

Table 3: Mining and Oil and Gas Extraction, Economic Analysis (clustered by type of intervention and sorted by quality score)

	Monet	ary conseque	nces		Monetar	y costs			Other details	
Study reference	Productivity changes	Insurance and health- care savings	Other	Capital equipment expenditures	External services	Internal staff time	Other	Discounting	CPI adjustment	Sensitivity analysis
Ergonomic and Other MSK Injury Prevention Interventions										
Maniscalco (1999)	yes	yes					yes			
study quality: 3.0										
health promotion program										
cost-benefit analysis										
Disability Management	Interventions							·		
Greenwood (1990)		yes			yes		yes			
study quality: 3.0										
disability management program										
cost-consequence analysis										
Ryan (1995)		yes								
study quality: 1.9										
disability management program										
partial economic analysis										

Table 4: Mining and Oil and Gas Extraction, Economic Analysis (clustered by type of intervention and sorted by quality score)

Study reference	Alternatives considered	Perspective of analysis	Details of analysis	Outcome(s) used in economic analysis	Description of economic analysis results
Ergonomic and Other MSK	Injury Prevention Int	terventions			
Maniscalco (1999) study quality: 3.0	status quo (pre-intervention)	employer	cost-benefit analysis	expenses associated with lost days	Costs of the intervention : Direct program costs were \$355,250 and "indirect costs" were \$174,000 over 5 years (unclear what is included in these costs).
health promotion program				and back injuries	Consequences of the intervention : The savings associated with the intervention include savings due to reduction in lost days and back injuries. The observed decrease in lost workday injuries associated with the wellness program was 9.5 lost
cost-benefit analysis				(medical expenses and productivity losses)	workday injuries per year (1993 to 1997), which translates into savings of \$1,330,000 for the 5-year period. Also, there was a 4.5 back injury decrease per year associated with the intervention, which translates into savings of \$309,375 for the 5-year period.
				,	Results : Net savings due to reduction in lost workday injuries for the 5-year period (NPV without discounting) were \$800,750 (or a return of \$2.51 per dollar after program cost is recovered). Net savings due to reduction in back injuries for the 5-year period (NPV without discounting) were \$167,085 (a return of \$1.85 per dollar after program cost is recovered).
Disability Management Inte	erventions				
Greenwood (1990) study quality: 3.0 disability management program cost-consequence analysis	status quo	system (state workers' compensation agency)	cost-consequence analysis: between-group comparison of disability benefits and medical care payments; cost of intervention	disability benefits and medical care payments	 Costs of the intervention: The total costs were \$49,505.03, which include costs of initial health and psychosocial assessment (by rehabilitation nurse), costs of travel for initial assessment, and costs of recovery management services. Specifically, the cost of initial evaluation per case including travel was \$110 and the mean cost per case for recovery management services was \$651.38. Consequences of the intervention: 1) No statistically significant difference found between the intervention and control groups in disability benefits paid. Medical benefits
			considered separately		paid were actually higher in the intervention group (significant at 10%), but this is driven by the incremental costs of the Very Early Intervention program (the significance of the difference disappears when the VEI costs are excluded). 2) The intervention group had fewer extreme (lengthy and expensive) cases than the control group (low statistical significance). Results : Intervention was as costly as standard practice and was not more effective. The fact that the intervention group had fewer lengthy and expensive cases than the
					control group may indicate that the intervention was beneficial.
Ryan (1995)	status quo	employer	comparison (on annual basis) of	average workers'	Costs of the intervention: No intervention costs considered.
study quality: 1.9			average workers'	compensation	Consequences of the intervention: Savings obtained due to lower average
disability management			compensation	expenses per	expenses per claim in the intervention mine compared to the control mine.
program			claim between the	(per year)	Results: The log mean expenses per claim were significantly lower in the intervention
partial economic analysis			intervention and control mines		mine compared to control mine (P<0.01). For the control mine versus the intervention mine, the claim expenses were: \$1412 vs. \$295 (1981-82); \$1546 vs. \$450 (1982-83); \$2941 vs. \$492 (1983-84); \$2009 vs. \$572 (1984-85); and \$2239 vs. \$846 (1985-86).

Appendix R Tables for Multiple Sectors

Table 1: Multiple Sectors, Description of Intervention (clustered by type of intervention and sorted by quality score)

Study reference	Motivation	Location	Industry details	Type of intervention	Description of intervention
Ergonomic and Other	MSK Injury Pr	evention Interve	ntions		
Shi (1993)	high injuries and	United States	Public Administration	multiple (primary prevention)	An integrated back injury program, which consisted of a combination of education, training, physical fitness activities and ergonomic
study quality: 2.4	high cost of injuries	California	workers from four county government		improvements.
multiple: back injury prevention program			divisions (parks and recreation, public		
cost-benefit analysis			county hospitals)		
Disability Managemen	nt Intervention	s	• • •		
Loisel (2002)	high cost of injuries	Canada	Multiple Sectors	disability management (secondary prevention)	four arms: 1) standard care
study quality: 4.0		Quebec	manufacturing, health care, service		2) clinical intervention: clinical examination by a back medical
disability management program		Sherbrooke	sector		specialist, participation in a back school after 8 weeks of absence from regular work, and, if necessary, a multidisciplinary work rehabilitation intervention after 12 weeks of absence from work
cost-benefit analysis					 occupational intervention: visits to the study occupational medicine physician, and a participatory ergonomic intervention with the study
cost-effectiveness analysis					ergonomist, the injured worker, his supervisor, and management and union representatives
					 Sherbrooke model intervention: clinical intervention combined with occupational intervention (main intervention under consideration)
Jensen (2005, 2001)	high number of	Sweden	Multiple Sectors	disability management (secondary prevention)	four arms: 1) behaviour-oriented physiotherapy (PT) aimed at enhancing
study quality: 3.8	injuries		blue-collar and service/care workers		physical functioning and facilitating a lasting behaviour change
disability management program					 cognitive behavioural therapy (CBT), aimed at improving the subjects' ability to manage pain and resume a normal level of activity
cost-benefit analysis					 behavioural medicine (BM) rehabilitation consisting of behaviour- oriented physiotherapy and cognitive behavioural therapy
					4) treatment-as-usual control group (CG)

Study reference	Motivation	Location	Inductry details	Type of intervention	Description of intervention
Study reference	wotivation	Location	industry details	Type of Intervention	Description of Intervention
Disability Manageme	nt Intervention	s (continued)			
Arnetz (2003)	multiple: high	Sweden	Multiple Sectors	disability management (secondary prevention)	A disability management program that includes early medical, rehabilitation and vocational interventions, as well as ergonomic
study quality: 3.7	injuries and high cost of	Skogas, Handen	various industries		improvements and adaptation of workplace conditions.
disability	injuries		various occupations		
management					
program					
cost-benefit analysis					
Karjalainen (2003, 2004)	multiple:	Finland	Multiple Sectors	disability management	Mini-intervention group (A) consisting of an interview with a physician
2004)	injuries and	Helsinki	blue and white collar	(secondary prevention)	concerns about their back pain by providing accurate information and
study quality: 3.5	high cost of iniuries	Tiolomia	industries		to encourage physical activity.
disability)		blue-collar and		Mini-intervention and worksite visit group (B), latter consisting of a 75-
management			service/care workers		minute visit to the worksite by the physiotherapist – the aim of the visit
program					was to ensure that the patient had adapted to the information and
					practical instructions of appropriate ways of using the back at work, to
cost-consequence					involve the supervisor and company health-care professionals, and to
analysis					encourage their cooperation.
					Usual care group (C), i.e., patients receiving treatment from general
					practitioners (GPs) in primary health care.
					Groups A and B underwant and assessment by a physician plus a
					nhysiotheranist. Group B received a worksite visit in addition. Group C
					served as controls and was treated in municipal primary health care.
					All patients received a leaflet on back pain.
Mathecon (1007	high cost of	United States	Multiple Sectors	disability management	The program uses a multidisciplinary team approach that focuses on
1995)	iniuries	United States	Multiple Sectors	(secondary prevention)	immediate identification and treatment of soft-tissue iniuries. At-home
,		California	injured workers from	(),	rest is avoided by the assignment of the patient to transitional light
study quality: 2.1			various industries		duty work, provided there is no medical contraindication. The patient
					participates in treatment during work hours. This model is based on
disability			various occupations,		the premise that workers' compensation medical care must be focused
nanagement			with two largest		to maintain the injured worker within the work role and to sucid the
program			deputies and hotel		patient role should be done.
partial economic			housekeepers		
analvsis			•		

Table 1 (continued): Multiple Sectors, Description of Intervention (clustered by type of intervention and sorted by quality score)

Table 1 (continued): Multiple Sectors, Description of Intervention (clustered by type of intervention and sorted by quality score)

Health Promotion					
Wickizer (2004)	systems level	United States	Multiple Sectors	health promotion (primary prevention)	Introduction of the Washington Drug-Free Workplace Program, which consisted of: written workplace policy on substance use; employee
study quality: 2.7	initiative	Washington State	(1) Agriculture, Forestry, and Fishing		assistance program for an approved provider list; paid drug testing pre-employment, post-accident and post-treatment; annual education
health promotion			(2) Mining		program on substance abuse; minimum two hours of training for all
program			(3) Construction		supervisors and managers on substance abuse, treatment referral and
			(4) Manufacturing		drug testing.
cost-consequence			(5) Transportation		
analysis			and Public Utilities		
			(6) Wholesale and		
			Retail Trade		
			(7) Finance,		
			Insurance, and Real		
			Estate		
			(8) Services		

Study reference	Start year	Exposure duration in months	Number of workers	Study design	Details of analysis	Information on uptake/ involvement	Effectiveness outcome measure	Observed effect including magnitude, if provided
Ergonomic and O	ther MSI	K Injury Preve	ention Interventions					
Shi (1993) study quality: 2.4 multiple: back injury prevention program cost-benefit analysis	1989	12	205-267	randomized controlled	before-after comparison of back pain prevalence using chi- square analysis		back pain prevalence, health risk assessment	 Overall modest decline in back pain prevalence. Daily pain and monthly pain numbers were not significant, but there was a significant decrease in annual back pain numbers, and an increase in no back pain numbers (1% level). Numbers in high-risk category decreased, medium risk increased, and low risk decreases (1% level). Increase in medium-risk numbers was due to declines in high-risk numbers.
Disability Manage	ement Int	terventions						
Loisel (2002) study quality: 4.0 disability management program cost-benefit analysis cost- effectiveness analysis	1991	77	Sherbrooke model arm: 25; Occupational arm: 22; Clinical arm: 25 Standard care: 26	randomized controlled trial	difference in workers' compensation expenses and in days on full benefits because of back pain across the four arms		workers' compensation expenses and days on full benefits because of back pain	At 1 year follow-up, workers' compensation expenses (consequences of disease costs) were as follows: standard care arm: \$7,133; clinical arm: \$6,458; occupational arm: \$6,529; and Sherbrooke arm: \$6515. At mean follow-up of 6.4 years, workers' compensation expenses were as follows: standard care arm: \$23,517; clinical arm: \$10,045; occupational arm: \$12,820; and Sherbrooke arm: \$7,060. The differences between arms were not statistically significant. There were a few costly cases, and differences between arms in proportion of costly cases were statistically significant. At 1 year follow-up, the mean number of days on full benefits (DFB) because of back pain was as follows: standard care: 126.9; clinical arm: 114.9; occupational arm: 116.1; Sherbrooke arm: 115.9. At mean 6.4 years follow-up, the mean DFB was as follows: standard care: 418.3; clinical arm: 178.7; occupational arm: 228.0; Sherbrooke model: 125.6.

Study reference	Start year	Exposure duration in months	Number of workers	Study design	Details of analysis	Information on uptake/ involvement	Effectiveness outcome measure	Observed effect including magnitude, if provided
Disability Manage	ment Inte	erventions (c	ontinued)					
Jensen (2005, 2001) study quality: 3.8 disability management program cost-benefit analysis	NA	36	Per protocol sample sizes (does not include dropouts): behaviour-oriented physiotherapy (PT): 48; cognitive behavioural therapy (CBT): 41; fulltime behavioural medicine rehabilitation (BM): 49 Per protocol sample size: 'treatment-as- usual' control group (CG): 48	randomized controlled trial	Analysis of co- variance (ANCOVA) using a mixed model approach, Cox regression, and logistic regression was employed to evaluate effects of treatment on absence from work, full-time early retirement, and the SF-36 global score at the 3-year follow-up.	therapist compliance was monitored by checklists and telephone interviews with participants (95% of scheduled activities were completed and the booster sessions were BM (65%), PT (64%), CBT (65%); follow-up questionnaires were mailed to participants	absence from work, health- related quality of life, health-care utilization	1) Per protocol results for three-year follow-up for total absences from work (days on sick leave or disability pension) comparing each intervention with controls: Females: BM (-201.3, significant at 5%), PT (-57.1, not significant at 5% [ns]), CBT (-1.5, ns). Males: BM (-136.7, ns), PT (25.5, ns), CBT (55.6, ns). 2) Per protocol results for three-year follow-up for SF-36 global score (health-related quality of life) comparing each intervention with controls: Females: BM (8.8, significant at 5%), PT (2.4, ns), CBT (5.5, ns). Males not presented due to small sample size. 3) Women in the BM group returned to work faster compared to the CG group; a significantly faster rate of return to work was found in the per protocol analyses; no significant results were found for men (Cox regression results). 4) The risk of being granted full-time early retirement did not significantly differ between the groups (logistic regression results). 5) In health-care utilization, the BM group consulted physiotherapists less than the others (significant at 5%) and the control group consulted the social services less often than subjects in the intervention programs (significant at 5%), with no other significant differences between the groups.
Arnetz (2003) study quality: 3.7 disability management program cost-benefit analysis	NA	12	Intervention group: 65 Control group: 72	randomized controlled trial	difference between intervention and control group in mean sick days and number of reimbursed rehabilitation days (Student's t tests, Chi- squared tests); logistic regression analysis used to assess the likelihood of being off sick leave	proportion and speed of employers submitting rehabilitation investigations; proportion with appropriate work accommodation	sick days, likelihood of being off sick leave, number of reimbursed rehabilitation days	For the 0-6 month and 6-12 month period, the mean sick days were 110 and 95.8 for the intervention group and 131.1 and 150.3 for the reference group (difference is significant at 5% for 0-6month, and 1% for 6-12). For the entire 12-month period (12 months after initiation of the project), the total mean number of sick days for the intervention group was 144.9 days/person as compared to 197.9 days in the reference group (P<0.01). The odds ratio of being off sick leave after the initial 6 months (as compared to the reference group) was 1.9 (significant at 10%) and for the 12-month point was 2.5 (significant at 1%). There was no significant difference in the number of reimbursed rehabilitation days during 0-6 and 6-12 months and for the entire 12 months.

Study reference Start Exposure Number of Study Details of Information Effectiveness Observed effect including magnitude, if provided duration workers design analysis on uptake/ year outcome measure in months involvement **Disability Management Interventions (continued)** Karjalainen NA 12 Intervention During follow-up, fewer subjects had daily pain in randomized modelling and follow-up Pain, disability, (2003, 2004)group A (mini controlled difference questionnaires specific and Groups A and B than in Group C (Group A vs. Group intervention): 58 analysis was generic health-C, P = 0.002; Group B vs. Group C, P = 0.030). In trial Group A, pain was less bothersome (Group A vs. used to test related quality of study quality: 3.5 life, satisfaction Group C, P = 0.032; B vs. C, P=0.315) and interfered Intervention differences disability group B (work site between groups with care, days on less with daily life (Group A vs. Group C. P = 0.039: B management visit group): 51 vs. C, P=0.088) than among controls. No statistically in pain, sick leave, and use disability. of health care significant difference between the three treatment program Control group C: specific and arms regarding intensity of pain, Oswestry disability cost-57 generic healthindex, or generic health-related quality of life. Average consequence related quality days on sick leave were 19 in Group A, 28 in Group B, and 41 in Group C (Group A vs. Group C, P = 0.019, analysis of life, B vs. C. P=0.128). The median sick leave was 0 days satisfaction with care, days on for the mini intervention group, 1 day for the work site sick leave, and visit group and 7 days for the usual care group (A vs. C, P=0.43; B vs. C, P=0.189). Treatment satisfaction use of healthwas better in the intervention groups than among the care controls (A vs. C, P=0.001; B vs. C, P<0.001). consumption

Study reference	Start year	Exposure duration in months	Number of workers	Study design	Details of analysis	Information on uptake/ involvement	Effectiveness outcome measure	Observed effect including magnitude, if provided
Disability Manage	ement Int	erventions (co	ontinued)					
Disability Manage Matheson (1997, 1995) study quality: 2.1 disability management program partial economic analysis	ement Int 1992	erventions (co	281 (back injury study) 295 (all injuries study)	post-only one group design	description of outcomes across the group	no	days lost from work, health-care costs, return to work	Back Injury Group Study (followed for 43 months): 1) 281 cases studied of the 279 subjects who returned to work (2 of 281 retired), 94 missed no days from work and 86 returned to work in 3 days or less - i.e. 65% of subjects returned to work before wage-loss payments were scheduled to begin. The mean (SD) number of days lost for all injured workers was 8.8 (23.6) days. For those subjects who returned to work, 10% of the subjects accounted for 70% of the days lost. 2) Return-to-work indicator based on days from injury: two subjects retired from the workforce, of the remaining, 266 (95.3%) eventually returned to their prior jobs, eight (3.6%) returned to new jobs and five (1.8%) returned to modified work at the prior employer. Within 30 days, 94% of all subjects had returned to work. 3) Health-care costs (based on 121 cases): medical costs were much higher for the injured workers who lost 1 or more days from work. Mean (SD) medical case costs were \$4,408 (\$4,064) for this group compared with a mean (SD) of \$2,459 (\$2,712) for the 68 subjects on whom complete costs data were obtained who returned to work before losing a day. <u>All Injury Group Study</u> (followed for 1 year): 1) 205 econop at udied.
								1) 295 cases studied. 2) Number of days lost: 225 missed no days from work, 32 returned to work in 2 days or less, mean (SD) days lost for all workers was 1.9 (6.6), for the 70 injured workers who lost at least 1 day the mean (SD) days lost was 8.0 (11.7). 2) Health-care costs (based on 294 cases): average cost was \$2,330, 30 most costly cases accounted for 53%, 60 most costly cases for 73%.

Study reference	Start year	Exposure duration in months	Number of workers	Study design	Details of analysis	Information on uptake/ involvement	Effectiveness outcome measure	Observed effect including magnitude, if provided
Health Promotion	l							
Health Promotion Wickizer (2004) study quality: 2.7 health promotion program cost- consequence analysis	1996	36	unknown (Intervention group: 261 <i>employers;</i> Control group: 20215 <i>employers</i>)	before-after with control	Difference-in- differences analysis and regression modelling on injury rates and lost-time injury rates per 100 FTEs.	mailed questionnaire and site visits revealed the great majority of employers fully implemented the program and complied with its requirements; qualitative information gathered through site visits suggests program may have helped	injury rate per 100 FTEs (person- years), lost-time (four or more days) injury rate per 100 FTEs (person- years)	The drug-free workplace intervention was associated (p < 0.05) with a statistically significant decrease in injury rates for three industry groups: construction, manufacturing, and services. Also, the overall change was significant at 5%. The rate difference-in-differences was 4.78 for construction, 3.41 for manufacturing, and 7.11 for services; the overall change was 3.33. The intervention was associated (p<0.05) with a reduction in the incidence rate of more serious injuries involving four or more days of lost work time for two industry groups: construction and services, as well as for all industries (taken together). The rate difference-in-differences was 0.95 for construction and 2.51 for services, while the overall change was 0.92. Sensitivity analyses (modelling) supported these findings. The drug-free workplace program was associated with a selective, industry-specific preventive effect. The strongest evidence of an intervention effect was for the construction industry.
						change the culture in ways that promoted safety		

	Moneta	ary consequer	nces		Monetary	y costs	Other details			
Study reference	Productivity changes	Insurance and health care savings	Other	Capital equipment expenditures	External services	Internal staff time	Other	Discounting	CPI adjustment	Sensitivity analysis
Ergonomic and Other N	ISK Injury Prever	tion Intervent	ions							
Shi (1993)	yes	yes		yes	yes	yes	yes			
study quality: 2.4										
multiple: back injury prevention program										
cost-benefit analysis										
Disability Management	Interventions									
Loisel (2002)		yes			yes	yes			yes	yes
study quality: 4.0										
disability management program										
cost-benefit analysis cost-effectiveness analysis										
Jensen (2005)	yes						yes			
study quality: 3.8										
disability management program										
cost-benefit analysis										
Arnetz (2003)		yes		yes	yes		yes	NA	NA	
study quality: 3.7										
disability management program										
cost-benefit analysis										

-	Monet	ary conseque	nces		Monetar	y costs			Other details		
Study reference	Productivity changes	Insurance and health- care savings	Other	Capital equipment expenditures	External services	Internal staff time	Other	Discounting	CPI adjustment	Sensitivity analysis	
Disability Management	Interventions (co	ontinued)									
Karjalainen (2003, 2004)	yes	yes			yes			NA	NA		
study quality: 3.5											
disability management program											
cost-consequence analysis											
Matheson (1997, 1995)		yes							yes (porthy)		
study quality: 2.1									(partiy)		
disability management program											
partial economic analysis											
Health Promotion											
Wickizer (2004)		yes			yes					yes	
study quality: 2.7											
health promotion program											
cost-consequence analysis											

Study reference	Alternatives considered	Perspective of analysis	Details of analysis	Outcome(s) used in economic analysis	Description of economic analysis results
Ergonomic and O	ther MSK Injury Prevention	Interventions			
Shi (1993)	status quo	employer	cost-benefit analysis	lost-time and medical	Costs of the intervention: Costs were \$90,000, which includes costs of outside consultants and providers who designed and implemented the program, and ergonomic
study quality: 2.4				expenses	spending related to ergonomic improvements (\$60,000); wages of company staff involved in the program (\$20,000); materials related to health promotion (\$10,000) (USD).
multiple: back					
injury prevention					Consequences of the intervention: Savings were \$251,108, which includes savings from fourier lays (\$137,760), and from the reduced medical expanses (\$113,348)
program					(USD).
cost-benefit					
analysis					Result: The net present value was \$161,108, and the return on investment was 179% (\$161,108 divided by \$90,000) (USD).

Study reference	Alternatives considered	Perspective of analysis	Details of analysis	Outcome(s) used in economic analysis	Description of economic analysis results
Disability Manager	ment Interventions				
Loisel (2002) study quality: 4.0 disability management program cost-benefit analysis	Alternative A: standard care Alternative B: clinical intervention Alternative C: occupational intervention	system (public workers' compensation insurer)	cost-benefit analysis cost- effectiveness analysis	workers' compensation expenses (per claim) and days on full benefits (natural units)	Costs of the intervention : Mean intervention costs at 1 year were \$2,656 in the standard care arm, \$5,580 in the clinical arm, \$3,040 in the occupational arm, and \$5,622 in the Sherbrooke arm, while total mean intervention costs at mean 6.4 years follow-up were \$9,562 in the standard care arm, \$6,857 in the clinical arm, \$3,432 in the occupational arm, and \$7,434 in the Sherbrooke arm (all in 1991 Canadian dollars). The costs include costs of health-care services, occupational medicine physician services, back pain specialist services, back school, rehabilitation, and ergonomist services, as well as time costs of employees spent in participatory ergonomic interventions.
cost- effectiveness analysis					Consequences of the intervention: <u>Workers' compensation income replacement expenses</u> (cost-benefit analysis): At 1 year follow-up, mean income replacement expenses were \$7,133 in the standard care arm, \$6,458 in the clinical arm, \$6,529 in the occupational arm, and \$6,515 in the Sherbrooke arm. At mean 6.4 years follow-up, mean income replacement expenses were \$23,517 in the standard care arm, \$10,045 in the clinical arm, \$12,820 in the occupational arm, and \$7,060 in the Sherbrooke arm (all in 1991 Canadian dollars). Differences between arms were not statistically significant.
					Days on full benefits (cost-effectiveness analysis): At 1 year follow-up, the mean number of days on full benefits (DFB) was 126.9 in the standard care arm, 114.9 in the clinical arm (12.0 DFB saved compared to standard care), 116.1 in the occupational arm (10.8 DFB saved),115.9 in the Sherbrooke arm (11.0 DFB saved). At mean 6.4 years follow-up, the mean number of DFB was 418.3 in the standard care arm, 178.7 in the clinical arm (239.6 DFB saved), and 125.6 in the Sherbrooke model (292.7 DFB saved).
					Results: <u>Cost-benefit analysis</u> : At 1 year follow-up the incremental net present value (NPV) per claim (compared to standard care arm) was (-\$2,250) for the clinical arm, \$220 for the occupational arm, and (-\$2,348) for the Sherbrooke arm. At mean 6.4 years follow-up, the incremental NPV per claim (compared to standard care arm) was \$16,176 for the clinical arm, \$16,827 for the occupational arm, and \$18,585 for the Sherbrooke arm (all amounts are per worker and in 1991 Canadian dollars). The differences between arms were not statistically significant. <u>Cost-effectiveness analysis</u> : At 1 year follow-up, the relative cost per DFB (compared to the standard care arm) was \$187.40 per DFB saved for the clinical arm, (-\$20.4) per DFB saved for occupational arm, and \$213.50 per DFB saved for the Sherbrooke arm. At mean 6.4 years follow-up, the relative cost per DFB (compared to the arm) was (-\$67.50) per DFB saved for the clinical arm, (-\$88.40) per DFB saved for the occupational arm, and (-\$63.50) per DFB saved for the Sherbrooke arm (all in 1991 Canadian dollars).

Study reference	Alternatives considered	Perspective of analysis	Details of analysis	Outcome(s) used in economic analysis	Description of economic analysis results
Disability Manage	ment Interventions (continu	ed)			
Jensen (2005) study quality: 3.8	Alternative A: status quo - 'treatment-as-usual' (control group, CG)	societal	cost-benefit analysis	wage value of sick leave and disability pension	Costs of the intervention : Total intervention costs per patient were 1,862 Euros for BM, 1,000 for PT, and 1,179 for CBT. These include costs of each standardized rehabilitation program, including costs of physician, psychologist, fitness trainer, and secretary time.
disability management program cost-benefit analysis	Alternative B: behaviour- oriented physiotherapy (PT) aimed at enhancing the physical functioning and facilitating a lasting behaviour change of the individual Alternative C: cognitive behavioural therapy (CBT) aimed at improving the subjects' ability to manage their pain and resume a normal level of activity Alternative D: full-time behavioural medicine (BM) rehabilitation, consisting of behaviour- oriented physiotherapy and cognitive behavioural therapy				Consequences of the intervention: Total sick leave and disability pension expenses net of intervention costs per person for a 3-year period stratified by gender: BM expenses of 107,703 Euros for females and 130,015 for males; PT expenses of 189,760 for females and 220,268 for males; CBT expenses 157,800 for females and 199,824 for males; CG expenses of 245,212 for females and 193,239 for females. Results : The results reveal that compared to the control group, the full-time program (BM) is the most cost-effective program, since it decreased the sick leave and disability pension expenses by about 137,509 Euros per subject in the female group during the first 3 years after rehabilitation. Overall for women the expenses were reduced with treatment, the least reduction being in behaviour-oriented physiotherapy (PT) 54,452 Euros.
Arnetz (2003) study quality: 3.7 disability management program	status quo	system (national insurance agency)	cost-benefit analysis	indemnity and medical care payments (total reimbursement payments)	 Costs of the intervention: Direct costs of the intervention were 550,000 Skr [Swedish krona] (\$91,700 USD) or 8,500 Skr (\$1,410 USD) per person. These include purchase of tools, ergonomic improvements, cost of occupational therapist / ergonomist time, and costs of vocational and occupational training. Consequences of the intervention: Benefits in reduced reimbursement were 1,015,625 Skr (\$169,325 USD) or 15,625 Skr (\$2,605 USD) per person.
cost-benefit analysis					Results : Direct savings (NPV) were 972,900 Skr (\$162,150 USD) or 7,164 Skr (\$1,195 USD) per case/person, with the (direct) benefit-to-cost ratio being 6.8.

Study reference	Alternatives considered	Perspective of analysis	Details of analysis	Outcome(s) used in economic analysis	Description of economic analysis results
Disability Manage	ment Interventions (continu	ied)			
Karjalainen (2003, 2004) study quality: 3.5 disability management program cost- consequence analysis	Alternative A: mini- intervention consisting of an interview with a physician specializing in physiatry Alternative B: mini- intervention and worksite visit group Alternative C: status quo - usual care group treatment by patients' GPs in primary health care	not clear	cost- consequence analysis	wage value of sick leave, direct health care expenses	Costs of the intervention: Cost of mini-intervention was \$181 (1999 USD) and mini- intervention plus worksite visit was \$250. These include: for mini-intervention – time cost of physician specializing in physiatry, cost of radiographs, and time cost of physiotherapist; for mini-intervention and worksite visit group – time cost of physician specializing in physiatry, cost of radiographs, time cost of physiotherapist, and time cost of worksite visit session for patient's work supervisor, company nurse, physiotherapist, and physician. The costs of diagnostic tests and radiologic examinations were significantly smaller in the worksite visit group than in the usual care group. Consequences of the intervention: The direct health-care expenses were \$359 (1999 USD) less in the mini-intervention group and \$163 (U.S.) less in the worksite visit group compared with controls, but these differences were not statistically significant. When adding expenses related to sick leave to the direct health-care expenses, total expenses were \$3,552 (U.S.) less in the mini-intervention group and \$2,927 (U.S.) less in the worksite visit group compared with the usual care group.
					Result : There were no statistically or clinically significant differences between the mini- intervention and the worksite visit groups with respect to clinical or economic outcomes.
Matheson (1997, 1995) study quality: 2.1 disability management program partial economic analysis	NA, post only one group design with comparison to external benchmarks, but no alternatives	not clear	comparison of average medical expenses per case in the return-to-work program under investigation to estimates of such expenses from external benchmarks (Liberty Mutual Insurance and the National Council on Compensation Insurance)	medical expenses	Costs of the intervention: No intervention costs considered. Consequences of the intervention: Back Injury Group Study (followed for 43 months): 1) Average per case medical expenses for back injuries under the Comprehensive Management Care (CMC) program were \$3,346, which compares favourably to average medical expense estimates from Liberty Mutual Insurance of \$3,757 (in 1992 dollars, adjusted for inflation). 2) Average per case expenses for lost-time back injuries under the CMC program was \$4,408 compared to average for National Council on Compensation Insurance (NCCI) of \$12,518 (in 1992 dollars adjusted for inflation). All Injury Group Study (followed for 1 year): 1) Average per case medical expenses for all injuries under the Comprehensive Management Care (CMC) program were \$2,330, which compares favourably to average medical expense estimates from Liberty Mutual Insurance of \$2,480 (in 1992 dollars, adjusted for inflation) [authors indicate a "savings of \$151 per case"]. 2) Average expenses per case for all lost-time injuries under the CMC program were \$4,701 compared to average for National Council on Compensation Insurance (NCCI) of \$8,990 (in 1992 dollars adjusted for inflation). Result : Average per case medical expenses for back and for all injuries under the CMC compare favourably to those from Liberty Mutual Insurance. Average per case expenses for lost-time back injuries under the CMC compare favourably to the average estimate from the National Council on Compensation Insurance (authors indicate a "savings of \$7,597 per back pain case" and "savings of \$4,289 per lost day case overall").

Study reference	Alternatives considered	Perspective of analysis	Details of analysis	Outcome(s) used in economic analysis	Description of economic analysis results
Health Promotion					
Wickizer (2004) study quality: 2.7	status quo	employer	cost- consequence analysis	workers' compensation medical and disability	Costs of the intervention : Costs of drug testing (per drug-test cost of \$50) and costs of employee assistance programs' (EAP) services (annual EAP cost of \$20 per employee).
health promotion program				(wage replacement) expenses	Consequences of the intervention : For construction, manufacturing, and service industries the average (medical and disability) expenses per injury were \$4,851, \$2,228, and \$3,222, respectively (1996 dollars). Given these expenses, the injury risk
cost- consequence analysis					reduction associated with the drug-free workplace program for a company with 50 employees would generate estimated annual savings of approximately \$11,600 for construction companies, \$3,800 for manufacturing companies, and \$11,450 for service companies.
					Result : The above figures (estimated annual savings) do not represent net savings because they do not account for the costs of drug testing or employee assistance programs' (EAP) services that the employer would pay. Depending upon the frequency of testing and the cost of EAP services, these gross savings figures could be reduced by \$1,500 to \$2,000 assuming a per drug-test cost of \$50 and an annual EAP cost of \$20 per employee.

Appendix S Tables for Public Administration

Table 1: Public Administration, Description of Intervention (clustered by type of intervention and sorted by quality score)

Study reference	Motivation	Location	Industry details	Type of intervention	Description of intervention
Ergonomic and Other	MSK Injury Prevent	ion Interventions			
Hilyer (1990)	high number of injuries	United States	Public Administration	multiple (primary prevention)	Introduction of a designated 30-minute exercise period and a formal 2-hour training session on flexibility exercises and
study quality: 2.4		Southeast	firefighting		flexibility testing for exercise leaders and alternates.
multiple: health promotion program			municipal firefighters		
partial economic analysis					
Brown (1992)	high number of injuries and high	United States	Public Administration	training (primary prevention)	Back school program consisting of 6 weeks of education and training.
study quality: 2.3	cost of injuries		municipal services		
education program			street and sanitation (maiority), police, parks and		
partial economic			recreation, equipment		
analysis			management, buildings and inspection, and engineering		
Disability Management	Interventions				
Karrholm (2006)	need for more effective return-	Sweden	Public Administration	disability management (secondary prevention)	Vocational rehabilitation program that included a one day course for the disabled worker's immediate superiors: a meeting with
study quality: 2.3	to-work programs	Stockholm	city municipality	, , , , , , , , , , , , , , , , , , ,	the rehabilitation team, the worker, the worker's immediate superior, a social insurance office representative, a
disability management program			occupations not specified		representative from the employer's personnel department, a company physician, and a support person for the worker.
partial economic analysis					
Dollard (1998)	high number of iniuries	Australia	Public Administration	multiple (primary prevention)	Multifaceted intervention to reduce work stress that included: (1) job redesign:
study quality: 1.5	,		department for correctional services	F,	(2) enrichment of psychological health services;(3) training and education:
multiple: health promotion program			correctional officers		 (4) surveillance of psychological distress and risk factors; (5) implementation research and evaluation;
partial economic analysis					(6) appointment of a safety consultant;(7) a health, safety and welfare incentive award; and(8) development of a stress management policy.

Study reference	Start year	Exposure duration in months	Number of workers	Study design	Details of analysis	Information on uptake/ involvement	Effectiveness outcome measure	Observed effect including magnitude if provided
Ergonomic and Othe	r MSK In	jury Preventio	n Interventions					
Hilyer (1990) study quality: 2.4 multiple: health promotion program partial economic analysis	Not stated	6	Intervention group: 218 Control group: 251	randomized controlled	use of ANCOVA to test the impact of the intervention on post- intervention flexibility	exercise physiologists visited experimental stations during exercise period in first 20 days of the intervention; exercise leaders were observed for delivery skills and rapport with their groups; when necessary, exercise leaders were given skill updates; monthly contact was made with the exercise leaders to identify problems and maintain the intervention	flexibility	 The exercise intervention program significantly increased the overall flexibility of firefighters (1% level). Pre-test flexibility scores for "sit and reach," "shoulder flexion," "shoulder extension" and "knee flexion" significantly contributed to overall flexibility (1% level), but not "twist and touch" or "knee extension."
Brown (1992) study quality: 2.3 education program partial economic analysis	1987	6	Intervention group: 70 Control group: 70	before-after with control	before-after comparison of number of back injuries lost work time, lost-time costs, total costs, medical costs one-tailed analysis of covariance for the comparison of post- intervention differences between intervention and control paired t-tests for the comparison of the pre- post within-group change		number of back injuries, lost-work time, lost-time costs, total costs, medical costs	 Post intervention differences in number of back injuries were significant (and lower) for the intervention group compared to the control group after control for pre-intervention numbers (5% level). Post-intervention lost-work time, lost-time costs, and total costs were not significantly different for the intervention group compared to the control group after controlling for pre- intervention numbers (5% level). Medical costs were significantly lower for the intervention group but only at the 10% level. Pre-post intervention differences were significant for the intervention group for number of injuries, lost-work time, lost-time costs, medical costs (1% level). Pre-post intervention differences were not significant the control group for the four outcome variables.

Table 2: Public Administration, Effectiveness Analysis (clustered by type of intervention and sorted by quality score)

Study reference	Start year	Exposure duration in months	Number of workers	Study design	Details of analysis	Information on uptake/ involvement	Effectiveness outcome measure	Observed effect including magnitude, if provided
Disability Manageme	ent Interv	entions						
Karrholm (2006) study quality: 2.3 disability management program partial economic analysis	2000	12	Intervention group: 64 Control group: 64	before-after with control	experimental matched-pairs design with before- after comparison of days per month on sick leave between intervention and control groups		days per month on sick leave	 No significant difference found in days per month absent between intervention and control group for the first six months post- intervention. Pre-intervention days on sick leave for the two groups were similar. Days per month absent were significantly lower for the subset with above median days of absence for workers in the intervention compared to the control group for the first six months post-intervention. Pre-intervention days on sick leave for the two groups were similar. Comparison of days per month absent for the second 6 month period post-intervention of the entire group and group with above median days of absence were significantly lower than their matched control counterparts.
Multi-faceted Interve	entions							
Dollard (1998) study quality: 1.5 multiple: health promotion program partial economic analysis	1991	60	NA	before-after uncontrolled	before-after comparison of yearly trends of number and rate of workers' compensation claims	over 500 staff contacts in 12 months with staff councillor	number of workers' compensation claims for work stress; number of workers' compensation claims per 1,000 workers	Substantial reduction in stress claims over a seven-year period. Decrease from 80 claims (78 per 1,000 workers) in 1989/90 (year prior to the intervention) to 52 claims (42 per 1,000 workers) in 1995/96.

	Monetary consequences				Monetar	y costs			Other details	
Study reference	Productivity changes	Insurance and health- care savings	Other	Capital equipment expenditures	External services	Internal staff time	Other	Discounting	CPI adjustment	Sensitivity analysis
Ergonomic and Other MSK In	jury Prevention I	nterventions								
Hilyer (1990)	yes	yes								
study quality: 2.4										
multiple: health promotion program										
partial economic analysis										
Brown (1992)	yes	yes						NA	NA	
study quality: 2.3										
education program										
partial economic analysis										
Disability Management Interv	entions			1						
Karrholm (2006)	yes									
study quality: 2.3										
disability management program										
partial economic analysis										
Multi-faceted Interventions										
Dollard (1998)		yes						NA		
study quality: 1.5										
multiple: health promotion program										
partial economic analysis										

Table 3: Public Administration, Economic Analysis (clustered by type of intervention and sorted by quality score)

Study reference	Alternatives considered	Perspective of analysis	Details of analysis	Outcome(s) used in economic analysis	Description of economic analysis results
Ergonomic and Othe	r MSK Injury Prevention Interv	entions			
Hilyer (1990)	status quo	employer	partial economic analysis, comparison	workers' compensation	Costs of the intervention: No intervention costs considered.
study quality: 2.4			of post-intervention workers'	lost-time, medical, and total expenses	Consequences of the intervention: Savings in workers' compensation lost-time and medical expenses over the two years
multiple: health promotion program			compensation expenses for the		post-intervention.
partial economic analysis			intervention and control groups		Result: Total workers' compensation expenses (medical and lost- time expenses) for the intervention group were \$85,372, and for the control group were \$235,131. Lost-time expenses were \$45,597 and medical expenses \$39,775 for the intervention group and \$147,581 and \$87,550 respectively for the control group. The difference in average total expenses per injury between the two groups was only significant at the 10% level. Average lost-time expenses per injury on their own were significantly different between the two groups (5% level); this was not the case for average medical expenses (USD).
Brown (1992)	status quo	system	partial economic	lost-time,	Costs of the intervention: No intervention costs considered.
study quality: 2.3			unaryolo	total expenses	Consequences of the intervention: Savings in lost time, medical, and total expenses.
education program					Result: In the six month nost-intervention period, lost time
partial economic analysis					medical, and total expenses for the intervention group were \$23,182.78, \$24,086.93, and \$47,269.71, respectively. For the control group they were \$19,532.48, \$33,829.96, and \$53,362.44, respectively. The difference between the two groups was not significant for these expenses (5% level), though medical expenses were lower for the intervention group at the 10% level (AUD).

Table 4: Public Administration, Economic Analysis (clustered by type of intervention and sorted by quality score)

Study reference	Alternatives considered	Perspective of analysis	Details of analysis	Outcome(s) used in economic analysis	Description of economic analysis results
Disability Management	t Interventions				
Karrholm (2006)	status quo	societal	partial economic analysis	indirect expenses	Costs of the intervention: No intervention costs considered. The authors assumed there was no intervention costs at the societal lovel sizes no outro funding was rejead for the project.
study quality. 2.5				with lost-time	level since no extra funding was raised for the project.
disability management program					Consequences of the intervention: Savings in indirect expenses associated with lost-time/sick leave.
partial economic analysis					Result: For the entire sample, the value of reduced days on sick leave was EURO 1,278.35 per month per person. For the sub-sample with sick days above the median this value was EURO 2,405.38 per month per person.
Multi-faceted Intervent	ions				
Dollard (1998)	status quo	employer	partial economic analysis	workers' compensation	Costs of the intervention: No intervention costs considered.
study quality: 1.5				expenses	Consequences of the intervention: Savings in workers' compensation expenses.
multiple: health					
promotion program					compensation expenses were \$ 2M (USD).
partial economic analysis					

Table 4 (continued): Public Administration, Economic Analysis (clustered by type of intervention and sorted by quality score)

Appendix T Tables for Retail and Trade

 Table 1: Retail and Trade, Description of Intervention (clustered by type of intervention and sorted by quality score)

Study reference	Motivation	Location	Industry details	Type of intervention	Description of intervention
Ergonomic and Other MSP	(Injury Prever	ntion Intervention	s		
Banco (1997)	high	United States	Retail and Trade	ergonomics	Three ergonomic interventions were implemented in 3 groups
	number of			(primary prevention)	of stores:
study quality: 2.5	injuries	Connecticut	supermarket chain		 Group A stores: new safety case cutters with education;
ergonomic program			supermarket workers (grocery department, deli,		 Group B stores: old cutters with education; Group C stores: status guo, i.e. old cutters (control)
cost-benefit analysis			general merchandise department)		group)

Study reference	Start year	Exposure duration in months	Number of workers	Study design	Details of analysis	Information on uptake/ involvement	Effectiveness outcome measure	Observed effect including magnitude if provided
Ergonomic and Other	NSK Injur	y Prevention I	nterventions					
Banco (1997)	1992	12	NA	randomized controlled trial	before-after comparison of		annual case cutter injury	The case cutter injury rate decreased by 3.5/100,000 man-hours in Group A stores (from
study quality: 2.5					annual cutting injury rates for the		rate per 100,000 man-	4.7 to 1.2), compared to a reduction of 1.5/100,000 in Group B stores (from 3.3 to 1.8),
ergonomic program					3 groups		hours	and a reduction of 1.6/100,000 man-hours in Group C control stores (from 3.6 to 2.0).
cost-benefit analysis								There was a marked reduction in compensation- related injuries in Group A stores.

Table 2: Retail and Trade, Effectiveness Analysis (clustered by type of intervention and sorted by quality score)
Table 3: Retail and T	Frade. Economic	Analysis (part	1) (clustered by typ	e of intervention and	sorted by quality score)

	Monet	ary conseque	nces		Monetary	y costs		Other details		
Study reference	Productivity changes	Insurance and health- care savings	Other	Capital equipment expenditures	External services	Internal staff time	Other	Discounting	CPI adjustment	Sensitivity analysis
Ergonomic and Other M	ISK Injury Preve	ntion Intervent	tions							
Banco (1997)	yes	yes				yes	yes			
study quality: 2.5										
ergonomic program										
cost-benefit analysis										

Study reference	Alternatives considered	Perspective of analysis	Details of analysis	Outcome(s) used in economic analysis	Description of economic analysis results
Ergonomic and O	ther MSK Injury Prevention	Interventions			
Banco (1997) study quality: 2.5	Alternative A: new safety cutters with education Alternative B: old cutters	employer	cost-benefit analysis	wage value of time-loss from work due to injury, workers'	Costs of the intervention: Costs include education costs (health educator's time spent in training employees) at \$20.00/hr and new case cutters at a cost of \$2.35/unit. Consequences of the intervention: Savings obtained due to reduction in time lost
ergonomic program	with education Alternative C: status quo			compensation (indemnity and medical care)	due to injury (using assumption 3 hrs lost it less than 1 day off from work, and 8 hours lost for a day lost from work) valued at a wage of \$6.00/hr. Workers' compensation expenses (indemnity and medical care) were \$317.00 for group A stores and \$188.00
cost-benefit analysis	(old cutters)			expenses	for group B stores.
					Results : Estimated savings for Group A stores were \$245 per year per store and \$29,413 per year for the chain when compared to the status quo (Group C stores). Benefits for Group B stores were less dramatic and totalled \$106 per 100,000 manhours per store, with total net savings of \$12,773 for the chain.

Table 4: Retail and Trade, Economic Analysis (part 2) (clustered by type of intervention and sorted by quality score)

Appendix U Tables for Transportation

Table 1: Transportation, Description of Intervention (clustered by type of intervention and sorted by quality score)

Study reference	Motivation	Location	Industry details	Type of intervention	Description of intervention
Ergonomic and Other	MSK Injury Pr	evention Interver	ntions		
Daltroy (1997)	high number of	United States	Transportation and Warehousing	education (primary)	Back school program consisting of two training sessions. The program included principles of back safety; correct lifting and handling; posture
study quality: 3.6	injuries and high costs	Massachusetts	mail processing		exercises and pain management. The therapists (instructors) also examined each workstation and suggested physical and procedural modifications. The
education program	of injuries	Boston	facilities (postal service)		therapists provided additional reinforcement training six months after the first sessions and yearly thereafter.
partial economic evaluation			mail handlers (incl. maintenance workers) and clerks		
Versloot (1992)	high number of	The Netherlands	Transportation and Warehousing	education (primary)	Back school program consisting of three training sessions. The first session covered topics such as motivation; responsibility for one's own health; mind-
study quality. 3.4	injunes		bus company		training; and body mechanics including sports, working posture, and seat
education program			bus drivers		adjustment. The second and third sessions reviewed participants' experiences since the first session and included a summary of the first session.
cost-benefit analysis					
Tuchin (1998)	high number of	Australia	Transportation and Warehousing	education (primary)	A comprehensive lecture of approximately 120 minutes covered topics such as spinal anatomy; pain-sensitive structures; causes of back pain and injury;
study quality: 2.8	injuries and high costs	New South Wales	large mailing house		types of back injuries; spinal biomechanics; correct lifting techniques; methods of care for back problems; effective exercises; analysis and explanation of
education program	of injuries	Sydney	(postal service)		ergonomics; relationship of back pain to occupation and tasks involved; and effects of static posture. Prior to giving lecture, a tour of the workplace was
cost-consequence analysis		(suburbs)			undertaken so that potential problem areas could be identified and brought to the workers' attention during the lecture.

Study reference	Start year	Exposure duration in months	Number of workers	Study design	Details of analysis	Information on uptake/ involvement	Effectiveness outcome measure	Observed effect including magnitude if provided			
Ergonomic and Other MSK Injury Prevention Interventions											
Daltroy (1997) study quality: 3.6 education program partial economic evaluation	1985	65	Intervention group: 1,703 Control group: 1,849	randomized controlled (not blinded)	1) extended log- linear models used to compare rates of low-back injury and rates of other MSK injuries (related to lifting and handling); 2) survival analyses to	attendance at training sessions was mandatory for workers and supervisors in the intervention group; number/percentage of people who actually received training, number of training sessions and	rate of low back and other MSK injury; time off work; likelihood of repeated injury	 1) Rate of injury was not significantly different between intervention and control groups, or between trained workers and untrained workers. 2) Rate of major lifting and handling injuries was not significantly different between intervention and control groups, or between trained and untrained workers. 3) Rate of other MSK injury was not significantly different between the intervention and control groups. 4) There was little difference in the proportions of total injuries that resulted in lost workdays in the intervention group (61%) and the control group (66%); 			
					model time off work per injury and time until further injury.	reinforcement contacts by physical therapists was noted; there was an undocumented amount of reinforcement by line supervisors		 gloup (61%) and the control gloup (56%), 5) Survival analyses of time until return to work showed no significant difference between the intervention and control groups or with training before injury. 6) The intervention group assignment to training or no training after injury (or whether the subject was actually trained) had no significant effect on the likelihood of repeated injury. 			

Table 2: Transportation, Effectiveness Analysis (clustered by type of intervention and sorted by quality score)

Study reference Start Exposure Number of Study Details of Information on Effectiveness Observed effect including magnitude if provided

Study reference	year	duration	workers	design	analysis	uptake/ involvement	outcome	Observed effect including magnitude in provided
		in months					measure	
Ergonomic and O	ther MSP	(Injury Preve	ntion Intervention	ons (continued)				
Versloot (1992)	1986	48	Intervention group: 166	randomized controlled	use of MANOVA to analyze	From the initial 200 individuals who	number and length of	 The cumulative 50% level of absenteeism decreased for the intervention group (from <26 to <16 days) and
study quality: 3.4				(not blinded)	differences	attended the 1st	absenteeism	remained steady for the control group (from <16 to <17
			Control		between and	session, 166 attended	events	days). The statistical significance for this outcome was
education			group: 300		within groups;	the second session (34		not estimated.
program					use of ANCOVA to correct for	lost to follow-up), and only 108 attended all		 The intervention group experienced a decrease in average length of absenteeism from 58.8 days in the
cost-benefit					initial differences	three sessions; a post-		before period to 49.3 days in the after period, whereas
analysis					between the groups; Chi- square analysis used to compare pre-program status of the two groups	training survey was given to the intervention group at the end of session 3 to assess the quality and perceived effects of the back school program		 the control group experienced an increased over the same time frame (from 56.9 to 59.9). The between group difference was significant only at the 10% level. 3) There was no change in short absenteeism (1-8 days) in the intervention group, whereas the control group experienced a significant decrease, but the between-group difference was not significant. 4) There was a significant decrease in intermediate absenteeism (8-43 days) in the intervention group from 26.7 days before to 20.4 days after the training, and no change in the control group; the between-group difference was no significant. 5) There was no significant within-group change in long absenteeism (more than 42 days) for the intervention or control groups. Between-group differences were significant only at the 10% level, indicating a trend to decrease long absenteeism in the control group, after intervention.

Table 2 (continued): Transportation, Effectiveness Analysis (clustered by type of intervention and sorted by quality score)

Study reference	Start year	Exposure duration in months	Number of workers	Study design	Details of analysis	Information on uptake/ involvement	Effectiveness outcome measure	Observed effect including magnitude, if provided
Ergonomic and O	ther MS	(Injury Preve	ntion Intervention	ons (continued)	l i i i i i i i i i i i i i i i i i i i			
Tuchin (1998) study quality: 2.8 education program cost- consequence analysis	NA	6	Intervention group: 34 Control group: 27 in the control group and 60 in the non- intervention group	randomized controlled (not blinded)	use of ANOVA and paired t- tests to compare the number of injuries and days lost due to injury for each group	-	days lost due to injury; Oswestry score for pain and disability; average expense of days lost per worker	 Days lost per worker due to injury decreased from 4.5 days 6-month pre-intervention, to 1.9 days 3-month post-intervention, to 2.69 days 6-month post-intervention for the intervention group. There was no (substantial) decrease observed in the control or non-intervention groups. Days lost due to injury in the intervention group decreased to 43% of pre-intervention level at 3 months post-intervention and then to 60% at 6 months post-intervention (5% level). There was no significant change in the control and non-intervention groups. Oswestry scores decreased (i.e. improved) in the intervention group relative to the control and non-intervention and non-intervention and increased to \$269 at the 6-month period, and increased to \$269 at the 6-month period, in the intervention group. For the control group it changed from \$396 to \$409, and then to \$382 in the respective time periods. For the non-intervention group it changed from \$420 to \$472, and then to \$422.50 in the respective time periods. The intervention changes were not significantly different from the control group values but were significantly different from the non-intervention group values at 3 months period. So level).

	Monetary consequences				Monetary	y costs		Other details		
Study reference	Productivity changes	Insurance and health care savings	Other	Capital equipment expenditures	External services	Internal staff time	Other	Discounting	CPI adjustment	Sensitivity analysis
Ergonomic and Other MSK	Injury Prevention	Interventions						•		
Daltroy (1997)	yes	yes								
study quality: 3.6										
education program										
partial economic evaluation										
Versloot (1992)	yes					yes	yes			yes
study quality: 3.4										
education program										
cost-benefit analysis										
Tuchin (1998)	yes				yes	yes		NA	NA	
study quality: 2.8										
education program										
cost-consequence analysis										

Table 3: Transportation, Economic Analysis (clustered by type of intervention and sorted by quality score)

Study reference	Alternatives considered	Perspective of analysis	Details of analysis	Outcome(s) used in economic analysis	Description of economic analysis results
Ergonomic and O	ther MSK Injury Prev	vention Interventions			
Daltroy (1997)	status quo	employer	total expenses per back injury	back injury expenses	Costs of the intervention: No intervention costs considered.
study quality: 3.6			claim compared using the		Consequences of the intervention: Savings in back injury expenses considered.
education			Wilcoxon rank-		Depute : The effectiveness of the intervention was not established, though
program			Sum Statistic		descriptive statistics of expenses were presented. The median total
partial economic evaluation					expenses per back injury were \$309 for the intervention group, and \$103 for the control group (USD). Group assignment (intervention or control) and training status were not significantly associated with cost. Workers with a history of low-back injury had higher median total expenses, medical expenses and personnel-replacement expenses than did workers without such a history.
Versloot (1992)	status quo	employer	net present value	absenteeism expenses	Costs of the intervention: Costs were \$46,000 (\$230 per worker x 200 workers); this includes costs with training (per employee) and costs of wages due to lost working hours (per employee) (USD)
education program					Consequences of the intervention : 1) Average length of absenteeism per worker decreased by 6.5 days per year based on changes between
cost-benefit analysis					the intervention and control groups. Savings were \$900 per Worker (\$140 per day), for a total savings of \$149,400 across 166 workers. 2) Average length of absenteeism per worker decreased by 5 days per year based on changes within the intervention group. Savings were \$700 per worker (\$140 per day), for a total savings of \$116,200 across 166 workers (USD).
					Result : If the change in absenteeism for the intervention group is assessed in relation to the change in the control group, then the net present value is \$103,400. If the change in absenteeism is assessed only within the intervention group, then the net present value is \$70,200 (USD).

Table 4: Transportation, Economic Analysis (clustered by type of intervention and sorted by quality score)

Study reference	Alternatives considered	Perspective of analysis	Details of analysis	Outcome(s) used in economic analysis	Description of economic analysis results
Ergonomic and O	ther MSK Injury Preventic	on Interventions (continued)		
Tuchin (1998)	Alternative A: status quo (non-intervention	employer	costs and consequences	absenteeism expenses	Costs of the intervention : Costs were \$71 per worker, which includes training costs and worker time cost for training. Total costs for the 281
study quality: 2.8	group)		considered separately		workers were \$19,880.
education	Alternative B:				Consequences of the intervention: Savings were \$257 per worker,
program	intervention of lower				based on a decrease in absence expenses of \$451 pre-intervention to \$194 post-intervention. Total savings for the 281 workers were \$71,960
cost-	perform a series of				
consequence analysis	daily exercises, but did not receive any educational classes) (control group)				Result : Though costs and consequences were only considered separately, the implied net present value was \$52,080. The authors mentioned that the saving could be in excess of \$50,000 for a three-month period.

Table 4 (continued): Transportation, Economic Analysis (clustered by type of intervention and sorted by quality score)

Appendix V Tables for Utilities

Table 1: Utilities, Description of Intervention (clustered by type of intervention and sorted by quality score)

Study reference	Motivation	Location	Industry details	Type of intervention	Description of intervention
Disability Managemer	nt Intervention	S			
Wiesel (1994)	high number of	United States	Utilities	disability management (secondary prevention)	An intervention consisting of an injury surveillance system with the use of quality-based standardized diagnostic and treatment protocols. All
study quality: 2.5	injuries and high cost of		public utility company		occupational injuries were to be reported within 24 months; workers were examined at a central medical facility as soon as it was practical,
disability	injuries		0.50/ () 1		and data on the injury was added to the computerized database.
management			65% of blue collar		Based on clinical data, a diagnosis was obtained and a course of management was recommended according to the standardized
piogram			white collar workers		diagnostic and treatment algorithm specific to the injury's anatomic
partial economic analysis					region. Time-loss injuries were reviewed on a weekly basis during the acute phase.

Study reference	Start year	Exposure duration in months	Number of workers	Study design	Details of analysis	Information on uptake/ involvement	Effectiveness outcome measure	Observed effect including magnitude if provided
Disability Manage	ment Int	erventions						
Disability Manage Wiesel (1994) study quality: 2.5 disability management program partial economic analysis	ment Into	108	NA	before-after uncontrolled	before-after comparison of MSK injuries (comparison between the year prior to intervention with the nine- year average after the intervention)	-	MSK injuries (low-back and knee), time-loss and light duty days	 Low-back injuries: The number of new back injuries reported fell by (decrease from 59 new injuries per year in index year to an average of 29 in the 1982-1990 period). The number of days lost due to low-back injury fell by 55% (decrease from 3,701 lost days per year to an average of 1,684 in the 1982-1990 period). The average time lost per back injury dropped by 40% (decrease from 28 days to 17 days lost per back injury). The number of surgeries performed decreased by 67% and the operative success rate increased dramatically (decrease from 9 to 3 surgeries per year). Return to work after surgery increased from 56% to 90% (a 34% increase). Knee injuries: The number of new injuries decreased from 21 to 8 (a 62% decrease).
								decreased from 1,614 to 680 (a 42% decrease). 3) The number of days lost per injury decreased from 40 to 29 (a 28% decrease).

Table 2: Utilities, Effectiveness Analysis (clustered by type of intervention and sorted by quality score)

Table 3: Utilities, Economic Analysis (clustered by type of intervention and sorted by quality score)

	Monetary consequences			Monetary costs				Other Details		
Study reference	Productivity changes	Insurance and health care savings	Other	Capital equipment expenditures	External services	Internal staff time	Other	Discounting	CPI adjustment	Sensitivity analysis
Disability Management Interventions										
Wiesel (1994)	yes								yes	
study quality: 2.5										
disability management program										
partial economic analysis										

Study reference	Alternatives considered	Perspective of analysis	Details of analysis	Outcome(s) used in economic analysis	Description of economic analysis results
Disability Manage	ment Interventions				
Wiesel (1994)	status quo	employer	relative cost savings for each year were	time-loss expenditures	Costs of the intervention: No intervention costs were considered.
study quality: 2.5			obtained by calculating the	(cost with lost	Consequences of the intervention: Savings with time-loss
disability			difference in cost	duty)	expenditures.
management			from the control (pre-		Desuits For low book injuries, equipped from last time, and light duty.
program			and aggregated		for the ten-year period were \$2,655,728 (average savings were
partial economic			(post-intervention)		59% compared to index year). For knee injuries savings were
analysis			years		\$1,369,803 (average savings of 65%). Total savings for low-back and knee injuries were more than \$4M dollars. All other MSK injuries were shown to have decreased, resulting in a cumulative 10-year savings of more than \$4.1M (1990 USD).

Table 4: Utilities, Economic Analysis (clustered by type of intervention and sorted by quality score)