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| **CRITICALLY APPRAISED TOPIC** |

**FOCUSED CLINICAL QUESTION**

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| In office workers (those who work on computers for 3 or more hours/daily), is a program consisting of an ergonomic education or exercise program more effective than group exercises (of 5 days or less), to decrease work- related neck and back pain and injury rates/ year and thereby to improve worker’s productivity? |

**AUTHOR**

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**CLINICAL SCENARIO**

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| Clinical scenario: The author of this document was inspired by her spouse to study this PICO question, as her spouse is a computer software professional and works on computer for 8 hours or more, every day for work. Many of her spouse’s colleagues having also approached the author in the past 3 years, for physical therapy treatment for neck and back issues, the author seemed to realize that this issue seemed to be more widespread among workers, who use computers at work. Interestingly, the author found that majority of these computer workers had no inkling about any work place and postural modification that they could have done, for secondary and tertiary prevention of these back and neck related injuries. Further, all of them greatly benefitted, when provided with ergonomic education and structured back and neck exercise program. Thus, the author developed this PICO question, to identify the evidence based literature that supports the use of ergonomics and exercise interventions for computer workers.Clinical importance: Many of the neck and back cases that the author has seen in the past 3 years, were preventable at one time, only if the patient had been provided with resources to improve his posture, working style, and back and neck muscle strength. The author wanted to develop a structured exercise and/or ergonomic program for the computer workers, to provide a template for the clinicians, which they could then individualize to the patient (office worker). Also, with this program, the therapists could reach out to companies, where computer workers form majority of the staff, and conduct educational programs to improve the worker’s productivity and decrease the work related injury rates, within the company.  |

**SUMMARY OF SEARCH**

[Best evidence appraised and key findings]

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| * 22 studies were located that met the inclusion/exclusion criteria, including 1 systematic review with meta-analysis, 10 systematic reviews and 11 Randomized controlled trials (4 high quality RCTs and 7 low quality RCTs).
* Three studies (1 systematic review with meta-analysis, 1 systematic review, and 1 high-quality RCT) were reviewed and discussed
* A combination of exercise and ergonomic intervention at workplace was not found either harmful or beneficial in decreasing neck pain in computer workers.
* Strong evidence exists for use of strengthening exercises and endurance exercises for decreasing neck pain in office workers, working with computers.
* Moderate evidence exists for use of endurance exercises for decreasing neck pain disability in office workers, working with computers.
* A web-based intervention, involving short daily intervention time , over a prolonged duration, is effective, safe and feasible, in decreasing back pain in computer workers.
* Key points for future research include study on non-specific exercises; flexibility and endurance exercises for neck pain; higher quality systematic reviews with or without analysis to study workplace intervention for decreasing neck pain and for studying the impact of web-based intervention for relieving back pain in United States of America.
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**CLINICAL BOTTOM LINE**

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| * A combined exercise and ergonomic workplace intervention (either of short, intermediate, or long term) was not found effective in decreasing neck pain intensity in patients with comp
* Endurance (3 sets, 20 reps, 5-8/week, 4 -12 months) and strengthening exercises (1-3 sets, 5-15 reps, 1-2/day, 3-5/week, 1-12 months) are effective in decreasing the non-specific neck pain intensity. Moreover, endurance exercises are also effective in decreasing the disability associated with neck pain.
* A web based intervention, constituting of exercises and postural education for 11 minutes/daily, 5days/week, for 9 months is effective in decreasing non-specific subacute back pain in computer workers.
* Future research is required to determine if the web based intervention could be application to a population that has demographics similar to those living in United States of America. Also further research is also needed to further improve the quality of evidence of the use of endurance, strengthening and non-specific exercise for non-specific neck pain.
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| ***This critically appraised topic has been individually prepared as part of a course requirement and has been peer-reviewed by one other independent course instructor*** |

**SEARCH STRATEGY**

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| **Terms used to guide the search strategy** |
| **P**atient/Client Group | **I**ntervention (or Assessment) | **C**omparison | **O**utcome(s) |
| “Office worker”Computer “Computer worker”“Computer terminal”“Video display terminal” Sedentary Worker | Ergonomic\*WorkplaceExercis\* TherapyBiomechanic\*Office“Physical therapy” | Sedentary “Group exercis\*”Office Workplace  | PainWorkProductivity“Back pain”“Lumbar pain”“Cervical pain”“Neck pain”“Back strain”“Neck strain”“Lumbar strain”“Cervical strain” Absenteeism |

**Final search strategy:**

*Show your final search strategy from one of the databases you searched. In the table below, show how many results you got from your search from each database you searched.*

***P component search:***

* Computer gave 45,922 results
* “Computer worker\*” OR “video display terminal” OR computer OR “computer terminal” OR Sedentary OR “Office worker” gave 33,635 results (Limiters applied: Jan 1, 1991 to Aug 31, 2014; English, Geographic location as USA)
* (Computer OR “computer terminal” OR “Video display terminal) AND sedentary gave 144 total results.

Limiters applied: Jan 1, 1991 to Aug 31, 2014, English, and Human.

Further application of limiters yielded, with systematic review 6 results and with RCT 5 results.

* (Computer OR “computer terminal” OR “Video display terminal OR Sedentary) AND worker gave 119 results

Limiters applied: Jan 1, 1991 to Aug 31, 2014, English, and Human.

Further application of limiters yielded, with systematic review 3 results and with RCT 5 results.

* (Computer AND worker) OR (“Video Display terminal” AND worker) OR (“Computer terminal” AND worker) gave 74 results.

Limiters applied: Jan 1, 1991 to Aug 31, 2014, and English.

Further application of limiters yielded, with systematic review 3 results and with RCT 2 results.

* (Computer AND worker) OR (“Video Display terminal” AND worker) OR (“Computer terminal” AND worker) OR (Sedentary AND worker) gave 72 results.

Limiters applied: Jan 1, 1991 to Aug 31, 2014, and English.

* Further application of limiters yielded, systematic review- 3 results, with Meta-analysis - 0 results and RCT - 2 results.

**I component search:**

* Ergonomic\* OR “Workplace ergonomics” OR Education OR Exercis\* OR “Structured exercise program” OR Biomechanics OR Therapy OR “Physical therapy” OR “Workplace intervention” gave 298,896 results. No limiters applied.
* (Ergonomic\* AND workplace) OR (Exercis\* AND workplace) gave 390 results.

Limiters applied: Jan 1, 1991 to Aug 31, 2014, and English and Human.

Further application of limiters yielded, with systematic review 27 results, with Meta-analysis 0 results, and with RCT 17 results.

* (Ergonomic\* AND workplace) OR (Exercis\* AND workplace) OR (Therapy AND workplace) OR (Biomechanic\* AND workplace) gave 788 results.

Limiters applied: Jan 1, 1991 to Aug 31, 2014, and English.

Further application of limiters yielded, with systematic review 47 results, with Meta-analysis 4 results, and with RCT 33 results.

* (Ergonomic\* AND workplace) OR (Exercis\* AND workplace) OR (Therapy AND workplace) OR (Biomechanic\* AND workplace) OR (Ergonomic\* AND office) OR (Exercis\* AND office) OR (Therapy AND office) OR (Biomechanic\* AND office) gave 5,550 results.

Limiters applied: Jan 1, 1991 to Aug 31, 2014, and English.

Further application of limiters yielded, with systematic review 96 results, with Meta-analysis 13 results, and with RCT 33 results.

* (Ergonomic\* AND workplace) OR (Exercis\* AND workplace) OR (“physical Therapy” AND workplace) OR (Biomechanic\* AND workplace) OR (Ergonomic\* AND office) OR (Exercis\* AND office) OR (“Physical Therapy” AND office) OR (Biomechanic\* AND office) gave 784 results.

Limiters applied: Jan 1, 1991 to Aug 31, 2014, and English.

* Further application of limiters yielded, with systematic review 43 results, with Meta-analysis 3 results, and with RCT 34 results.

**C component search:**

* “Group exercis\*” gave results.

Limiters applied: Jan 1, 1991 to Aug 31, 2014, and English.

* “Group exercis\*” AND office AND workplace AND sedentary gave 0 results.

Limiters applied: Jan 1, 1991 to Aug 31, 2014, and English.

* (“Group exercis\*” AND office) OR (Sedentary AND office) gave 44 results

Limiters applied: Jan 1, 1991 to Aug 31, 2014, and English.

* (“Group exercis\*” AND office) OR (“Group exercis\*” AND workplace) OR (Sedentary AND office) OR (sedentary AND workplace) gave 54 results.

 Limiters applied: Jan 1, 1991 to Aug 31, 2014, and English.

* Further application of limiters yielded, with systematic review 4 results, with Meta-analysis 0 results, and with RCT 4 results.

***O component search:***

* (Back AND Pain) OR (lumbar AND Pain) OR (back AND strain) or (lumbar AND strain) OR (cervical AND Pain) OR (Cervical AND strain) OR (neck AND pain) OR (neck AND strain) gave 24,873 results

Limiters applied: English and Jan 1, 1991 to Aug 31, 2014.

* (“Back pain” AND work) OR (“lumbar pain” AND work) OR (“back strain” AND work) OR (“Lumbar strain” AND work) OR (“cervical pain” AND work) OR (“cervical strain” AND work) OR (“neck pain” AND work) OR (“Neck strain” AND work) gave 1,384 results

Limiters applied: English and Jan 1, 1991 to Aug 31, 2014.

* (Pain AND “work productivity”) OR (Strain AND “Work productivity) OR (“Musculoskeletal injur\*”AND “work productivity”) OR (Pain AND absenteeism AND work) OR (strain AND absenteeism AND work) OR (“Musculoskeletal injur\*” AND absenteeism AND work) gave 25 results

Limiters applied: English and Jan 1, 1991 to Aug 31, 2014.

* (“Back pain” AND work AND productivity) OR (“lumbar pain” AND work AND productivity) OR (“back strain” AND work AND productivity) OR (“Lumbar strain” AND work AND productivity) OR (“cervical pain” AND work AND productivity) OR (“cervical strain” AND work AND productivity) OR (“neck pain” AND work AND productivity) OR (“Neck strain” AND work AND productivity) OR (“Back pain” AND work AND absenteeism) OR (“lumbar pain” AND work AND absenteeism) OR (“back strain” AND work AND absenteeism) OR (“Lumbar strain” AND work AND absenteeism) OR (“cervical pain” AND work AND absenteeism OR (“cervical strain” AND work AND absenteeism) OR (“neck pain” AND work AND absenteeism) OR (“Neck strain” AND work AND absenteeism) gave 110 results

Limiters applied: English language and Jan 1, 1991 to Aug 31, 2014.

Further application of limiters yielded, with systematic review 7 results, meta-analysis 1 results, and with RCT 15 results

* (“Back pain” AND work AND productivity) OR (“lumbar pain” AND work AND productivity) OR (“back strain” AND work AND productivity) OR (“Lumbar strain” AND work AND productivity) OR (“cervical pain” AND work AND productivity) OR (“cervical strain” AND work AND productivity) OR (“neck pain” AND work AND productivity) OR (“Neck strain” AND work AND productivity) OR (“musculoskeletal injur\*” AND work AND productivity) OR (“Back pain” AND work AND absenteeism) OR (“lumbar pain” AND work AND absenteeism) OR (“back strain” AND work AND absenteeism) OR (“Lumbar strain” AND work AND absenteeism) OR (“cervical pain” AND work AND absenteeism OR (“cervical strain” AND work AND absenteeism) OR (“neck pain” AND work AND absenteeism) OR (“Neck strain” AND work AND absenteeism) OR (“musculoskeletal injur\*” AND work AND absenteeism) gave a total of 127 results

Limiters applied: English language and Jan 1, 1991 to Aug 31, 2014.

* Further application of limiters yielded, with systematic review 7 results, meta-analysis 1 results, and with RCT 15 results

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| **Databases and Sites Searched** | **Number of results** | **Limits applied, revised number of results (if applicable)** |
| 1. **CINAHL with full text**
 | **P component: 72 results****I component: 784 results****C component: 54 results****O component: 127 results****Total: 1037 results** | **Limiters applied to each component: English and Jan 01, 1991 to Aug 31, 2014.** **Revised result number for:****RCTs: 55****Systematic reviews: 57****Meta-analysis: 4****Total: 116****Final number of results (removing repetitions in the search): 106 results.** |
| 1. **Hooked on Evidence**
 | **Total for all components (P, I, C, and O) : 39 results** | **(Refined manually, with limiters English (all Hooked on evidence articles are ones that have been indexed in English-language journals.1) and Jan 01, 1991 to Aug 31, 2014.****Results refined to:** **Total: 7 results (All 7 results were RCTs. No systematic review or meta-analysis were obtained.)** |
| 1. **PEDro**
 | **Total for all components (P, I, C, and O) : 145 results.**  | **As PEDro does not allow filtering of the results as English language or RCT. The author manually filtered all the results obtained, where were >145 results and then narrowed them down to the following with the limiters as follows:****English and Jan 01, 1991 to Aug 31.****Total = 48 studies were identified, including RCTs and systematic reviews and based on the above limiters.**  |

## INCLUSION and EXCLUSION CRITERIA

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| **Inclusion Criteria** |
| * Randomized controlled trials, systematic reviews, and meta-analyses.
* Articles published in English language
* Studies that involve computer/office workers, who are using computers for at least 3 hours/daily or at least 15 hours/week, for employment purposes.
* Studies involved with computer workers, who have pre-existing back and neck pain.
* Articles should be studying an ‘intervention’, to relieve back and neck pain relief among those using computers for work.
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| **Exclusion Criteria** |
| * Case reports, uncontrolled clinical trials, clinical practice guideline, letter to editors, dissertations, lectures, newspaper articles, observational studies.
* Government regulations, conference proceedings, and publications for employee workplace safety
* Interventions that are involved with introduction of new workplace equipment, to relieve neck and back pain.
* Studies published before 1991.
* Articles published after August 2014.
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**RESULTS OF SEARCH**

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| A total of  | 22 | relevant studies were located and categorised as shown in the following table (based on Levels of Evidence, Centre for Evidence Based Medicine, 2011) and (insert name of) quality assessment rating scale |

**Summary of articles retrieved that met inclusion and exclusion criteria**

*Note that this table is arranged differently from the example CAT on Sakai. For each article that meets your inclusion and exclusion criteria, score for methodological quality on an appropriate scale, categorize the level of evidence, and note the study design (e.g., RCT, systematic review, case study). Add more rows as necessary.*

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| **Author (Year)** | **Study quality score** | **Level of Evidence** | **Study design** |
| **Andersen CH, et al.2 (2014)** | **PEDro scale: 7/10** | **1b** | **RCT** |
| **Andersen CH, et al.3 (2012)** | **PEDro scale: 4/10** | **2b** | **RCT**  |
| **Bernaards CM, et al.4 (2007)** | **PEDro scale: 6/10** | **2b** | **RCT** |
| **Del Pozo-Cruz B, et al.5 (2012)** | **PEDro scale: 7/10** | **1b** | **RCT** |
| **Esmaeilzadeh S, et al.6 (2014)** | **PEDro scale: 6/10** | **2b** | **RCT** |
| **Kietrys DM, et al.7 (2007)** | **PEDro scale: 5/10** | **2b** | **RCT** |
| **Ma C, et al.8 (2011)** | **PEDro scale: 4/10** | **2b** | **RCT** |
| **Irmak A, et al.9 (2012)** | **PEDro scale: 4/10** | **1b** | **RCT** |
| **Speckle EM, et al.10 (2010)** | **PEDro scale: 6/20** | **2b** | **RCT** |
| **Telles S, et al.11 (2009)** | **PEDro scale: 5/10** | **2b** | **RCT** |
| **van Eijsden MA, et al.12 (2009)** | **PEDro scale: 7/10** | **1b** | **RCT** |
| **Williams RM, et al.13 (2004)** | **AMSTAR scale: 4/11** | **3a** | **Systematic Review** |
| **Verhagen AP, et al.14 (2007)** | **AMSTAR scale: 6/11** | **2a-** | **Systematic Review** |
| **Verhagen AP, et al.15 (2007)** | **AMSTAR scale: 8/11** | **2a** | **Systematic Review** |
| **Sihawong R, et al.16 (2011)** | **AMSTAR scale:****7/11** | **2a** | **Systematic Review** |
| **Leyshon R, et al.17 (2010)** | **AMSTAR scale: 6/11** | **2a** | **Systematic Review** |
| **Kennedy CA, et al.18 (2010)** | **AMSTAR scale: 7/11** | **2a-** | **Systematic Review** |
| **Goodman G, et al.19 (2012)** | **AMSTAR scale: 5/11** | **3a\*\*** | **Systematic Review** |
| **Brewer S, et al.20 (2006)** | **AMSTAR scale:****7/11** | **2a** | **Systematic review** |
| **Boocock MG, et al.21 (2007)** | **AMSTAR scale: 8/11** | **3a-\*\*** | **Systematic Review** |
| **Barredo RV, et al.22 (2007)** | **AMSTAR scale:****7/11** | **3a** | **Systematic Review** |
| **Aas RW, et al.23 (2011)** | **AMSTAR scale: 10/11** | **2a** | **Meta-analysis** |

**BEST EVIDENCE**

The following 3 studies were identified as the ‘best’ evidence and selected for critical appraisal. Reasons for selecting these studies were:

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| * Del Pozo-Cruz B, Adsuar JC, Parraca J, et al. A web-based intervention to improve and prevent low back pain among office workers. A randomized controlled trial. J Orthop Sports Phys Ther. 2012 Oct; 42 (10): 831.
* The reasons for selecting this study include – High level of evidence (1b); one of the highest PEDro score (7/10), out of all the 11 RCTs that were studied; the fact that it is the only study effectively addressing back issues in computer worker, among the 22 studies; and lastly, the subjects are involved with working at a computer work-station for at least 6 hours/day. Further, though it advocates a long term program, it does not deal with introducing any new equipment in the workplace and is cost-effective, thus meeting the PICO inclusion criteria.
* Sihawong R, Janwantanakul P, Sitthipornvorakul E, Pensri P. Exercise therapy for office workers with nonspecific neck pain: a systematic review. J Manipulative Physiol Ther 2011 Jan; 34 (1):62-71.
* The reasons for selecting this study include, as follows - High level of evidence (1b); it is mainly related with office workers and computer workers, who work with computers, Video display terminals or video display units; it studies workplace-associated neck pain; and though it has lower PEDro scale score (7/10) compared to other studies, it effectively address and focuses on the role of exercise, unlike other studies that are looking at workplace interventions, in general.
* Aas RW, Tuntland H, Holte KA, et al. Workplace interventions for neck pain in workers. Cochrane Database Syst Rev. 2011 Apr; 13(4): CD008160.
* The reasons for selecting this study are as follows: High level of evidence (2a); highest quality appraisal score from AMSTAR scale (9/11), compared to all other included studies; though it studies neck pain not only in office and computer workers, but in all workplaces, it does include a majority of the former populations; and it is the most recent of the two Cochrane reviews that were included in this assignment.15,23
* The reasons as to why other studies that scored >7 with AMSTAR were not included
* **Verhagen et al**15 : (AMSTAR score 8/11): This is a Cochrane review and it studies neck pain in not only those workplaces, where computers are being in use, but also those at industrial, etc. settings. Unlike Aas et al23, it studies the workplace related pain, not only at neck, but also the “shoulder” and “arm”. Lastly, this Cochrane study was not selected, in favour of a more recent Cochrane review by Aas, et al23.
* **Boocock et al**21 **:** (AMSTAR score 8/11): This study was not selected as it reviews the studies that were published for the workplace neck/ upper extremity conditions, during only 5 years tenure -1999 to 2004; while Sihawong et al16 et al, includes review of studies that span from 1980 to 2010. Also, the study by Boocock et al, presents with extremely low level of evidence (3a), which is further questionable (as indicated by a minus “-“ sign, next to it), due to inclusion of not only intervention studies, but also other studies of descriptive nature.
* The reason as to why other studies that scored 7/10 on PEDro scale, were not included.
* Both Anderson CH et al2 (2014) and van Ejisden et 12 (2009) did meet the inclusion criteria for the PICO question and scored the same PEDro score, like Del Pozo-Cruz et al5 (2012). But the latter was selected, and not the former two, as the study by Del Pozo-Cruz et al5 is the only study out of the 22 studies, that was studying back pain. (The study by Anderson CH et al2 was related to studying scapular training for neck and shoulder pain, while the study of van Ejisden et a12l was related with assessing the cost-effectiveness for an exercise intervention for work related upper extremity musculoskeletal disorders.) It was important to select at least one study that would address the issue of back pain for the PICO question, as both the other two articles (Aas et al23 and Sihawong et al16), selected as best evidence, address the neck pain issue of PICO question.
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**SUMMARY OF BEST EVIDENCE**

**(1) Description and appraisal of (study title) by (authors, Year) The following information in this first article appraisal, is based on the study by Aas et al23, unless specified otherwise.**

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| **Aim/Objective of the Study/Systematic Review:** |
| With neck pain becoming so common among working population in developed countries, the authors wanted to assess the effectiveness of interventions used at workplace settings, in decreasing neck pain, when compared with no or other workplace interventions. |
| **Study Design**[e.g., systematic review, cohort, randomised controlled trial, qualitative study, grounded theory. Includes information about study characteristics such as blinding and allocation concealment. When were outcomes measured, if relevant]Note: For systematic review, use headings ‘search strategy’, ‘selection criteria’, ‘methods’ etc. For qualitative studies, identify data collection/analyses methods. |
| This is a systematic review with meta-analysis of randomized controlled trials. Search strategy: Studies were searched from the following databases – MEDLINE and EMBASE (Search strategy used was based on “ Cochrance Handbook for Systematic Reviews of Intervention and the 2009 Updated method guideline for systematic reviews in the Cochrane Back Review Group26” 23(p7)); CINAHL and PsycINFO (search strategy based on, “RCT search filters used at the Norwegian knowledge Centre for the Health Services” 23(p7)); ISI Web of Science, OTseeker, and PEDRO (with search strategy, provided in MEDLINE). The search was conducted to include all the articles published by July 2009. Language limitations were not applied. The authors did use “Reference lists and contacted experts in the field”. 23(p1)Selection criteria: Randomized controlled trials studying effectiveness of workplace intervention in relieving neck pain were included. * In relation with participants:
* Workers of age 18 to 67 years, both male and female gender, who were currently having an “employment agreement” (irrespective, of the fact, if they were currently sick, retired (early), or were using disability services), were considered in inclusion criteria.
* No discrimination was done related to the job location or sector, for the inclusion criteria.
* Studies involving neck pain due to pathological diagnoses (e.g. fractures, etc.) and where, 50% of subjects did not have neck pain at baseline, were excluded. However, if the annual incidence of neck pain in the subjects was found to be >50%, they were considered for inclusion. The criteria of included studies having at least 50% subjects with neck pain at baseline, was to ensure that consideration was being allowed to the waxing-and-waning nature of the neck pain that has lapses and relapses. And, also to ensure that the included studies did not deal with only primary prevention.
* Lastly, for the study to be included, the subjects in the study should have had neck pain, of duration <6 weeks to > 12 weeks (i.e. comprising acute, subacute and chronic neck pain). Also, if they had shoulder pain, it should be accompanying an existing neck pain.
* In relation with interventions:
* No limitation was placed on the type of intervention selected, as long as the workplace intervention studied in the study was being used to relieve the neck pain in the workers.
* Interventions were classified based on ICF components of body impairment (including, interventions addressing the physical and psychological challenges at work, e.g. stress management); activity limitation (including, interventions addressing the biomechanics associated with performing the job activity or the type of job activity performed), participation restriction (including, interventions addressing the work hours or the work-related absenteeism), environmental factors (including, interventions addressing the workplace equipment modification/replacement with new equipment, changes to the workplace culture or to the workplace organization, etc.), and personal factors (including, interventions addressing habits, lifestyle changes and age-related changes needed).
* Further, the authors had agreed upon that the intervention need not contain only one component of International Classification of Functioning, Disability, and Health (ICF), but rather may include multiple components at the same time.
* Lastly, the authors did not include the interventions that were not conducted in the workplace, and which included as intervention the components of exercise (performed as, “group gymnastics, fitness program, aerobics, spinning, graded exercise programs” 23(p6)).
* In relation to the outcome measures
* As long as the studies measured at least one of the following primary or secondary outcome, they were included, and were categorized based on, the time the results of the intervention were measured, post-randomization, in the respective studies, i.e. – short term (~ 4 weeks), intermediate term (~6 months) and long term (> 1 year)
* These outcomes were as follows :
* Primary: “Pain severity or pain prevalence” 23(p7) or “work absenteeism” 23(p7) (Pain measured as subjective scores obtained from a Visual Analogue Scale or Numeric pain rating scale; while absence from work was measured as the decrease in work duration compared to normal, associated disability, and if patient ended up taking early retirement).
* Secondary: Overall improvement of the subjects condition with the intervention, or “functional status” 23(p7) or “well-being/Quality of life” 23(p7).

Methods involved with data collection and analysis: * As some of the studies reviewed, did not present with all the information needed, the respective authors of these studies were contacted, to get access to the missing information. In cases, where Aas et al. did not receive the information requested from the authors of the included studies, they have mentioned what they did with the missing data.
* For collecting data from the included studies, Aas et al. followed the steps presented in the following - “Cochrane Handbook for Systematic Review of Intervention and the 2009 Updated method guidelines for systematic reviews in the Cochrane Back Review Group4” 23(p7).
* They revised this form with inclusion criteria, first by “pilot” 23(p7) testing on 10 of the studies.
* Two reviewers after removing the duplicates from the original search, studied the abstracts of the studies obtained, for selecting the studies for inclusion. When, it started to become difficult to decide if the study met the inclusion criteria or not, based on the abstract, the entire article was studied by the authors. Then, based on standardized form (developed on experience), the information presented in the selected studies were extracted and documented, by the two review authors. The information that was extracted included information about “participation, interventions, outcomes, and results” 23(p7).
* Based on the criteria for risk of bias form, developed by “Cochrane Back Review Group26”, the included 10 studies were studied for risk of bias. Only 2 studies presented to be of low risk of bias based on this criteria, which meant that they were the only studies that met out of the 12, the criteria components for randomization, “allocation concealment” 23(p7), and “outcome assessor blinding” 23(p7), along with 3 other criteria components in this form.
* They used Odds ratio, where the data was dichotomous, which included about 50% of the results, and for the remaining 50% of the data, that was continuous, mean differences were calculated by them, for the outcomes.
* Because of significant variations in the characteristics of each of the 10 studies (except, two studies), only a single meta-analysis was developed.
* In cases, where both reviewers disagreed (at any of the above steps), consensus was resorted to first and if that did not help then a third reviewer’s opinion was requested.

Grading of Recommendations Assessment Development and Evaluation (GRADE) approach25 was used to assess the quality of the evidence for the primary outcomes. A modified version of the 5 categories of actual GRADE approach were used to do this analysis. The actual 5 categories are –study limitations, consistency, directness, precision, and publication bias.25 High quality evidence was considered, when all the 5 categories were met; moderate quality evidence was considered when one of the category was not met, low and very low quality evidence was considered, when two or three categories were not met, respectively. No evidence would be stated based on GRADE approach, if RCTs related to the outcome did not exist, based on the selection.  |
| **Setting**[e.g., locations such as hospital, community; rural; metropolitan; country] |
| Location: All workplace locations, without distinction between the type of job and the workplace settings, were included for data collection. The following are the settings for the 10 included studies in the study by Aas, et al.23* Bernaards 200727: This study had been conducted in Netherlands and includes the workers using computers, from “head-offices” related to different sectors, like “insurance, science, energy, transportation policy and taxes” 23(p24);
* Fostervold 200628: This study was conducted in Norway in insurance sector;
* Haukka 200829: This study was conducted in Finland in culinary field, on workers working in “institution-based kitchens” 23(p30);
* Hedge 199930: This study was conducted in Phoenix, USA, for office workers;
* Horneij 200131: This study was conducted in Sweden for nurses’ assistants and aides;
* Kamwendo 199132: This study was conducted in Sweden among office workers in medical setting;
* Ketola 200233: This study was conducted in Finland in administrative office workers;
* Morken 2002a34: This study was conducted in Norway in an aluminium industrial factory;
* van den Heuvel 200335: This study was conducted in Netherlands in computer workers;

 Voerman 200736: This study was conducted in Netherlands and Sweden in office workers. |
| **Participants**[N, diagnosis, eligibility criteria, how recruited, type of sample (e.g., purposive, random), key demographics such as mean age, gender, duration of illness/disease, and if groups in an RCT were comparable at baseline on key demographic variables; number of dropouts if relevant, number available for follow-up]Note: This is not a list of the inclusion and exclusion criteria. This is a description of the actual sample that participated in the study. You can find this descriptive information in the text and tables in the article. |
| * There was 10 total studies that were included and all were randomized controlled trials.
* Based on the PICO question, the interesting part is that, computers workers were studied by the following 6 of the 10 studies (with the number of working hours mentioned, next to the study in parenthesis) :
* Bernaards et al. (3 hours/day, for at least 3 times/week of computer work)27,
* Fostervold et al. (50% of their work time on VDU)28,
* Hedge et al (5.4 hours/ day of computer work)30;
* Ketola et al (>4 hours/day computer work)33;
* van den Heuvel (> 5 hours/day of computer work) 35.
* Voerman et al (at least 20 hours/ week of computer work)36

(Though Aas et al, quote that 7 studies are related with computer work, the study by Kamwendo et al, did not include office workers using computers)* The following studies do not meet the inclusion criteria for the PICO question, as they do not include computer workers as their population.
* Haukka et al had full time kitchen workers29;
* Horneij et al includes nurses’ assistants and aides31;
* Kamwendo et al32, included participants, who were office workers in medical settings, but did not use computer for daily work;
* Morken et al34 included a combination of operators, office workers and supervisors in an industrial setting, where the did not mention if the computer workers, were involved with computers or not.
* Of the 4179 total number of participants, 1434 participants were subtracted (Horneij et al – 90 participants31 and Morken et al -1344 participants34) as they did not meet the inclusion/exclusion criteria of the study by Aas et al.23
* Based on the gender, all the studies had equal distribution of female and male gender, except for two studies – Morken et al34, where the study that was based on an industrial aluminium factory, majority of the subjects were males; while in the study by Horneij et al31, where the majority of the workers were nursing assistants and aides, there the subject population was mainly female in gender.
* Except for two studies – Horneij et al, where the neck pain was present in 54% to 61% in the year, prior to which the study was conducted; and van den Heuvel et al35, where 100% of subjects had neck pain too, but in the prior week to the week, when the baseline measures were recorded; all the other 8 studies presented with 54 to 90% of their subjects having neck pain at the time of baseline assessments.
* Absenteeism due to neck pain, was reported only in few studies, all the subjects studied were either working as full time or as part-time employee.
 |
| **Intervention Investigated**[Provide details of methods, who provided treatment, when and where, how many hours of treatment provided] |
| *Control* |
| The control groups of the included 10 studies are as under:* Bernaards 200727: Control group present, but no intervention.
* Fostervold 200628: No control group was included in the study.
* Haukka 200829: No control group present.
* Hedge 199930: Conventional key board was used.
* Horneij 200131: No control group present. As all selected participants participated in the study.
* Kamwendo 199132: No care was provided to the control group.
* Ketola 200233: No care was provided to the control group, except providing them with a pamphlet of information.
* Morken 2002a34: No care to the control group.
* van den Heuvel 200336: Usual care to the control group
* Voerman 200737: “Ergonomic counselling” 1(p63) was provided to control group.
 |
| *Experimental* |
| * The following are the interventions provided in the 10 included RCTs.
* Bernaards 200727: (Two-component intervention addressing activity limitation and environmental components of ICF): Focused on improving body posture, need for rest breaks, and modifying workplace equipment. Two intervention groups were present. One was related with work modification techniques, and the other was related with education on work modification techniques and physical activity. All the participants received the training from a counsellor (trained), for 6 sessions of 15 to 60 minutes, during a six-month period.
* Fostervold 200628: (One-component intervention addressing environmental component of ICF): Focused on providing video display units with computer screen that could be tilted or lowered. (They had two intervention groups, angle of back tilt of the computer screen differed between the two groups, 15 “degree below the horizontal line”23 for one group and 30 degrees for the other group).The follow up assessment was at 12 months.
* Haukka 200829: (4-component intervention addressing body limitation, environmental and activity domain components of ICF)): Focused on improving factors that increase mental and physical work load and creating, identifying and using ergonomic solutions at workplace. This included a 2 month pre-implementation phase, which included 10 hours of workshop and then 9-12 month of implementation phase that included, 18 hours of workshop. The researcher guided the participants during the study, where the researcher, in turn was guided through the study, by the “project co-ordinator”23.
* Hedge 199930: (One-component intervention addressing environmental modification component of ICF): Focus was placed on computer workstation modification, with use of downward tilted keyboard among subjects. The study was conducted for 3 weeks.
* Horneij 200131: (One-component intervention addressing body impairment component of ICF): Focused on strategies to improve the psychological burden felt by worker at workplace. Two intervention groups were present, the first received stress reduction education for 1.5 hours/session, with 1 session/week, with follow up at 3 and 6 months. While the other group, received individualized exercise program with individual goals and had to document notes, in a record, as directed.
* Kamwendo 199132: (Two-component intervention addressing body impairment component and activity limitation component of ICF): Focus was on improving strategies to cope with the mental stress at workplace and to improve office ergonomics. Two intervention groups were present, both were conducted by the therapist, where the first group attended 4-hour lectures of body impairment and ergonomics. While the other group, received the above lectures and also techniques on how to be able to implement them, with compliance, in a total of 6 hour session.

Ketola 200233: (Two-component intervention addressing body impairment and activity limitation component): Focus was on addressing rest breaks during work hours and work posture. 2 intervention groups were present, where for the first group, the physiotherapists visited the workplace and provided workplace modifications and provided new workplace equipment, which took about 1.5 to 2 hours. While for the other group, there was 1 hour ergonomic education and the subjects were supposed to evaluate their own work station. * Morken 2002a34: (Three-component intervention addressing body impairment, activity limitation and environmental modification components of ICF): Focus on improving work techniques, modifying work tasks, modifying work place equipment, and awareness about musculoskeletal body impairments. 3 intervention groups were present, with different participants in different job positions, but they all received the same intervention of 1 hour and 15 minutes of education on work related subjects and 45 minutes of discussion on the same. Was conducted by company’s physical therapists.
* van den Heuvel 200335: (One-component intervention addressing activity limitation component of ICF): inclusion of rest break and physical exercises. 2 intervention groups were present, one focused on 7 second rest breaks alone, for every 35 minutes; and the other with rest breaks and four physical exercises prescribed, at specific time intervals.
* Voerman 200736: (One-component intervention addressing activity limitation component of ICF): Focused on work performance technique modification. Included two intervention groups, where one received only ergonomic education with workplace modification for 4 weeks, along with weekly visits by therapist. While with the other group, there was myo-feedback training to improve work posture during working, along with ergonomic education. All sessions were conducted by the therapists.

None of the above interventions were found to address personal factors or the participation restriction component of ICF. |
| **Outcome Measures** (Primary and Secondary)[Give details of each measure, maximum possible score and range for each measure, administered by whom, where] |
| * Aas et al studied two outcomes – “pain severity or prevalence” 23(p9) (assessed in all of the 10 studies) and absenteeism from work due to neck pain (assessed in 3 out of 10 studies). Due to issue of missing data, data for neck pain was available only in 7 studies and for work-place absenteeism due to neck pain in 1 study.
* Interestingly, the authors were able to specify with certainty only in 5 out of 10 included studies that blinding of the outcome assessors existed. Of the remaining 5 studies, 4 did not have blinding of the outcome assessors (Fostervold et al28, Morken et al34, van den Heuvel et al35, and Voerman et al36) and for one study (Kamwendo et al32) data was missing.
* An attempt at summarizing the measurement instruments used only to measure these 2 outcomes (pain severity/ pain prevalence, absenteeism from work due to neck pain) in the 10 included studies has been attempted below:
* Bernaards 200727:
* “The degree of recovery from neck and upper limb symptoms”23(pg25): Assessed by Visual analogue scale (7-point scale), with 0 indicating being worst and 7 indicating recovered completely.
* Intensity of neck pain: A 11 point scale was used, with ‘no pain’ being indicated by number 0 and worst pain by number 10.
* Work disability: 11 point scale was used to assess the alteration in ability to perform work, with ‘no change’ indicating number 0 on the scale and score of 11 indicating extreme change in ability to work.
* “Number of days with neck and upper limb symptoms” 23(pg25): Dutch Musculoskeletal Questionnaire
* Number of symptom-free months experienced by the patient: Patients were asked the following question for gaining information about this outcome: “In how many of the past six months did you have no symptoms in neck and upper extremities?”27
* Fostervold 200628:
* Symptoms related to computer work: A subjective questionnaire was developed that could measure 14 different symptoms related to musculoskeletal, visual, skin integrity and GI issues. Each of the 14 questions had 7 items, through which the respective symptom could be measured.
* Musculoskeletal loading at neck and shoulder: Electrode electromyography.
* Control measures: Psychological condition, work satisfaction, work strain, working hours, and workstation parameters, like lighting and distance from screen were measured.
* Haukka 200829:
* All outcomes -“prevalence of neck pain” 23(pg31), “trouble caused by pain during the past three months” 23(pg31), Fatigue at the neck and upper extremity after work each day for past seven days, absenteeism from work due to sickness in the past 3 months, were measured by a questionnaire (the name of the questionnaire has not been specified).
* Hedge 199930:
* “Musculoskeletal discomfort” 23(pg34): Non-validated questionnaire used. Patients self-reported pain at specified body regions.
* Horneij 200131:
* “Musculoskeletal pain” 23(pg36): “Nordic musculoskeletal questionnaire” 1(pg36) was used.
* “Perception of pain during the previous 6 months” 23(pg36) : 5- point scale use, lowest score = “much better” 23(pg36); highest score = “much worse” 23(pg36)
* “Perceived interference with work and/or leisure activities due to discomfort” 1(pg36): Visual analogue scale (100 mm).
* Kamwendo 199132:
* Fatigue and pain at neck and shoulder: Measured with Visual analogue scale (10 cm), where lowest score= no pain, and highest score = “considerable pain” 23(pg40).
* Absenteeism due to sickness: Information was collected from the “Swedish social insurance agency” 23(pg40).
* Ketola 200233:
* “Musculoskeletal discomfort” 23(pg43): Subjects recorded in their dairy, with a 5-point scale (lowest score- no discomfort, highest score- maximum discomfort), the level of musculoskeletal discomfort that they were experiencing.
* “Musculoskeletal pain and strain” 23(pg43): Pain and the strain the past 30 days were assessed with a 5 point scale for muscle strain (where, lowest sore = no strain, and highest score = maximum strain); and yes/no options for muscle pain (where, 0 day of pain = no pain, > 1 day of a muscle pain = pain).
* Morken 2002a34:
* Musculoskeletal symptoms and discomfort: Standard Nordic Questionnaire with modifications was used.
* van den Heuvel 200335:
* Frequency and severity of complaints: “Complaints for discomfort or pain at neck, shoulder, upper arms, elbows, forearms, wrists, and hands or fingers” 23(pg49) in the past 7 days were measured. Frequency was measured, by asking them the frequency with which they had the symptoms in the above mentioned areas, while severity was measured by a 10-point scale, where lowest score indicates ‘absence of complaints’ and highest score indicates maximum complaints.
* Sickness related absenteeism: Subjective question was asked for about being on sick leave for the past 3 months.
* Voerman 200736:
* Intensity of pain: Subjective assessment with Visual analogue scale (10 cm) was used with the least rating indicating ‘no discomfort’ and maximum rating, indicating maximum discomfort possible.
 |
| **Main Findings**[Provide summary of mean scores/mean differences/treatment effect, 95% confidence intervals and p-values etc., where provided – if you need to calculate these data yourself, put calculations here and add interpretation later, under ‘critical appraisal’ on next page] |
| * The study of 2745 subjects through 10 included studies, revealed that there was low quality evidence at this time that receiving workplace intervention, compared to not receiving it, did not improve or worsen the existence of neck pain or the severity of neck pain.
* However, when the two studies that had low risk of bias, based on GRADE approach were assessed, it was found that the pain at 10/12 months was 0.12 SD lower (0.36-0.2) at 95% confidence interval, when workplace intervention was provided, compared to control receiving no intervention.
* Despite there being limited information on work related absenteeism due to neck pain, there was found moderate quality evidence (based on the four component study of Haukka et al29, n =415 workers) for decrease in work-related absenteeism in intermediate term(“ OR 0.56, 99% CI 0.33-0.95” 23(2)), as compared to short term (“OR 0.83, 95% CI 0.52 to 1.34”)23(p2) or long term (“OR 1.28, 95% CIC 0.73 to 2.26”) 23(p2). This indicates that the effect of decrease of absenteeism that is gained at 6 months, may not sustain at 10/12 months (long term).
* For the meta-analysis, the authors did have forest plots, but interestingly none of the forest plots studied more than one study at a time, as they studies could not be pooled, due to heterogeneity.
* Forest plots were constructed individually for the following studies, and for Haukka et al (described above):
* Ketola et al33: A forest plot was presented for both interventions- ergonomic interventions and ergonomic education to relieve musculoskeletal pain in the neck. Both the forest plots favour the experimental intervention used in decreasing the neck pain, in short term (intensive ergonomic intervention: MD -0.60, 95% CI -1.15 to -0.05; and Ergonomic education: MD -0.60, 95% CI -1.04 to -0.16). However, this positive significant effect was not present at immediate term follow up (Intensive ergonomic: - 0.30, 95% CI -0.85 to 0.25; Ergonomic education intervention: MD -0.25, 95% CI -0.77 to 0.28).
* Fostervold et al28: A forest plot was presented studying how modifying the “computer screen angle, high v/s low, low line-of-sight”, would modify the “prevalence of discomfort in neck /shoulder” 1(pg15). The forest plot supports that the modifications to the computer screen does result in decrease in prevalence of neck and shoulder discomfort. Though both Fostervold et al and Hedge et al, both studied this intervention, pooling was not possible in the forest plot, due to heterogeneity in follow up periods, with Fostervold et al studying long term follow up (OR 0.48, 95% CI 0.22 -1.02) and Hedge et al studying short term follow up (OR 0.47, 95% CI 0.12- 1.76).
 |
| **Original Authors’ Conclusions**[Paraphrase as required. If providing a direct quote, add page number] |
| * No workplace intervention (either of short, intermediate, or long term) was found to either increase or decrease the occurrence of severity of neck pain among workers.
* If the workplace intervention has multiple components in it, like the four-component intervention like Haukka et al, then such an intervention was found to be effective in decreasing the absenteeism from workplace, due to neck pain, provided the workplace intervention program was of at least intermediate term. However, short and long term programs, did not seem to confer such positive effects on the worker absenteeism. This also means that the positive effects that were obtained at 6 months, were lost in long term (at 10/12 months, or >12 months).
* Better quality randomized controlled trials and improved workplace interventions are needed at this time, to determine if workplace interventions can effectively relieve neck pain or not.
 |
| **Critical Appraisal** |
| **Validity**[Methodology, rigour, selection, sources of bias, quality score on methodology quality rating scale (indicate the quality assessment tool used and the maximum possible score on that scale, e.g., 7/10 on PEDro scale), appropriateness of analytical approach (e.g., adjustments for confounding variables, management of missing data).]Comment on missing information in original paper. |
| * The authors attempted to combine the findings of the study by using ICF, and by arranging them as four, three, two or one component interventions, based on the number of components of ICF (e.g. body impairment, activity limitation, participation restriction, etc.) that the intervention would include. They tried to further subgroup the findings, by trying to explain the results into three categories –“1. Workplace intervention v/s no interventions; 2. Workplace intervention versus usual care; 3. Comparison of two or more workplace interventions” 23(p6).This made reading of the meta-analysis and the understanding of the, many-a-times complex, interventions in the included studies, easy.
* Having study selection, in such a way that at least 50% subjects in each study had pre-existing neck pain at baseline, ensured that they were not assessing studies involved only primary prevention. Further, by choosing the criteria of 50% they were giving leeway to the fact that those who have neck pain, do suffer with frequent lapses and relapses, with this condition.
* Because of the heterogeneity in the studies, the authors have developed a meta-analysis, but the forest plots that they developed at no point included more than one study (For e.g. While grouping together the 2 two-component studies, they were unable to create a forest plot including both, Forstervold et al28 and Hedge et al30, as the times for follow up were different for the two tests. That is for Forstervold et al28 it was long term follow up, while for the Hedge et al, it was short term follow up. ).
* The GRADE approach that they used has been widely used for assessing the quality of the studies in the systematic review and according to Guyatt et al25, it helps the reader and the researcher to know whether the quality of evidence in a systematic review, from which the recommendations are being drawn, has correct estimate of effect size or not.
* The author of this assignment believes that the inability of Aas et al, to get access to all the missing data, despite their best efforts, might have affected the results. The assignment author believes so, as due to the missing data, there were only 7 studies of the 10 studies that had data about the outcomes related with neck pain presence and/or severity; while there was only 1 study (Haukka et al29) that had information about work related absenteeism from neck pain.
* The assignment author strongly feels that Aas et al, used a good methodology to perform this study, where they scored 10/11 on the AMSTAR37 scale for their methodology quality appraisal. The only criteria of AMSTAR that they did not meet was that, they had not assessed the likelihood of publication bias, with the use of any graphs or statistical tests. Also, in addition to this high rating on AMSTAR scale, a systematic review with meta-analysis is the highest quality design, present in evidence-based literature, indicating that the present study by Aas et al is of high quality.
* In context of the included 10 studies, interestingly, none of the studies scored the criteria of blinding of the participants and the providers on the GRADE approach scale25. Now for the study to be of low risk of bias, based on GRADE approach24, it is important that it should be sufficing the criteria 1 of randomization, criteria 2 of “allocation concealment” 23(p7) and criteria 5 of “outcome assessors blinded” 1(p7), along with 3 other criteria being met. This was seen in only two studies – Bernaards et al27 and Haukka et al29. Also, all of the 10 included studies, based on the GRADE approach25, unfortunately, are of low-quality evidence. And, further lack of blinding of participants and therapists might have resulted into the introduction of ‘performance bias’ in the study by Aas et al23.
* Furthermore, lack of possible blinding of the outcome assessors in half of the included studies, might have also introduced potential biases in the findings of the respective studies.
* Bias may have been introduced in the study, by having less number of included studies (n=10), by having small sample size in the included studies, by having all included studies to be of low quality evidence (based on GRADE approach), to have only 2 low risk bias studies (based on GRADE approach), and missing data.
* Lastly, another matter of concern is that none of the studies focused on the personal component and participation restriction component of ICF.
 |
| **Interpretation of Results**[Favourable or unfavourable, specific outcomes of interest, size of treatment effect, statistical and clinical significance, minimal clinically important difference. You may calculate effect size or confidence intervals yourself from the data provided in the article.] Describe in your own words what the results mean. |
| * Of the 10 studies, 6 studies were about office workers, who used computers, while other 4 studies, were related to healthcare, industrial workers, office workers who don’t use computers at workplace, and lastly, kitchen workers.
* The main conclusion of the study indicates that with moderate quality evidence, with intermediate term application of a four component intervention, there is a decrease in work related absenteeism (“OR 0.56, 99% CI 0.33-0.95” 23(2)). Here, the results are significant, because the OR < 0.56 (indicates that the intervention is better than control) and CI which does not include the number 1 (the neutral line passing through score 1, indicating that the above results are significant1). However, the same four component intervention, when is applied for short term (“OR 0.83, 95% CI 0.52 to 1.34”)23(p2) or long term (“OR 1.28, 95% CIC 0.73 to 2.26”) 23(p2), the results have been found to be insignificant. This is so, because despite having Odds ratio < 1 in both the studies (indicating that the intervention is better than control), the CI in both the short and long term, passes over the neutral line of 1. This indicates that one of the score, within the confidence intervals of short and long-term is of ‘no effect’ (that is both intervention and control have the same effect)
* Interestingly, in relation to the PICO question, the only moderate quality evidence study is not relevant, as the PICO question is related with studying computer workers, while this study is based on kitchen workers (Haukka et al29).
* To discuss further about the results found based on the ICF classification:
* For 3 –Component interventions:
* Only one study was present here, Morken et al34, with results as follows: Mean difference “(MD) 0.01, 95% CI -0.21 to 0.23” 1(p13) for one group; “MD 0.01, 95% CI -0.21 to 0.23” 1(p13) for group 2, and “MD -0.04, 95% CI -0.24 to 0.16” 1(p13) for group 3. As is seen in all these 3 studies, the mean differences are significantly low at 95% CI.
* For 2-Component interventions:
* Similar situation as with Morken et al34, is seen with Bernaards et al27, where the confidence intervals in both the intermediate and long term, in both the intervention groups is found to cross the neutral line, making the results non-significant. Intermediate results (intervention 1: “MD 0.30, 95% CI -0.26 to 0.86” 23(p13), Intervention 2: “MD 0.20, 95% CI -0.37 to 0.77”) 23(p13) or long-term (intervention 1: “MD -0.20, 95% CI -0.84 to 0.44” 23(p13), intervention 2:” MD -0.10, 95% CI -0.73 to 0.53)” 23(p13).
* Ketola et al33: Has significant decrease in pain for short term with MD of -0.60 at 95% CI and CI of -1.15 to -0.05. Subjective rating of pain was used in the study. Though a decrease of 0.60 is significant for short term, clinically a decline of only 0.60 of pain, after 4 weeks of intervention may not seem effective to the patient.
* No significant results were found with Kamwendo32 et al (CI not stated in the meta-analysis), a two-component intervention study.

Further, in this study, the intermediate term follow up studies were found to be non-significant, as the CI passes over the neutral line.* For 1 –component studies:
* Study by Horneij31 et al was not significant, as the CI includes the neutral line (no-effect score); Hedge et al30 and Fostervold et al34, both had Odds ratio <1 (significant effect), but as their CI includes 1 as one of the score (CI 0.12 to 1.76 and CI 0.22 to 1.02, resp.), the total scores were found to be non-significant. Statistical values were not provided for Voerman et al36 and van den Heuvel et al35 in the study.
* For the forest plot results: ( Haukka et al, explained above)
* For both Ketola et al33 for short term results(intensive ergonomic intervention: MD -0.60, 95% CI -1.15 to -0.05; and Ergonomic education: MD -0.60, 95% CI -1.04 to -0.16) and for Fostervold et al28 for short term results, the respective interventions were found to be significant in decreasing the neck pain (Ketola et al33) and discomfort at neck and shoulder (Forstervold et al28) (OR 0.48, 95% CI 0.22 -1.02), due to the confidence intervals being on the positive side of the ‘no effect line’, indicating that there is low evidence for use of these interventions.
* However, the immediate term results of the study by Ketola et al33 (Intensive ergonomic: - 0.30, 95% CI -0.85 to 0.25; Ergonomic education intervention: MD -0.25, 95% CI -0.77 to 0.28), were found to be non –significant as the confidence intervals here includes ‘0’ and hence indicating that at least one of the score, within the range of the confidence intervals has ‘no effect’ on the outcome.
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**(2) Description and appraisal of (study title) by (authors, Year): The following information in this second article appraisal, is based on the study by Del pozo-cruz**5**, unless specified otherwise**

|  |
| --- |
| **Aim/Objective of the Study/Systematic Review:** |
| The authors wanted to study how safe, practical and useful was a “web-based” workplace intervention in office workers, who were involved with 6 or more hours of daily work at computer workstations, in relieving non-specific low back pain (of 6-12 weeks onset, subacute). |
| **Study Design**[e.g., systematic review, cohort, randomised controlled trial, qualitative study, grounded theory. Includes information about study characteristics such as blinding and allocation concealment. When were outcomes measured, if relevant]Note: For systematic review, use headings ‘search strategy’, ‘selection criteria’, ‘methods’ etc. For qualitative studies, identify data collection/analyses methods. |
| * This is a single-blinded randomized controlled trial, where the assessors were reported to be blinded. There was no blinding of either the researcher, who administered the intervention, or the subjects. And, the outcome assessor was administered part of the outcome assessments, was reported as not being a part of this research team. No information has been provided as to who assessed the remaining outcomes.
* Concealment of allocation was present though, as the subjects were randomly allocated to 2 groups in equal ratio, through a computer-based program.
* The members of this research team were provided with a manual that was created, to include the information about the study protocol. Also, 2 study technicians were provided training, on how to implement this study protocol, for about 2 weeks.
* The protocol included providing intervention 5 days/week over a 9 month period, where there were two groups- one control and one experimental group. The control group was provided with standard care that did not include the web based intervention, while the experimental group was provided with both, the standard care and the web based workplace intervention.
* The outcome measures were assessed, both before and after the application of intervention, i.e. at the beginning and at the end of 9 months of intervention.
 |
| **Setting**[e.g., locations such as hospital, community; rural; metropolitan; country] |
| This study, which was approved by the research ethics committee of University of Extremadura in southern Spain, was conducted in the same university, among office workers of administrative offices.  |
| **Participants**[N, diagnosis, eligibility criteria, how recruited, type of sample (e.g., purposive, random), key demographics such as mean age, gender, duration of illness/disease, and if groups in an RCT were comparable at baseline on key demographic variables; number of dropouts if relevant, number available for follow-up]Note: This is not a list of the inclusion and exclusion criteria. This is a description of the actual sample that participated in the study. You can find this descriptive information in the text and tables in the article. |
| * Prior to the start of the study, the authors calculated the minimum sample size that would be needed to detect a 2.5 point between-group difference for Roland Morris Disability Questionnaire [(RMDQ37), the primary outcome measure for this study, where 2.5 is Minimal Clinically Important Difference (MCID) for RMDQ]; with 80% power, at 95% confidence intervals and with “conservative standard deviation of 5 points”. The required sample size was detected to be 62 subjects for both groups together, but to account for possible dropouts from the study, the authors selected a sample of 100 subjects for this study and divided it equally between the control and the experimental groups (50 each).
* The subjects were recruited from within the staff working in the administrative offices in the University of Extremadura, Spain. For the process of recruitment, an advertisement was provided to all the university employed individuals, through emails, internal newsletters and also through posters.
* A screening was performed based on the following inclusion /exclusion criteria for the 342 individuals, who responded initially. 138 individuals were selected. This screening was performed by the staff of the Preventive Medicine services, by reviewing the related medical databases.
* The 138 individuals that were selected, where further evaluated, based on an in-person assessment, and finally 100 subjects were selected for the study. ( 38 were excluded, because 30 had no low back pain, 5 were not willing to participate and 3 were not fluent in Spanish)
* All these 100 subjects singed an informed consent at the beginning of the study and then were divided equally through a computer-based “random-allocation” 5(pg833) procedure, to both the control and the experimental group. Thus concealed allocation was used for dividing the subjects into groups.
* The exclusion and inclusion criteria are as follows:
* Inclusion criteria: The patients were included if they had first or recurrent episode of low back pain, which should be of subacute nature (i.e. should be of 6 weeks to 12 weeks in duration, since onset( and was localized between the 12th rib and the inferior gluteal fold with or without radiating pain along one or both legs. Major neurological deficit should not be present. Patient should be between age 18 to 64 years and should be agreeable to provide informed consent to participate in the study. Furthermore, the patient should not be very physically active (i.e. physical activity should be < 30 minutes/ week). Lastly the subject should be involved with computer work as part of the job for at least 6 hours/ day.
* Exclusion criteria: “ Diagnosed cause of backache (infection, tumor, disc herniation with an associated neurological deficit, osteoporosis, ankylosing spondylitis, fracture, an inflammatory process, or cauda equine syndrome), chronic backache, any other major disease, or a lack of fluency in Spanish” 5(pg833)
* Sample attrition did take place during the period of 9 months, with the number of subjects, who actually completed the study was 44 for the control group and 46 for the experimental group. The loss of 6 subjects in the control group was due to unwillingness to participate, secondary to not having interest. While, the loss of 3 subjects in the intervention group was due to pregnancy x 1 and due to change of job x 3.
* No significant differences were noted at baseline, between the control and the intervention group. The age group range was 45 years to 56 years of the selected participants, of which approximately 84% and more, in each group, were females, with almost 50% of the selected subjects in each group being smokers. At baseline, in each group, further assessment was done of RMDQ scores, the Time Trade Off scores (TTO scores, for the European Quality of Life -5 Dimensions -3 Levels utility index38), lumbar and abdominal endurance test and the number of episodes of non-specific low back pain that the subjects suffered from in the last 9 months, prior to the start of the study.
* All the baseline characteristics were compared for both groups with the originally selected subject population and also with the subject population, who actually completed the study, following attrition (i.e. control group n =44, intervention group n =46). In both these comparisons both before and after attrition, no significant differences were noted, between the groups for age, sex, being a smoker, RMDQ scores, TTO scores, lumbar and abdominal endurance tests, and the episodes of incidence of non-specific low back pain in the last 9 months, prior to the start of the study. .
* Lastly, as the subjects were selected from a setting that was convenient for the researchers (in this case, the University of Extremadura), it is convenience sampling.
 |
| **Intervention Investigated** [Provide details of methods, who provided treatment, when and where, how many hours of treatment provided] |
| *Experimental* |
| * Two groups were created, control and intervention groups, each with 50 subjects. The intervention group was offered the web-based workplace intervention, along with standard care.
* Standard care constituted of yearly medical visits (usually at start of the academic year) and online information about how to prevent injury to visual health and how one should safely lift heavy loads to prevent musculoskeletal injury.
* The daily 11 minute web based intervention, constituted of a 7 minutes exercise routine that was both preceded and followed by a 2 minute video, on “postural interventions” 5(pg833).
* 4 main types of exercises constituted the 7 minutes daily exercise routine – Mobility exercises, flexibility exercises, strengthening exercises and the stretching exercises. The 11- minute web-based intervention was provided to the subjects for 5 days a week, during the 9 month program, with varying frequency and duration of the type of exercises in the 7 minutes of exercises session. For example:
* In the first month, there were a total of 16 sets of exercises performed in the 7 minutes, each set of 20 seconds and with 6 seconds of rest in between. Of these, there were 4 sets of mobility exercises (performed Monday-Friday); 4 sets of flexibility exercises (performed Tuesday, Thursday, and Friday); 2 sets of strengthening exercises (performed, Monday and Wednesday, with 1:1 “shortening and stretching speed-motion ratios” 5(pgD1)); and 6 sets of stretching exercises (performed, Monday-Friday).
* In the second month, the 7 minute exercise session ( of the total 11 min web-based intervention) was the same as the first month, except for the fact that there were 3 sets of strengthening sessions and 5 sets of stretching sessions, instead.
* In the third month, there were again 16 sessions of 20 seconds each, with 6 second rest break between each session. These 16 sessions were divided as 4 sets of mobility exercises (Monday – Friday), 5 sets of flexibility exercises (Tuesday, Thursday), 3 sets of Strengthening exercises (Monday, Wednesday, and Friday, with the same 1:1 ratio of shortening and stretching, as in month 1); and lastly, 4 sets of stretching exercises (Monday –Friday).
* In the fourth month, the program was similar to third month, except for the change in the speed-motion ratios of the shortening and stretching phases during the strengthening exercises. This ratio was changed to 2:1, from the earlier 1:1.
* The change in the fifth month, compared to the 7-minute exercise program in the 3rd month, was that there are only total of 15 sessions, with there being only 4 sets of 20 seconds each of flexibility exercises. Further, other important changes are - the change in the speed-motion ratios to 3:1, instead of 1:1, during the shortening and stretching phases of strengthening exercises; the decrease in rest period between the strengthening sets to 5 seconds, from earlier 6 seconds; and the increase in frequency of the strengthening exercises to 4 days/week (Monday, Wednesday, Thursday, and Friday).
* The sixth month, had exactly the same program as the fifth month, with there being a total of 15 sessions of exercise and with each exercise being of 20 seconds each, with their being 6 seconds of rest break between the sets of each type of exercise, except for that for strengthening exercise sets, where each set was of 30 seconds duration and rest break was only 5 seconds, between the sets. There was total of 4 sets for mobility exercises (Monday –Friday), 4 sets of flexibility exercises (Monday, Wednesday, Friday), 3 sets of strengthening exercises (Monday, Wednesday, Thursday, and Friday, 3:1 speed-motion ratio of shortening and stretching phases), 4 sets of stretching exercises (Monday –Friday) .
* The seventh month exercise program was exactly similar to the sixth month, except for three changes, all pertaining to the strengthening exercises sets : the speed motion ratio was changed to 1:2 for shortening and stretching ratio; the duration of each set was increased to 40 seconds and the frequency of the sets was reduced to 2.
* Month eight exercise program was similar to the sixth month, except for the decrease in strengthening number of sets to be performed to be 2 sets, the strengthening exercises to be performed Monday –Friday, with 1:3 shortening and stretching speed-motion ratio and with the duration of each set being 40 seconds.
* On the last, ninth month, the mobility (4 sets), flexibility (4 sets), strengthening (1 set of 80 seconds), and stretching exercises (4 sets) were performed Mon-Friday, with the flexibility sessions performed Monday, Wednesday and Friday. Each exercises set was of 20 second duration with 6 seconds rest break in between, except for strengthening session, where one set is of 80 seconds duration and there is 5 seconds of rest break.
* The 2 minutes postural intervention (provided twice to the participants, each day) and the 7 minutes daily exercise program, were provided to the intervention group subjects in video format. These videos were recorded in a laboratory setting, with a standard video camera, and was uploaded onto the website of the Preventive medicine services. The education provided in these videos was provided verbally and also the subjects were provided with subtitles to account for those, who prefer to read.
* The format of the postural program was created by the clinician working at the University’s preventive medicine services and featured education about the proper posture, one should assume, while working in the office with computers, and about appropriate workplace modifications needed to avoid musculoskeletal discomfort (e.g. appropriate placement of computer screen, computer mouse pad; adjustment needed for the seat height, foot rest, or the height of the armrest).
* The format of the exercise program, on the other hand, was created by a clinical exercise physiologist and included the above explained format of 4 types of exercises that varied in frequency and duration through the 9 month period. These 4 types of exercises were – Mobility exercises involving the “large movements of the joints associated with postural stability in muscles” 5(pg833). Flexibility exercises involved stretching exercises with static holding at the end. Strengthening exercises involved exercises with varying shortening and stretching speed-motion ratios, along with isometric contractions, to a lesser extent. And lastly, there were stretching exercise, where moderate amount of stretching was provided, just like the strengthening exercises, to the hip, lumbar, thigh and abdominal muscles to improve the postural stability.
* The subjects were explained about this 5 day/ week, 9 month program, at the start of the program. They were provided with a username and password and were provided with 1 email, every day (at about 10 am each day), to remind them to participate in the intervention, during the working hours. The reminder provided in the email was kept the same during the entire duration of the study and it included instructions and the online website link, where the subjects could access the 11 minutes intervention program for that day.
* Participants were requested to avoid any other form of physical activity during the period of the study.
 |
| *Control*  |
| The control group were provided with only standard care, as described above for the intervention group, and did not receive the web-based workplace intervention. |
| **Outcome Measures** (Primary and Secondary)[Give details of each measure, maximum possible score and range for each measure, administered by whom, where] |
| * Primary outcomes:
* Functional Disability, associated with non-specific low back pain, as measured by the Roland Morris Disability Questionnaire37,39
* Health Related Quality of Life (QOL) as measured by European Quality of Life -5 Dimensions- 3 Levels (EQ-5D-3L38) (with TTO scores)
* Secondary outcomes:
* Number of episodes of low back pain (This was recorded for the duration of 9 months before the start of the study and for 9 months of the intervention study)
* Trunk muscle endurance
* All outcomes were recorded for both before and after the 9 month intervention administration in the study, for both the control and the intervention group. At the end of the study, the outcome measures were recorded at the workplace.
* Whenever the subjects of the intervention group logged on to the website, to participate in the daily intervention program, or whenever the subjects contacted the research team by telephone, these activities were automatically recorded as data about subject participation in the study.
* For those participants, who stopped participating in the study, the reasons for doing so, were inquired and recorded. Also, for those participants were did continue participating in the study, but suffered from adverse health conditions during the study, were requested to inform the same, to the researchers.
* “An experienced physical fitness tester” 5(pg834) who was not part of the research team, participated in assesses the physical aspects of the study (endurance tests). However, no information is provided in the study, as to who assessed the questionnaires that assessed the quality of life and functional disability.
* Two questionnaires were used in this study:
* RMDQ37,39: This questionnaire includes a set of 24 questions that try to seek information of how the low back pain is interfering with the daily activities. The subject may score 0 to 24, with higher score indicating the worse functional disability. An increase of 5 points with RMDQ scores, is considered clinically meaningful decline in functional disability.
* EQ-5D-3L questionnaire38: The question is so called because it has 5 dimensions (questions) and 3 levels to each question (3 options, from best to worst possible health). There are two ways in which this questionnaire could be scored. Of these two methods, Time Trade Off (TTO) scoring method was used.

Fitness related tests: There are two endurance tests from Shiraldo-Ito, one assessing the flexors (abdominals) and the other assessing the extensors (lumbar muscles). The flexors’ endurance is evaluated with the patient performing spinal flexion, with keeping the hips and knees at 90 degrees of flexion. To test the extensors’ endurance, the patient performs spinal extension in prone position, where to decrease the lumbar lordosis, a pillow is placed under the lower abdomen. In both these endurance tests, the patient needs to maintain maximal flexion at the cervical spine and needs to maintain pelvic stabilization with gluteal muscles, for the test to be effective. The score measured is the longest duration that the patient is able to hold these positions. The researchers conducted a 7 day reliability preliminary study for these two endurance tests with 46 individuals with non-specific low back pain, at the beginning of the study. They determined the relative reliability with 2 sessions, performed a week apart, using interclass coefficients and found that the minimal real improvement for a single subject will be if the score changes by 7.5% for the trunk extensor endurance (lumbar muscles) and by 23.5% for the trunk flexor endurance (abdominal muscles). |
| **Main Findings**[Provide summary of mean scores/mean differences/treatment effect, 95% confidence intervals and p-values etc., where provided – if you need to calculate these data yourself, put calculations here and add interpretation later, under ‘critical appraisal’ on next page] |
| * During the 9 month-study, there were no adverse health effects noted in any of the originally randomized (n =100) subjects.
* At the end of the 9 month-study, 92% of the intervention group and 88% of the control group completed the study. The study results have been presented both, with a per-protocol analysis and with an intention-to-treat analysis. Of the drop-outs, in the intervention group, 3 had job change, 1 had pregnancy; while in control group, all 6 subjects dropped out due to lack of interest.
* Overall, the intervention group had significant improvements with respect to all the 4 (primary and secondary) outcomes, compared to the control group.
* The main findings pertaining to the 2 primary and the 2 secondary outcome measures are as under:
* Functional Disability:
* Functional disability in the test was measured by RMDQ in this study.
* In per protocol analysis, pretest-to-posttest mean + SD was -7.36 + 3.53 points at 95% confidence intervals (-8.41,-6.31) at p < 0.001 for the intervention group, while it was 1.89 +3.18 at 95% confidence intervals (0.71 2.65) at p = 0.001.
* In per intention-to-treat analysis, pretest-to-posttest mean + SD was -6.76+ 4.01 points at 95% confidence intervals (-8.41,-6.31) at p < 0.001 for the intervention group, while it was 1.66 +2.59 at 95% confidence intervals (0.71 2.65) at p < 0.001.
* In per protocol analysis, the between group difference is -9.25 points. Likewise, the between group difference, per intention to treat analysis is -8.42.
* All the above, indicate positive functional mobility changes in the intervention group, compared to control group, in both per protocol and the intention-to-treat analysis.
* Effect size was -2.80 for RMDQ scores (large effect), measuring change in functional disability, based on both per protocol or intention-to-treat analysis.
* Based on subjects who completed the study, only 5 subjects met the minimal significant change criteria of 5 points or more increase for RMDQ. All of these 5 subjects were in the control group and none in the intervention group. Based on this, the authors calculated the risk reduction measures and found that absolute risk reduction was 13.6% at 95% confidence interval ( 3.5% , 23.8%); relative risk reduction was 100% and number needed to treat was 7 at 95% confidence interval (4,29).
* Lastly, RMDQ scores have been found to be associated to Shiraldo-Ito abdominal endurance test (standardized beta coefficient (-.512) at p <0.001), and with Shiraldo-Ito lumbar endurance test (standardized beta coefficient (-2.59) at p = 0.005).
* Health Related Quality of Life:
* Health Related Quality of Life was measured by EQ-5D-3L in this study, with the TTO method.
* In per protocol analysis, pretest-to-posttest mean + SD for TTO score was 0.22 + 0.10 points at 95% confidence intervals (0.19,0.25) at p < 0.001 for the intervention group, while it was -0.02 +0.11 at 95% confidence intervals (-0.05,0.11), where p >0.05 (0.209).
* In per intention-to-treat analysis, pretest-to-posttest mean + SD for TTO scores was 0.20+ 0.11 points at 95% confidence intervals (0.17, 0.23) at p < 0.001 for the intervention group, while it was -0.01 +0.10 at 95% confidence intervals (-.004,0.01), where p> 0.05 (.211).
* In per protocol analysis, the between group difference is 0.24 points. Likewise, the between group difference, per intention to treat analysis is 0.19.
* Effect size for TTO scores was 2.60, per protocol analysis; and 2.50 per intention-to-treat analysis. (Large effect).
* All the above, indicate that the intervention group had improvement in the EQ-5D-3L scores, but the control group did not.
* Health related quality of life, as measured by TTO scores, at p <0.001, was found to be associated with the functional disability, as measured by the RMDQ scores, with a beta standardized coefficient of -6.12.
* Muscular Endurance tests:
* There were two tests used in this study by Shiraldo-Ito, for lumbar (trunk extensors) and abdominals (trunk flexors).
* In per protocol analysis, pretest-to-posttest mean + SD for lumbar endurance test was 19.13 +16.40 points at 95% confidence intervals (14.26, 24.00) at p < 0.001 for the intervention group, while it was -1.00 + 4.10 at 95% confidence intervals (-0.24,2.24), where p >0.05 (0.114). Likewise, for abdominal endurance test was 19.84 + 10.43 points at 95% confidence intervals (16.74, 22.94) at p < 0.001 for the intervention group, while it was 1.59 + 8.53 at 95% confidence intervals (-1.00, 4.18), where p >0.05 (0.223).
* In per intention-to-treat analysis, pretest-to-posttest mean + SD for lumbar endurance test scores was 13.32+ 26.58 points at 95% confidence intervals (5.76,20.87) at p = 0.001 for the intervention group, while it was -5.18 + 20.19 at 95% confidence intervals (-10.91,0.55), where p> 0.05 (.076). Likewise, for abdominal endurance test scores was 13.98 + 23.82 points at 95% confidence intervals (7.20,20.75) at p < 0.001 for the intervention group, while it was -4.66 + 21.52 at 95% confidence intervals (-10.77, 1.45), where p> 0.05 (.132)
* In per protocol analysis, the between group difference is 18.13 points, while for the intention-to-treat analysis, it is 18.50, for the lumbar endurance test scores. Likewise, the between group difference for abdominal endurance test scores, per protocol analysis is 18.25, while per intention-to-treat analysis, it is 18.64.
* The effect size was for lumbar tests was 0.68 (per protocol) and 0.50 (intention-to-treat); while for the abdominal tests, the effect size was 0.63 (per protocol) and 0.50 (intention-to-treat analysis).
* All of the above indicate that there was a significant improvement in the lumbar and abdominal endurance in the intervention group and not in the control group, both in the per-protocol analysis and in the intention-to-treat analysis.
* Number of non-specific low back pain episodes:
* In per protocol analysis, pretest-to-posttest mean + SD was -1.43 + 0.62 points at 95% confidence intervals (-1.61,-1.25) at p < 0.001 for the intervention group, while it was 0.32 + 0.60 at 95% confidence intervals (0.13,0.50) at p = 0.001.
* In per intention-to-treat analysis, pretest-to-posttest mean + SD was -1.58+ 6.72 points at 95% confidence intervals (-1.77,-1.38) at p < 0.001 for the intervention group, while it was 0.18 + 0.62 at 95% confidence intervals (0.0001,0.359),with p <0.05 (0.048)
* In per protocol analysis, the between group difference is -1.75 episodes. Likewise, the between group difference, per intention to treat analysis is -1.92 episodes.
* Effect size for non-specific low back pain episodes was -2.90, per protocol analysis and 1.92, per intention-to-treat analysis. (large effect)
* This indicates that the low back pain episodes was less for the intervention group, as compared to the control group, during the 9 month study period, compared to the number of low back episodes that the subjects had recorded in the 9 months prior to the study.

Based on the data of the subjects who completed the study, which indicated that 11 subjects did end up suffering with a at least 1new episode of low back pain episode during the 9 month intervention study period, as compared to the number of low back pain episodes noted in the 9 months, prior to the study; the absolute risk reduction was found to be 25% at 95% confidence interval (12.2%, 37.8%), relative risk reduction was calculated as 100% and the number needed to treat as 4 at 95% confidence intervals (2,8). |
| **Original Authors’ Conclusions**[Paraphrase as required. If providing a direct quote, add page number] |
| A 9 month web-based workplace intervention, administered Monday –Friday with short daily sessions of postural education and daily exercises, is feasible, safe and effective in decreasing functional disability, improving quality of life, and decreasing the incidence of low back pain episodes, in office workers, who work on computers for 6 hours or more/day, and have existing subacute non-specific low-back pain. The decrease in functional disability and improvement in quality of life are found to be associated with the re-onset of LBP episodes, in this 9 month based program. |
| **Critical Appraisal** |
| **Validity**[Methodology, rigour, selection, sources of bias, quality score on methodology quality rating scale (indicate the quality assessment tool used and the maximum possible score on that scale, e.g., 7/10 on PEDro scale), appropriateness of analytical approach (e.g., adjustments for confounding variables, management of missing data).]Comment on missing information in original paper. |
| * On PEDro scale, this study scores 7/10, where the study meets the criteria of having a random allocation through a computer generated software, having concealed allocation to groups, in having non-significant differences in the baseline characteristics between the control and the intervention group, all the 4 key outcomes were measured in more than 85% of subjects at follow up, an intention-to-treat analysis was used along with a per-protocol analysis, to include the scores of the drop outs (For this the baseline score of the dropouts was considered as zero and that was carried forward to at the time of follow up); and lastly, between group differences, point measures (mean) and measures of variability (SD) were reported for all 4 key outcomes.
* However, the study does not meet the following criteria on the PEDro scale that might introduce potential biases.
* There was no blinding of the subjects, as the participants were educated about the program, before being introduced to the website and username/password. The author of this document believes that this might have impacted negatively the study in the following ways40-
* Firstly, the control subjects, knowing that they were not being provided with the correct intervention, and thinking that therefore they will not improve, might not have been motivated to participate in using the standard care. The standard care required the subjects to attend a medical visit once/ year and to educate one’s own self through online information, on how one can take care of one’s visual health and use proper biomechanics to lift weights. Interestingly, the study does not report as to how they ascertained that the control subjects did avail the standard care. (E.g. like for the intervention groups, those who logged and stayed in the computer program for a total of 11 minutes, were said to have completed the program).
* Also, the subjects, who were office workers primarily working on computers, may also not have been excited to read through a manual that provided information about lifting objects, which may not be a daily job task, to begin with. A possible resultant poor participation by the control group might have resulted in, themThis all may have resulted in the control subjects scoring significantly less than the intervention group.
* Further, lack of blinding of the control and the intervention groups, may have greatly impacted the study results, as except for the endurance tests (Shiraldo-Ito) for lumbar and abdominal muscles, the remaining 3 measurement instruments are all subjective in nature. The subjects may have completed these subjective measurement instruments (RMDQ, EQ-5D-3L, pain episode incidence), in the way they though the reaserches might be expecting them to be. That is the intervention group might have mentioned that they are having less pain and disability, as compared to the control group (Hawthorne effect).
* Interestingly, the authors state that their study is a single-blind study and that the researchers were blinded, but it has not been stated clearly if the blinding has been at the level of administering the intervention/standard care or at the level of assessing outcomes. This is so, because, though they state that the researchers were provided with the study protocol at the beginning of the studyp832; they did not clearly specify if the clinical exercise physiologist who created the exercise program was blinded or not. Also, they state that the fitness instructor assessing the physical tests was not part of the research team (hence, the author of this document presumes that he was blinded), but what about the assessor who administered the subjective questionnaires, was he blinded? These questions are unanswered, making it difficult to identify at which level blinding really occurred. To the author of this document, it seems that blinding may have not occurred completely at all, at any of the 3 levels –subjects, therapists or assessors (due to lack of clarity from the study). Hence, the author of this document, has scored this study on PEDro scale as 7/10.
* Further, though a detailed program has been provided with the study that gives details about the duration, frequency and intensity parameters of the exercise program, the exact exercises that were performed has not been specified. Likewise, the exact postural and equipment modifications (e.g. modification in height of arm rest or seat, etc.) supposedly suggested in the 2 minute videos, have not been specified in the study. This makes it very difficult to reproduce the same exercise program elsewhere. Moreover, neither is this information is accessible in the ‘supplementary material section’ of the journal website, where this article was published. (Here, when the link of video URL is selected on the journal website, an error message stating that the video is no longer available, is obtained.)
* In addition, there are 3 notable points in this study that makes one wonder, if the results of these studies could be generalized to all the office workers with non-specific subacute low back pain, working on computers for 6 hours or more. These are – (1) the criteria in the inclusion criteria that requires all the subjects to be extremely sedentary (i.e. participating in < 2 sessions or total of 30 minutes of exercise workout each week); and (2) in the selected sample, there being a much larger number of females, as compared to males (i.e. > 84% of the subjects in both the intervention and control groups were females); and (3) The study was conducted in a community that included primarily south-European, white and people used to urban lifestyle, that may limit the results of this study to people with these demographics.
* The authors in a 7 week study, at the beginning of this study, they assessed and established the reliability of the Shiraldo-Ito lumbar and abdominal endurance tests and also identified the minimum score change needed for one to consider that real improvement has occurred in the patient. No information has been provided by the authors about the validity of these two studies.
* Not much information has been provided by the authors about the psychometric properties of the outcome measures studied in this study. Except for them stating the RMDQ and trunk muscle endurance tests are the most widely used tests for measuring functional disability and improvement with exercise, respectively, in patients with low back pain. Also, that EQ-5D-3L is valid for use for assessing the general health, but may not be so suitable for a specific population group like that of low back pain. Further, they did not explain, how did they measure the pain episodes? Was there a specific level of low back pain or did the pain need to exist for a specific period of time, for it to be considered as a low back pain ‘episode’?
* As the study was conducted originally at 95% confidence intervals at p <0.05, narrower confidence intervals were used for the study. Further, as the attrition of the subjects in the study is < 15%, the study can be graded on the hierarchy scale, provided by Jewell et al1, as 1b. (A “randomized controlled trial with narrow confidence intervals” 1).
* Favourable points about the intervention include that it requires relatively less time through a working day (11 minutes) and helps the employees, to break the monotonous tendency to sit for prolonged periods of time, where due to lack of alternative movements, sustained cumulative stress may be exerted on different parts of the body (e.g. spine, upper extremity, etc.). Also, the postural education program will help in improving the poor biomechanics in these patients, further decreasing the change for musculoskeletal distress.
* In addition, using computer as a media to provide daily reminders to these ‘computer’ professionals, was a very ingenious idea. Reminder emails have been considered by the authors as responsible for increasing the adherence to the exercise program, as a high level of adherence has been noted in the intervention group to the program.
* With respect to the time frame of the exercise program, the author of the document feels that there was only one drawback- the overall time frame was too long -9 months. The factor that the employees may take sick leave, may take vacation time off, and may not been able to attend every day, Monday to Friday, for 9 months, has not been taken into account.
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| **Interpretation of Results**[Favourable or unfavourable, specific outcomes of interest, size of treatment effect, statistical and clinical significance, minimal clinically important difference. You may calculate effect size or confidence intervals yourself from the data provided in the article.] Describe in your own words what the results mean. |
| * Overall, the 9 month web based intervention provided to workers with subacute non-specific low back pain, who use computers for 6 hours or more, was found to be associated with significant improvements with functional disability, quality of life, number of back pain episodes and with improving the lumbar and abdominal endurance.
* Of these 4 above mentioned outcomes, number of back pain episodes is the most related to the PICO question. The functional disability as measured by RMDQ is indirectly related to the PICO question, as the higher is the functional disability, the lower will be the worker’s productivity and the higher will be the work-related absenteeism.
* Effect sizes:
* In this study, the cohen coefficient (used to represent effect size) was calculated by taking the difference between the means of the two groups (intervention and control) and then dividing it by pooled SD. The value of the Cohen coefficient was associated with the size of effect size, as under – With 0 to 0.2 : very small effect size change

- With 0.2 to 0.6 : Small effect size change- With 0.6 to 0.12: moderate effect size change- With 1.2 to 2.0: Larger effect size change- If it is >2.0: Very large effect size change.* In relation to this scale,
* Very large effect size changes were noted in this study with functional disability improvement (as measured by RMDQ, per protocol:- 2.80; intention to treat analysis: -2.80); with quality of life improvement (as measured by EQ-5D-3L, per protocol: 2.60; intention-to-treat analysis 2.50); and with number of back pain episodes (per protocol: -2.90)
* Large effect sizes are noted with number of back pain episodes when assessed as intention-to-treat analysis with 1.92 effect size. While, for the Shiraldo-Ito lumbar and abdominal tests, the effect size was moderate based on per protocol analysis. However, based on the intention to treat analysis, there is small effect size change.
* Between group differences:
* For functional disability, the between group difference at 95% confidence intervals for the per protocol analysis was huge, -9.25 and with the intention to treat analysis it was -8.42, at 95% confidence interval. All these indicated towards a significant improvement in the intervention group in RMDQ scores, compared to the control group. These results are significant, as the study sample size had been selected to get a minimum of 2.5 point decrease in the RMDQ scores to meet the MCID of RMDQ. However, the actual decrease obtained in the results, is much higher.
* For health related quality of life, measured by EQ-5D-3L, at 95% confidence interval and p < 0.001, significant between-group differences were noted between the intervention and the control group with 0.24 points.
* For lumbar and abdominal muscle endurance, as measured by the Shiraldo-Ito endurance tests, at p < 0.001, significant between-group differences were noted. (Endurance of lumbar muscles: per protocol (18.13 points), intention to treat analysis (18.50 points); and Endurance of the abdominal muscles: per protocol (18.25 points), intention to treat analysis (18.64 points)). These values have been found to be significant, as they are more than 7.5% (lumbar) and 23.5% (abdominal) improvement, the criteria determined by the 7-day reliability study performed by the authors, which indicates a real clinical improvement.
* Lastly, with number of pain episodes notes, the between group differences at p <0.001, was -1.75 episodes with per protocol and -1.92 with intention to treat analysis, indicating that with this web based 9 month intervention, the intervention group will have approximately 1-2 episodes of non-specific back pain less, as compared to what to the control group.
* Reason for non-significant results:
* At 95% confidence intervals, the mean + SD, from the pre-test and post-test scores for the control group were not significant either in the per protocol analysis (-0.02 +0.11, CI: -0.05, 0.11) or with the intention to treat analysis (-0.01 +0.10, CI: -.004, 0.01). This was so, because, one of the score in the confidence interval range, in both cases, could include a zero, indicating no effect of the intervention.
* Likewise, a similar reasoning can be provided for the non-significant results noted at 95% confidence intervals, within the control group results for the lumbar endurance tests (per protocol: -1.00 + 4.10, CI: -0.24,2.24) (Intention to treat analysis: 1.59 + 8.53, CI: -1.00, 4.18); and abdominal endurance tests (per protocol analysis: -5.18 + 20.19, CI: -10.91,0.55) (intention-to-treat analysis: -4.66 + 21.52, CI: -10.77, 1.45)
* Absolute risk reduction, Relative risk reduction, and Number needed to treat:
* For RMDQ, used to calculate functional disability, an increase of the score by 5 points, indicating clinically significant worsening of low back pain. Except for 5 participants in the control group, no subject demonstrated this clinical worsening of the low back pain, by meeting this criteria. Similarly, for the low back pain episodes, there were only 11 subjects who presented with at least one new episode of back pain, and all those 11 subjects were found in the control group. Based on this information, the authors calculated the absolute risk reduction, relative risk reduction, and number needed to treat.
* The absolute risk reduction indicates the actual risk that has been reduced by the use of the 9 month web-based intervention. That is, with this use of this program, there is an actual decrease of risk by 13.65% in functional disability (as measured by RMDQ) and 25% decrease in actual risk of suffering from a low back pain episode, at 95% confidence intervals.
* The relative risk reduction, helps us here to estimate the risk reduction with the intervention (9 month web based program), in comparison to the “standard care” used in the control group. That is, there was 100% of reduction of the functional disability and low back pain episodes, with this web-based 9-month program, compared to the treatment provided to the control group.
* Lastly, the number needed to treat, indicates the number of people who should receive the treatment, before the treatment could be found effective. This 9-month web-based program has to be provided to at least 7 people with non-specific low back pain, to be able to prevent the “clinically meaningful worsening of function” (i.e. if measured by RMDQ, an increase of 5 points, will be co-related with clinical worsening) for at least one of them, at 95% confidence intervals. Similarly, this web-based program needs to be provided to at least 4 people with non-specific low back pain, to prevent 1 person from having the low back pain, at 95% confidence intervals. Each time, the financial cost is also saved with the NNT, when we are able to prevent functional disability or low back pain episode.
* Standardized beta coefficient:
* Standardized beta coefficient was used to identify association between the outcomes.
* Association were found to exist between functional disability ( as measured by RMDQ scores) and Shiraldo Ito endurance tests (Abdominal endurance test: standardized beta coefficient -.512, at p < 0.001) ( Lumbar endurance test: standardized beta coefficient -2.59 at p =0.005); and between the health related quality of life (TTO scores) and functional disability (RMDQ scores) at p < 0.001 (beta standardized coefficient -6.12).
 |

**(3) Description and appraisal of (study title) by (authors, Year): The following information in this third article appraisal, is based on the study by Sihawong et al**16**, unless specified otherwise**

|  |
| --- |
| **Aim/Objective of the Study/Systematic Review:** |
| The purpose of this study was to identify and study the different exercise interventions that have been studied in the current evidence based literature, for primary and secondary prevention of neck pain in office workers, who work on computers for prolonged periods of time. And from these exercise interventions, to identify the exercise interventions that are most effective in being able to prevent or relieve this non-specific neck pain. |
| **Study Design**[e.g., systematic review, cohort, randomised controlled trial, qualitative study, grounded theory. Includes information about study characteristics such as blinding and allocation concealment. When were outcomes measured, if relevant]Note: For systematic review, use headings ‘search strategy’, ‘selection criteria’, ‘methods’ etc. For qualitative studies, identify data collection/analyses methods. |
| * This is a systematic review including both high quality and low quality Randomized Controlled Trials (RCTs).
* **Search strategy:**
* Articles published in the time period between January 1980 and April 2010 were searched. Also references of the selected articles were further searched for articles that might meet the selection criteria.
* A total of 8 Databases were searched with a computerized search –
* “PubMed
* CINAHL Plus with full text
* Cochrane library
* Science Direct
* PEDro
* ProQuest
* PsycNet
* Scopus”(16,pg63)
* Terms used in the search strategy to search the databases include-
* “Neck pain
* Cervical pain
* Exercise,
* Strengthening
* Stretching
* Endurance
* Office workers
* Visual display unit
* Computer users” (16,pg63)
* **Selection criteria:**
* Non-specific neck pain for this study has been defined as the pain in the neck, which cannot be attributed to any serious spinal pathology (“e.g. Tumor, fracture, dislocation, or infection” (16, pg63)) or specific systematic disease. This pain may consist of localized cervical pain or it may exist in combination with radiating pain down the length of upper extremity
* The selection criteria required that the study should be a RCT, should have studied at least one exercise intervention for relieving non-specific neck pain as primary treatment method; and should be related to neck pain as described as above. Additional limitations included language limitation to English only; for the studies to be related to “office workers, visual display unit/ terminal operators, or computer users” (16,pg63); and for the exclusion of the ‘grey’ unpublished literature (e.g. “letters, abstracts, books, conference proceedings, and posters” (16,pg63))
* **Methods for data collection and analysis:**
* Data Collection:
* Of the 4961 citations found, after searching these databases by the two reviewers (independently), a closer look yielded 35 related abstracts. These full text of these 35 articles were studied and assessed by the two reviewers independently, on whether they meet the selection criteria or not and of these 14 were selected. Following this assessment, duplicates were removed, and a final count of 9 related articles were obtained.
* Of these 9 studies that met the selection criteria, these 2 reviewers then collected the information from these selected studies, about the characteristics of subjects in these studies; those of the exercise interventions studied; the parameters of the exercise interventions studied; the outcomes assessed in these studies; and the results obtained.
* For any disagreements that arose, between these 2 reviewers, first an attempt at consensus was tried, however, if this did not help in resolving the differences in opinions between the reviewers, then a third reviewer was consulted for arriving at a final decision.
* Quality analysis of the RCT studies:
* PEDro scale was used to analyse the quality of these selected RCT studies. Excluding the criteria 1 of the PEDro scale, which relates to external validity, studies were assessed based on criteria 2 to criteria 11, to assess the internal validity of the study. Each question in a PEDro scale can be scored as Yes/no and for every ‘yes’, 1 point is awarded to that study. Thus, each RCT could gain a maximum of 10 points and a minimum of 0 points. For this study, a score of 5/10 was used as a ‘cut-off’ measure to distinguish between the high quality (> 5/10) and low quality studies (<5/10).
* Managing homogenous/ heterogeneous data:
* In these 9 studies, if the study participants, the type of exercise intervention and the duration of the follow-up, were found to be consistently similar (homogenous) then pooling of the studies was done. However, when this pooling was not possible, then “the results were drawn using a rating system according to levels of evidence” (1,pg63)
* Assessment of the effectiveness of the exercise interventions:
* Outcomes like “the incidence and prevalence of neck pain, discomfort, pressure pain threshold, frequency, duration and severity of pain, productivity, work ability index, sick leave, recovery and disability” (16,pg63) were looked in the studies, to assess and identify, whether the exercise intervention used in that study was effective or not.
* For the exercise intervention to be effective (positive rating), according to this study, it is important that the results obtained in at least one of these key outcomes in the experimental group, should be statistically more than the control group.
* However, if the experimental group ends up having the scores in at least one key outcome statistically less than the control group, then that exercise intervention is considered to be ineffective (negative rating).
* On the other hand, neutral rating was allotted, indicating that there was no effect, if the effect of the exercise program on at least one key outcome was equal for both the experimental and the control groups.
* Analysis of the strength of evidence:
* This was done based on the methodological quality and the results of how consistent the outcomes of the included studies were.

There was overall 5 categories, as follows* Strong evidence: This indicates that at least 2 high quality RCTs indicate statistically significant similar findings, i.e. 3/4th of the studies should indicate the results in one direction (that is whether the intervention is effective or not effective)
* Moderate evidence: This indicates that at least 2 low quality RCT or a single high quality RCT indicate statistically significant findings, i.e. here also 3/4th of the studies should report significant results in one direction only (i.e. if effective, 3/4th of the studies are in the direction of the intervention being effective).
* Limited evidence: This indicates that statistically significant result is present, but only from 1 low quality of RCT.
* Conflicting evidence: This indicates that multiple RCTs are providing results about this intervention and all of these results are not primarily direction in one direction (inconsistent results).
* No evidence: This indicates that currently there are no RCTs present out there in the evidence base literature, studying the intervention.
* Analysis of the subgroups:
* The studies were divided into groups, based on the purpose for which the intervention was being used for, that is, was it being used as a treatment measure, to prevent the non-specific neck pain or for decreasing the functional disability.
* Exercises were classified into 4 categories and the definition for each of these 4 categories has been provided. These categories include – Muscle strengthening and muscle endurance exercises are the exercises used to improve the strength and endurance of the cervical muscles by performing movement repetition with loading. Third category is the stretching exercise that consists of stretching of the soft tissues, to improve tissue extensibility of cervical muscles and flexibility of cervical joints.
* Lastly, the fourth category was named as the “non-specific exercise”, which included those exercise interventions, where the intention of using a specific exercise intervention was not clearly specified.

 * Sensitivity Analysis:
* The authors performed the systematic review initially, including all the 9 RCTs identified. Where after, they excluded the low quality studies, and tried find the evidence from the 6 high quality RCTs, only.
 |
| **Setting**[e.g., locations such as hospital, community; rural; metropolitan; country] |
| * A total of 9 studies were included in the systematic review.
* Of these 9 studies, the settings have not been specified in 6 studies (van den Heuvel et al43, Viliganen et al44, Ylinen et al45, Sjogren et al47, Blangsted et al49, Hamberg-van Reenen et al50).
* For the other 3 studies, the settings are as described below
* Henning et al42: This study was conducted at Insurance companies.
* Tsauo et al46: This study was conducted at an Airline company
* Kietrys et al48: For this study, varied settings were used – administration offices at an University, insurance company, reception desk at a physical therapy clinic, “software development firm”
 |
| **Participants**[N, diagnosis, eligibility criteria, how recruited, type of sample (e.g., purposive, random), key demographics such as mean age, gender, duration of illness/disease, and if groups in an RCT were comparable at baseline on key demographic variables; number of dropouts if relevant, number available for follow-up]Note: This is not a list of the inclusion and exclusion criteria. This is a description of the actual sample that participated in the study. You can find this descriptive information in the text and tables in the article. |
| * Of the total of 14 selected articles, the studies that got repeated were removed and a final count of 9 RCTs were selected. If a study had two publications and both varied in the methodological quality, then the study with the highest methodological quality was selected and the other duplicate was deleted.
* These 9 RCT studies were assessed by the two reviewers by PEDro scale for quality analysis. Of the 9 studies, 6 studies scored PEDro score of 5 or greater out of 10, and hence being tagged as high-quality RCT studies. While the remaining 3 studies that scored less than 5/10 were scored as low-quality RCTs (Henning et al42, van den Heuvel et al43, and Tsauo et al. 46)
* In relation to the PICO question,-
* Of the 9 included RCTs, Sihawong et al, in their systematic review have explicitly specified for only 4 studies that these studies were related to workers using computers (Henning et al42, van den Heuvel et al43, Tsauo et al46, Kietry’s et al48).
* Also, within these 4 studies, for only two studies (van den Heuvel et al43 and Kietry’s et al48) have the authors mentioned, the exact number of hours that the participants were involved with computer work, an information that is important to meet the inclusion criteria of the PICO question.
* Both these studies meet the PICO inclusion criteria of a minimum of 3 hours/day of computer work (Participants involved in computer work of >5 hours/day for van den Heuvel et al.43 and for > 3 hours/day for Kietry’s et al48).
* On the other hand, for the remaining studies, Sihawong et al16, have mentioned for 4 studies (Viljanen et al44, Ylien et al45, Sjogren et al47, Blangsted et al. 49) that the participants were office workers, and for the remaining 1 study (Hamberg-van-Reenen et al50) that the participants were “healthy workers” (16, pg67). They did not specify if these office workers of “healthy workers” (16, pg67) were but have not specified in the systematic review, if these office workers were using daily computers for work and if they were, for how many hours were they using it.
* In relation to gender of the participants within the included studies:
* Of the 9 included RCTs, Sihawong et al16 have provided gender of the participants of all of the included studies, except for one (van den Heuvel et al43), where only the sample size of the study has been stated, with no allusion to the gender of these participants.
* Overall, there was much higher number of female participants within these 8 included studies, compared to males (female: male ratio in participants for 6 studies: Henning et al42, 80:12; Tsauo et al46 100:78; Sjogren et al47, 43:10; Kietry’s et al48,56:16; Blangsted et al49, 354:195; and Hamberg-van Reenen et al50, 13:6), with 2 of the included studies having solely female participants (Viljanen et al44 (393 female participants); and Ylinen et al45 (180 female participants)).
* In relation to health/sickness/ disability of the participants:
* Clear specification was not found by Sihawong et al16, on whether the participants were healthy or sick/disabled in all of the included studies, except for two studies.
* Of these 2 studies, one included all healthy participants (Hamberg-van Reenen et al50), while the other included both healthy participants and participants with non-specific neck pain (Blangsted et al49)
* In relation to type of prevention targeted (primary/secondary/ tertiary):
* Many RCTs had a combination of the types of preventions that they were targeting through their exercise interventions.
* Primary prevention was targeted in two studies (Blangsted et al, Hamberg-van Reenen et al) 49,50.
* Secondary prevention was targeted in a total of 8 RCTs, except 1 study (Hamberg-van Reenen et al49). Two of the studies solely focused on secondary prevention (Tsauo et al46 and Sjogren et al47).
* Tertiary prevention was targeted in 6 studies, with each study possibly having more than one outcome studied in this regard (Henning et al, van den Heuvel et al, Viljanen et al, Ylinen et al, Kietrys et al, Blangsted et al) 42-45,48,49
* In relation to the type of neck pain studied:
* Of the 9 studies, with 2 studies having healthy subjects to start with, 7 RCTs had subjects with non-specific pain to start with.
* Of these 7 studies, where the subjects had non-specific neck pain, Sihawong et al16 found it to be unclear in 5 RCTs, about which type of neck pain the participants had. While for the remaining 2 studies, Sihawong et al, have mentioned that the participants had chronic pain.
* In relation to intervention used in the studies:
* Of the 9 RCTs, in 4 studies (Hamberg-van Reenen et al, Sjogren et al, Viljanen et al, Henning et al) 50,47,44,42 the control group were not provided with any intervention, while in the other 5 studies (van den Heuvel et al, Ylinen et al, Tsauo et al, Kietrys et al, Blangsted et al) 43,45,46,48,49, the control group was provided with alternative exercise intervention.
* Further, of these 9 included RCTs, 5 RCTs studied individual exercise interventions, where each RCT may be studying more than one specific individual exercise interventions (Ylinen et al, Tsauo et al, Keitrys et al, Blangsted et al, Hamberg-van Reenen et al)45,46,48,49,50
* While, 4 of the studies seemed to study combined exercise interventions, where a single exercise intervention may be combined with an intervention like postural training (Sjogren et al) 47 or rest breaks (Henning et al, van den Heuvel et al, Viljanen et al) 43,43,44.
* In relation to the follow up period:
* The follow up periods seem to vary for majority of the included studies (n =6), except for 3 studies (van den Heuvel et al, Viljanen et al, Blangsted et al) 43,44,49, where the follow up time was of 1 year.
* For the remaining 6 studies, this follow up period seemed to vary from 3 weeks to 30 weeks period (Henning et al: 3 weeks; van den heuvel: 8 weeks; Tsauo et al: 8-12 weeks; Sjogren et al: 30 weeks; Kietrys et al: 4 weeks; Hamberg van Reenen et al: 8 weeks) 42,43,47,48,50.

The 9 RCTs were found to be not consistent with their study characteristics (follow up period, type of intervention used, type of neck pain, etc.), because of the lack of homogeneity, pooling of the data was not done, but instead the “findings were drawn using a rating system with levels of evidence” (16, pg65) |
| **Intervention Investigated**[Provide details of methods, who provided treatment, when and where, how many hours of treatment provided] |
| *Control* |
| The interventions/lack of intervention, used in the control groups of the included 9 studies, are as under (The following description is based on the details provided by Sihawong et al16 in their systematic review):* Henning et a42l: Control group was present, but no intervention was assigned to it.
* Van den Heuvel et al43: Control group was provided with the modification of the workplace equipment. No information has been presented by Sihawong et al, on what type of adjustments were done to the workstation, when were they done during the study period and by whom were these adjustments done.
* Viljanen et al44: Control group was present, but no intervention was assigned to it.
* Ylinen et al45: Control group was provided with aerobic exercise and stretching exercises, 3x/week. Information about duration and intensity of these exercises; where and by whom the exercises were conducted, has not been provided by Sihawong et al, in their systematic review.
* Tsauo et al46: Control group was educated regarding the cervical (neck) anatomy and stretching. Sihawong et al, have not provided any information about the number of education sessions conducted (total time allotted), the location where the sessions were conducted, and the type of stretching exercises that were educated.
* Sjogren et al47: Control group was present, but was not provided with any intervention.
* Kietrys et al48: Control group was provided with deep breathing and ankle exercises (“ankle pumps” (1, pg67)). The subjects in the control group had to perform these twice/day, during work hours.
* Blangsted et al49: Control group was provided with education about “health-promotion” (1, pg67). Sihawong et al have not specified what constituted the “health promotion” education classes and who conducted it.
* Hamberg-van Reenen et al50: Control group was present, but was not provided with any intervention.
 |
| *Experimental* |
| The interventions used in the experimental groups in the 9 included RCTs, are as under (The following description is based on the details provided by Sihawong et al, in their systematic review). * Henning et al42: 2 intervention groups were present, where after every 15 minutes of work on the computer, the first group received a rest break (duration of the rest break has not been specified by Sihawong et al), while the second group received stretching exercise for 15 seconds, along with a rest break (Again, the duration of rest break and the type of stretching exercise were not provided by Sihawong et al.). Information has not been provided by Sihawong et al, about how these rest breaks were enforced (e.g. Was a software program used, did a researcher guide the time to take rest break, did the participants have to self-enforce their own rest breaks, how?)
* Van den Heuvel et al43: 2 interventions were present, where the intervention was administered after every 35 minutes. The first group received a combination of rest break and modification of the workstation, while the second experimental group received a combination of 3 interventions – rest break, medication of workstation and exercises (type of exercises was not specified in the study, according to Sihawong et al). No information has been reported by Sihawong et al, about who conducted the interventions, how the intervention were provided (Self-administered, therapist administered, etc.), and when were they provided.
* Viljanen et al44: 2 intervention groups were present, one receiving strengthening and stretching exercise, while the other receiving relaxation exercises. These exercises were provided by a physical therapist, 3 times/ week for 12 weeks, where after a reinforcement session was conducted at 6 months.
* Ylinen et al45: 2 intervention groups were present, the first group received specific neck strengthening exercises and group 2 received neck stretching exercises. Both groups received “dynamic exercise for trunk and upper and lower limbs” (1, pg660) , where the first group performed a 1 set of 15 repetitions of all the exercises, while the second group performed 3 sets of 20 repetitions for all exercises. Total time allotted for all these exercises was 45 minutes for each group and these exercise sessions were performed 5 days per week. Sihawong et al, however, have not reported about who conducted these sessions, and where and when (during work hours/ after work hours) were they conducted.
* Tsauo et al46: 3 intervention groups were present and each were presented with a 15-20 minutes of stretching exercise session (Sihawong have not reported, how many times a week, this intervention was performed). The subjects of the first group had to self-administer the stretching exercises, as compared to the group 2 and 3. The first group performed stretching exercises for tight cervical spine muscles and exercise for neck range of motion, where each stretch had to be repeated 10 times and had to be held for 5 seconds.
* Sjogren et al47: Only one intervention group was present, that was provided a program of combination of 3 interventions, including endurance exercise, and guidance about proper posture and proper biomechanics. Though the total daily duration dedicated for the intervention is not known (not reported by Sihawong et al), in this total 15 weeks of the training program, during the first 5 weeks, the intervention was provided only 5 times a week, and during the remaining 10 weeks, 7-8 times/ week, intervention was provided.
* Kietrys et al48: There were 2 intervention groups, where the first was provided with strengthening exercises and the second group with stretching exercise, that the subjects had to perform at work, twice every day. Specific exercises that were performed in the program have been reported – “Isometric cervical spine rotation with manual resistance” (1, pg67) was by the first group, with 5 second holds, for 5 repetitions; along with shoulder shrugs that were performed for 12 repetitions, where the resistance was gained with elastic band. On the other hand, the specific exercises performed by the second intervention group included “lateral, posterior, cervical, anterior arm/forearm stretch” (1, pg67), with 5 second holds, and performed as 5 repetitions. No information was provided about the duration of daily time spent in doing these exercises, about who conducted these exercise sessions and where were the exercise sessions being performed.
* Blangsted et al49: 2 intervention groups were present, with the subjects in the second group encouraged to increase their daily physical activity with the exercise that they were performing (According to Sihawong et al, the type of exercise was not specified by Blangsted et al). While for the first group, two types of strengthening exercises were performed, one included using dynamic resistance for muscles of arm and shoulder(“2-3 sets of 10-15 repetitions” (1, pg67)), while the other type of strengthening exercises included static loads for neck muscles, where the load was statically held for 5 seconds, in each repetition. For the first group, the exercises were performed for 3 x/week and the total time allotted for the exercises was 20 minutes. No information was reported about the location where the exercises were performed, or who conducted the exercise session, by Sihawong et al, in their systematic review.
* Hamberg-van Reenen et al50: Only one intervention group was present, which was provided with 30 minute sessions of strengthening exercises about 3 times/ week.

A point to be noted is that, according to the quality analysis by the PEDro scale, none of the therapists/ researchers/ subjects, who administered the intervention were blinded. |
| **Outcome Measures** (Primary and Secondary)[Give details of each measure, maximum possible score and range for each measure, administered by whom, where] |
| * The outcomes of the 9 included RCTs were categorized as related to Primary Prevention (PP), Secondary Prevention (SP) and Tertiary Prevention (TP). For the PICO question, only the outcomes studying the SP and TP, meet the inclusion criteria.
* The following are the outcomes studied in the included 9 RCTs:
* Henning et al42: SP: Discomfort; TP: productivity
* Van den Heuvel et al43: SP: Pain – frequency and severity; TP: absenteeism due to sickness, productivity, and recovery from neck pathology.
* Viljanen et al44: SP: Pain intensity; TP: Functional disability, ability to work, absenteeism due to sickness, recovery from neck pathology.
* Ylinen et al45: SP: pain intensity; TP: Functional disability
* Tsauo et al46: SP: “Pressure pain threshold” (1, pg67)
* Sjogren et al47: SP: Pain intensity
* Kietrys et al48: SP: Pain intensity, musculoskeletal discomfort; TP: functional disability.
* Blangsted et al49: PP: Prevalence of neck pain; SP: “duration of pain” (1, pg67), pain intensity; TP: ability to work and absenteeism due to sickness.
* Hamberg-van Reenen et al50: PP: Musculoskeletal discomfort.

The instruments used to measure these outcomes, in the respective studies, have not been reported by Sihawong et al.16 in the systematic review. |
| **Main Findings**[Provide summary of mean scores/mean differences/treatment effect, 95% confidence intervals and p-values etc., where provided – if you need to calculate these data yourself, put calculations here and add interpretation later, under ‘critical appraisal’ on next page] |
| * No likelihood ratio, odds ratios, relative risks, effect size or standardized effect sizes were used to explain the results.
* Rather, a system of rating was used, to understand the findings from the included 9 RCTs and the level of evidence for an exercise intervention studied was computed, based on the rating obtained.
* In this rating system, for each of these outcomes in the 9 included RCTs, a rating was provided, as either positive, negative or neutral. If the results for a specific outcome, was statistically more in the experimental group, compared to the control group, then positive rating was provided **(+)**, however, if it was statistically more in the control group, compared to the experimental group, then negative rating was provided **(-)**. If neither program had a higher rating, i.e. if both the groups had equal rating, then the rating of neutral or no effect **(0)** was awarded to that outcome, for that study.
* Based on these ratings of the results of the individual 9 studies, further analysis was made to understand, which exercise intervention was effective as follows –
* Effectiveness of exercise interventions for prevention of neck pain:
* Hamberg-van Reenen et al50 and Blangsted et al49 studied the exercise interventions for the primary prevention of neck pain.
* Both of these studies were high quality studies (Hamberg-van Reenen et al: 7/10; Blangsted: 6/10). 49,50
* Blangsted et al49 used dynamic (arm and shoulder muscles) and static (neck muscles) strengthening exercises in one intervention group and non-specific exercise (type of exercise not specified) in the second intervention group.
* **+ rating:** Dynamic and static strengthening exercises were found to be effective in decreasing the pain prevalence in the experimental subjects. (Positive rating)
* **0 rating:** On the other hand, non-specific exercises have been found to produce no effect (neutral rating) for pain prevalence, i.e. the pain prevalence is equivalent in experimental and the control groups (control group had “health-promotion” (1, pg67) education classes).
* **0 rating:** In contrast to the study by Blangsted et al49, Hamberg-van Reenen et al50 used strengthening exercises for back, neck and shoulder muscles, as intervention in the healthy employees and found that they these exercises had no effect in the primary prevention of the neck pain- associated musculoskeletal discomfort in the experimental subjects, compared to a control group having no intervention.
* Effectiveness of exercise interventions as a treatment for non-specific Neck pain:
* Viljanen et al, Ylinen et al, Sjogren et al, Kietrys et al, Blangsted et al (High quality RCTs); 44,45,47,48,49 and van den Heuvel et al43 and Tsauo et al46 (low quality RCTs) were included, in this category, as all these 7 studies, were found to study the secondary prevention of nonspecific neck pain. Henning et al (low quality study) has not been included in the following analysis by the Sihawong et al16, as they were unsure, if the study was based on primary or secondary/tertiary prevention.
* Overall 4 forms of exercise interventions were studied in these 7 studies -
* Strengthening exercise:
* **+ rating:** Ylinen et al44 (High quality RCT) used neck strengthening exercise and exercise for trunk, upper and lower limbs (1 x 15 reps) as one of the intervention, and found that there was positive effect, with the experimental group showing statistically higher results as compared to the control group (aerobic exercise and stretching, 3x/wk), for pain intensity
* Endurance exercise:
* **+ rating:** Ylinen et al44 and Sjogren et al47 (High quality RCT) studied endurance exercises as intervention for non-specific neck pain and fourdn that neck endurance exercises are effective in decreasing the pain intensity, when provided with dynamic exercises for trunk, upper and lower extremities (3 x 20, Ylinen et al. 44) and with guidance/education about postural correction and improved biomechanics (5-8x/wk for 15 weeks, Sjogren, et al. 47).
* Stretching exercise:
* Stretching exercises were studied by Kietrys et al48 (in one of their intervention) (high quality RCT) and Tsuao et al46 (low quality RCT).
* **+ rating:** In the study by Kietrys et al48, stretching was provided twice a day for 5 repetitions with 5 seconds of holds for specific neck, arm and forearm muscles, during the work hours. This stretching program seemed to result in a positive rating that is the experimental group showed statistically higher result with reduction in musculoskeletal discomfort, compared to the control group.
* **0 rating:** Interestingly, however, this stretching program by Kietrys et al48 was not found to be effective in decreasing the pain intensity.
* **0 and + rating:** On the other hand, the stretching exercises were used by Tsuao et al 46 in all their 3 intervention studies, with the first group involved in self stretching. Self-stretching by the subjects resulted in no decline in pain pressure thresholds in the experimental group; compared to participation in a stretching exercise group for 1-2x/day that seemed to statistically decrease the pain pressure threshold in the experimental subjects, compared to control.
* Combination of exercise interventions:
* **0 rating:** A combination of stretching and strengthening exercises was used an intervention by Viljanen et al44 (high quality study), who found that this 30 minute exercise session performed under the training of the PT, 3x/wk, for 12 weeks (and reinforcement of the exercise session provided at 6 months) resulted in Neutral effect, i.e. the experimental group showed no improvement with pain intensity compared to the control group.
* **0 rating:** In the study by van den Heuvel et al43 (low quality study), a combination of rest breaks, non-specific exercise (45 seconds) and workstation modification, seemed to result in no improvement in pain frequency or pain severity in the experimental subjects, compared to the control group (receiving only workstation modification).
* Non-specific exercise (type of exercise not specified):
* **+ rating:** Non-specific exercise was studied by Blangsted et al49, where the subjects were asked to increase their daily physical activity (with no specification about the type of the exercise). Such non-specific exercise intervention, also, seemed to improve the neck pain intensity and pain duration, in the experimental group, compared to the control group (receiving education about “health promotion” (1, pg67))
* Effectiveness of exercise interventions for decreasing neck pain associated functional disability:
* 5 RCTs in total, 4 high quality RCT (Kietrys et al, Blangsted et al, Viljanen et al, Ylinen et al) 48,49,44,45 and 1 low quality RCT (van den Heuvel et al) 43, studied this tertiary prevention of neck pain. An additional study, Henning et al, also studied an outcome associated with tertiary prevention (Employee productivity), but this study has not been included in this analysis by Sihawong et al16, as they were unsure, if Henning et al had based their study on primary, secondary or tertiary prevention.
* The type of exercise interventions studied in this category are as follows:
* Strengthening exercises:
* Kietrys et al48, Ylinen et al45, and Blangsted et al49, studied the effectiveness of the strengthening exercise in decreasing disability associated with neck pain.
* **0 rating:** In the study by Kietrys et al, the strengthening exercises of isometric neck rotations (5 second holds) and should shrugs with therabands, were found to have no statistical effect in reducing the disability associated with neck pain in experimental group compared to the control group
* **+ rating:** In contrast to this, in the study by Ylinen et al, 30 minutes of exercise session, constituting specific neck strengthening exercises (muscles not specified by Sihawong et al) along with dynamic exercise for trunk, upper and lower extremities,3x/week, were found to statistically decrease the disability in those with chronic non-specific pain in experimental group, compared to control group (that received education about
* **0 rating:** Other outcomes related to tertiary prevention were studied by Blangsted et al – work ability and sick leave, and found that a 20 minutes exercise session, 3 x/week, of strengthening exercises (static loads for neck muscles, and dynamic loads for the arm and the shoulder) were not effective in improving either of the 2 outcomes in experimental group, compared to the control group (that received education classes about “health promotion”)
* Stretching exercises:
* **0 rating:** Kietrys et al48 studied the outcomes of tertiary prevention with stretching exercises and found that stretching exercises of specific neck, arm and forearm muscles, 1 x 5 reps, twice a day, with holds at the end, did not result in decreasing the disability associated with neck pain in the experimental subjects with nonspecific neck pain, compared to control group (that received deep breathing and ankle exercises).
* Endurance exercises:
* **+ rating:** Ylinen et al44 were the only ones, who studied neck endurance exercises in those with non-specific neck pain and found that a 45 minutes of exercise session including endurance exercises for the neck and dynamic exercises for the trunk, upper and lower extremities, for 5 days/ week, resulted in statistically reduced disability in those with chronic neck pain, compared to the control group (that received aerobic exercise and stretching).
* Combination of exercise interventions:
* **+ and 0 rating:** In the study by van den Heuvel et al43, provision of a combination of rest break with nonspecific exercises (of 45 seconds duration) and workstation modification, every 35 minutes, was found to be effective in improving productivity and recovery from neck related pathology, but was found to have ‘no effect’ in decreasing the sick leave.
* Non-specific exercises:
* **0 rating:** Blangsted et al49 motivated the subjects of their second intervention group to increase their daily physical activity, with no specification about the type of exercise they need to focus on. Such non-specific exercise was found to be not associated with any increase in work ability or decrease in sickness related absenteeism.
* Effectiveness of exercise interventions, based on sensitivity analysis.
* There were in total 3 low quality studies in this systematic review. One of them, by Henning et al, was not included by Sihawong et al16, in any analysis of secondary or tertiary prevention, as Sihawong et al were unsure, if the subjects in the study were healthy or had neck pain, to begin with.
* Thus only 2 low quality studies were involved in all the analyses of the results.
* A sensitivity analysis was performed to analyse, if there would be any change in the results, on removing the results of the 2 low quality studies. 2 changes in results were noted and they are as follows:
* Following the sensitivity analysis, the effectiveness of non-specific exercise intervention that was associated with secondary prevention of neck pain with conflicting evidence, was altered to moderate evidence for treating neck pain.
* Likewise, the conflicting evidence present for indicating the effectiveness of non-specific exercise intervention for tertiary prevention of neck disability, will be altered to no evidence, indicating no effect of this intervention in decreasing neck disability.
 |
| **Original Authors’ Conclusions**[Paraphrase as required. If providing a direct quote, add page number] |
| Despite the methodological limitations in this study based on primary, secondary and tertiary prevention of non-specific neck pain, the following are the conclusions provided by the author.* “The findings revealed strong evidence supporting the effectiveness of muscle strengthening and endurance exercises for treating neck pain.
* Moderate evidence indicated that muscle endurance exercise was effective for reducing disability attributed to neck pain” 16(pg69)

Further, high quality studies (possibly, RCTs, systematic reviews and meta-analyses) that address this issue in population, should be developed, with efforts made to avoid the methodological limitations that exist in this review. |
| **Critical Appraisal** |
| **Validity**[Methodology, rigour, selection, sources of bias, quality score on methodology quality rating scale (indicate the quality assessment tool used and the maximum possible score on that scale, e.g., 7/10 on PEDro scale), appropriateness of analytical approach (e.g., adjustments for confounding variables, management of missing data).]Comment on missing information in original paper. |
| * Despite the fact that in evidence based literature, systematic review are higher quality studies, the author of this document strongly feels that there were many methodological limitations in this systematic review by Sihawong et al. 16
* Due to these limitations, the study scored only 7/11 on AMSTAR scale, when quality analysis was performed. The study did not meet the criteria of – including ‘grey’ unpublished literature, not including the details about the excluded studies, not providing all the details about the included studies, and lastly, not assessing the likelihood of publication bias. Each of these having been explained further, as follows:
* An interesting observation made by the author of this document, pertains to the fact that though there were 3 ratings that could be awarded to each of the outcomes, in each study (positive, neutral and negative rating), and not even a single outcome scored negative rating. This makes one wonder, if not including unpublished literature, may have resulted in Sihawong et al16, having access to only those studies, which had only significant positive effects of the exercise interventions on the outcomes. This portends that there is a likelihood that publication bias may have existed and the conclusions of the study may be affected by its presence (by exclusion of studies that may have had negative results due to exercise interventions).
* Further, to add to the existing problem of possible publication bias, the search criteria was further limited by language restriction that articles should be in English only.
* Sihawong et al16, by not including the references of the excluded studies, have made it difficult for the reader to know, which studies they excluded and to be analyse if the exclusion was justified. Also, the list of excluded studies may also open another avenue of evidence based literature that needs further study.
* It is not clear to the author of this document, if it is Sihawong et al16, who have done a poor job at extracting data from the 9 included RCTs or were the RCTs not well written and did not contain all the details needed about the exercise intervention they used in their respective studies. As for almost all the included 9 RCTs, the description provided by Sihawong et al, does not specify –
* What actually constituted the intervention; what was the frequency, duration, intensity of the exercise intervention; how was the program administered (e.g. self-administered, provided by therapist, administered by a software web program, etc.); and when and where was the intervention conducted (e.g.: during work hours, after work hours, at home, or at a specific group exercise class).
* How where the participants in the study divided between the experimental and control groups – did all the groups in a study end up with equal number of participants or were they different; and if the ratio of female: male participants was the same in all the groups within each of the included 9 RCTs.
* Occasionally, Sihawong et al16 have mentioned that they themselves are unsure of the information provided in the included RCTs (the type of pain present in the study participants, e.g. acute, chronic), as the authors of the respective included RCT had not clearly provided the respective information in that study. Interestingly, Sihawong et al do not mention of having taken any steps to address this problem of ‘missing data’. In fact, the author of this document strongly believes that this might have affected the analyses of results of the RCT done by Sihawong et al, as they had not included a study, by Henning et al, in the analyses. Though this was a low –quality study, it did study the outcomes of musculoskeletal discomfort (SP) and productivity (TP). The reason provided by Sihawong et al for not including this study, was that they were not sure, if the participants in the study were healthy or had existing neck pain, to begin with.
* PEDro quality analysis:
* Of the 9 selected RCTs, 6 RCTs scored > 5/10 (high quality studies- Viljanen et al, Ylinen et al, Sjogren et al, Kietrys et al, Blangsted et al, and Hamberg-van Reenen et al) 434,45,47,48,49,50 and 3 scored < 5/10 (low quality studies- Henning et al, van den Heuvel et al, and Tsauo et al..) 42,43,46
* None of the 9 studies presented with blinding of the subjects or the blinding of the therapist. Lack of blinding of subjects may result in Hawthorne effect, where the subjects may have modified their response or behaviour in the study, according to what they thought the researchers expected. Likewise, lack of blinding of the therapists may also affect the results of the study, as the therapists administering the intervention may be more enthusiastic than those administering treatment to the control group. Lack of blinding to the subjects and the therapists, may result in ‘performance bias’, which would affect the internal validity of the study.
* Despite all the 9 RCTs presented with randomization, ‘selection bias’ was still noted in almost 6 of the 9 studies with the lack of concealment of allocation (Henning et al, van den Heuvel et al, Tsauo et al, Kietrys et al, Blangsted et al, Hamberg-van Reenen et al) 42,43,46,48,49,50. Lack of concealment of allocation, may influence the decision of the researcher about which group they want to assign a patient to, as they already know, which group is going to be treatment group and which group is going to control group. This may further affect the internal validity of the study.
* Further, there were 4 studies, out of the 9 included RCTs, that did not meet the criteria, of being able to measure at least one key outcome in 85% of the original sample size, at time of follow up. This may have resulted in introduction of ‘attrition bias’, another threat to internal validity of the study.
* Thus, overall there for this study by Sihawong et al, there seem to be three threats to its internal validity – Performance bias, selection bias and attrition bias.
* Of the 4 studies, which the authors have specified to be related to the computer workers, 3 studies are of low quality (Henning et al42: PEDro score 1/10, van den Heuvel et al43: PEDro score 3/10, Tsauo et al46: PEDro score 3/10). Only one study (Kietry’s et al48: PEDro score 5/10) has been found to be high quality study. (Please note that this study barely made it to the category of being a high-quality study, by scoring only the least PEDro score, needed to be in this category.)
* Last, but not the least, surprisingly, the author of the document found that Sihawong et al16, have not provided the right score/ rated one study correctly – Ylinen et al44. Sihawong et al have placed a yes answer (+ sign) for 9/11 items of PEDro scale for the study by Ylinen et al (one of the item is related to external validity, removing which the PEDro score will be 8/10). However, they have documented it as 7/10. The author of this document is unsure, if they wrongly placed a positive sign or if they wrongly computed the score of 7/10.
* Homogeneity/Heterogeneity:
* All the 9 RCTs were found to be heterogeneous in terms of the characteristics of their subjects (including, the type of neck pain, which was unspecified according to authors, by 75% of the included studies); the parameters (frequency, duration and intensity) and the type of the exercise intervention used; the treatment provided to the control groups (of the 9 studies, 4 were provided with no intervention, while the remaining 5, were provided with varying interventions); and the time frame used for follow ups (ranging from 3 weeks to 1 year); making it difficult to pool the results together.
* Sihawong et al16 consider this heterogeneity of the results as a limitation that might have resulted in there being variations in the findings of the systematic review.
* Due to the presence of heterogeneity, the authors had ended up using a rating system, that provided positive (+), neutral (0), negative (-) rating for each outcome, in each study. Based on these ratings the level of evidence was analysed.
* Points of concern are:
* Based on the description provided by Sihawong et al, out of 9 studies, only 4 studies are related to computer workers.

Further, the study results may be more suitable for female computer workers, as the study participants in all the 9 studies, were more females than males. |
| **Interpretation of Results**[Favourable or unfavourable, specific outcomes of interest, size of treatment effect, statistical and clinical significance, minimal clinically important difference. You may calculate effect size or confidence intervals yourself from the data provided in the article.] Describe in your own words what the results mean. |
| * Interestingly, to explain the findings from the included RCTs in this systematic review, Sihawong et al16 used no likelihood ratios, odds ratio, relative risks, effect sizes, or standardized effect sizes of the individual studies were studied.
* They used a rating system, and these ratings of each outcome, formed the groundwork in being able to analyse the evidence on the intervention.
* The level of the strength of the evidence was categorized as strong, moderate, limited, conflicting, or no evidence, depending upon the type (high /low) and the number of RCT, in which the outcome rating showed statistically significant results.
* The studies were studied for 3 conditions – Primary prevention (preventing neck pain), secondary prevention (treating neck pain) and Tertiary prevention (reducing the neck pain associated disability).
* 4 subgroups of exercises were studied for each of these 3 conditions. These subgroups of exercise interventions were – endurance, strengthening, stretching and non-specific exercises. There were also combinations created that include two or more of these exercise intervention subgroups.
* In relation to the prevention of the neck pain (primary prevention),
* two subgroups of exercise interventions, strengthening and non-specific exercises, were studied (Hamberg-van Reenen et al and Blangsted et al) 50,49.
* Neither of the exercise interventions were found to be effective in preventing the neck pain.
* This was so, as neutral rating had been awarded to the non-specific exercise intervention studied by Blangsted et al49, indicating no effect, indicating level of evidence for non-specific exercises is ‘No evidence’.
* Also, though there was positive rating for the static and dynamic strengthening intervention used by Blangsted et al, there was neutral rating awarded to the strengthening exercises by Hamberg-van-Reenen et al. As the findings are not consistent between the two high-quality RCTs, the level of evidence for the effectiveness of strengthening exercise is “Conflicting evidence”
* In relation to the PICO question, primary prevention results are not pertaining. Only the results from the secondary prevention and tertiary prevention, presented below are pertaining, as one of the criteria of the inclusion criteria of the PICO question, needs the patients to have existing neck and back pain, before the intervention is used.
* In relation to the treatment of the neck pain (secondary prevention):
* There was a positive rating for using neck strengthening exercises (with static loads) as an effective intervention for decreasing the neck pain intensity. (Ylinen et al) 45
* Blangsted et al49, also studied the use of a program with static loads for the neck pain and dynamic exercises for the trunk and upper extremity and was rated with positive rating for the effectiveness of this program in decreasing the pain intensity and pain duration.
* Endurance training with endurance exercises for neck, trunk, upper and lower extremities has been provided a positive rating for being effective in decreasing neck pain intensity. (Ylinen et al45)
* Endurance training provided with postural and biomechanics education has also been found effective in reducing the neck pain intensity.(Sjogren et al47)
* Thus, due to positive rating from two high quality studies, the level of evidence assigned to the effectiveness of strengthening exercise for treating neck pain is ‘strong evidence’ (Yliinen et al and Blangsted et al) and likewise, is assigned as ‘strong evidence’ for endurance exercise (Ylinen et al and Sjogren et al). (For Ylinen et al, the control group was involved with doing aerobic exercise and stretching; for Blangsted et al, the control group was involved with education classes about “health promotion”; and for Sjogren et al, the control group had no intervention).
* The strengthening regimen suggested by Sihawong et al16, based on this evidence level, consists of “ strengthening neck and shoulder muscles in the static mode and consist of 1 to 3 sets of 5 to 15 repetitions, once or twice a day, 3 to 5 times a week over a period of 4 weeks to 12 months”1(pg69). Dynamic training for the neck muscles for strengthening was dissuaded, as it was found to be not effective in decreasing neck pain, even when provided over a span of 12 months for 3 times/ week.
* The exercise regimen suggested by Sihawong et al, for endurance training, based on the level of evidence, consists of, “training of neck and shoulder muscles with light resistance performed in 3 sets of 20 repetitions, 5 to 8 times a week over a period of 15 weeks to 12 months”. 1(pg69)
* Further for stretching exercises, neutral effect was found by the stretching exercise intervention used by Kietrys et al48 in decreasing the intensity of pain, while positive rating was provided to the same stretching intervention for being able to decrease the musculoskeletal discomfort. Along a similar note, self- stretching exercise intervention by Tsuao et al46 was found to be of neutral rating, whereas stretching exercise group intervention by the same authors (Tsauo et al) resulted in being able to decline the pain intensity and were awarded positive rating. Because of these inconsistent findings from multiple RCTs, the level of evidence for the effectiveness of stretching exercises for treatment of neck pain is ‘Conflicting evidence’.
* For non-specific exercises, inconsistent findings are present from the studies, Blangsted et al (positive rating), and van den Heuvel et al 43(neutral rating), resulting in the level of evidence for the effectiveness of non-specific exercises being conflicting evidence.
* In relation to reducing neck pain associated disability:
* For strengthening exercises, positive rating was present for the strengthening exercise intervention used by Ylinen et al45, but there were neutral ratings awarded to the strengthening exercise interventions, used by Kietrys et al48 and Blangsted et al49. Thus, due ot inconsistent findings between multiple RCTs, the level of evidence for the effectiveness of strengthening exercises in decreasing neck pain associated disability, has been rated as “conflicting evidence”.
* For endurance exercises, positive rating was found in 1 high quality study (Ylinen et al) for the effectiveness of the neck endurance exercise intervention in decreasing the neck pain associated disability. The endurance exercise regimen suggested by Sihawong et al, based on the this level of evidence, for reducing neck pain associated disability consists of “neck flexor endurance exercises performed in 3 sets of 20 repetitions, 5 times a week over 12 months.” (Control group in Ylinen et al participated in aerobic exercise and stretching exercises)
* For stretching exercise, with the only low quality study, studying this intervention, being presented with neutral rating, the level of evidence for the effectiveness of the stretching exercises for reducing the neck pain associated disability is ‘no evidence’.
* For non-specific exercises, positive rating has been presented for the intervention used in the study of van den Heuvel et al43 for improving the productivity and improving the recovery from neck related pathology, but neutral effect with the same intervention in this study has been noted for sickness related absenteeism. Also, neutral rating was also given for the effectiveness for non-specific exercises for improving work ability and decreasing sickness related absenteeism, in the study by Blangsted et al. 49 Because of the inconsistent findings related to non-specific exercises, the level of evidence rated for the effectiveness of non-specific exercises in decreasing the neck pain associated disability has been “conflicting evidence”.
* Effectiveness of exercise interventions based on sensitivity analysis:
* Of the 9 included RCTs, only two studies (1 high quality – Blangsted et al49. and 1 low quality study – van den Heuvel et al.) studied non-specific exercise interventions in patients with non-specific neck pain.
* In the sensitivity analysis, the low quality study was removed and hence the results of the sensitivity analysis, ended up being dependent on only one high quality RCT (Blangsted et al, PEDro score 6/10), and these results indicated that the conflicting evidence levels for non-specific exercise for treating neck pain and for reducing neck pain associated disability, will get changed to moderate evidence and no evidence, respectively.
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**IMPLICATIONS FOR PRACTICE and FUTURE RESEARCH**

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| * Implications to clinical practice:
* A combination of exercise and ergonomics program does not seem either beneficial or harmful to improve the neck pain intensity and prevalence in computer workers. Though the result of the study has not provided any positive finding, this result could still be very beneficial for the employers. This finding from Aas et al23 indicates to the employers to avoid instituting any employee health wellness program in their companies for computer workers, that would be a combination of exercise program and ergonomics program. Especially, this finding also indicates to the employers, to avoid introduction of any new ergonomic equipment in the workplace. Ergonomic equipment are usually very expensive and employers could prevent financial losses by not investing in this expenditure.
* Though Aas et al23 did not find any significance associated with use of a combination of exercise and ergonomics program, use of only exercise interventions for relieving neck pain and decreasing neck pain associated disability has shown positive benefit in the study by Sihawong et al.16 This indicates that though employers could/should avoid introduction of ergonomic equipment at workplace, they would definitely be benefitting their employees, who work for at least 3 hours/ day on computers by introducing strengthening and endurance exercises. Strong evidence suggests that strengthening and endurance exercise help decrease pain intensity, while moderate evidence suggests that endurance exercise decreases the disability, associated with neck pain.
* The strengthening program with isometric exercises (1-3 sets, 5-15 reps, 1-2/day, 3-5/week, 1-12 months) and the endurance training program (3 sets, 20 reps, 5-8/week, 4 -12 months) for neck and shoulder muscles, suggested by Sihawong et al16 are not time-consuming and could be fitted by the employee in his daily life.
* Similarly the program suggested by Del Pozo-Cruz et al5 that includes only an 11 minute intervention could also be easily inculcated in patient’s work schedule. Especially, with the intervention being web-based and the computer workers being on computer, during the work hours, the program would be easily accessible to the employees. The employees would also not receive any additional training on how to use the web-based intervention, except for the initial tutorial, being well-versed with using the computers.
* However, the barriers to successful implementation of both the interventions, suggested by Sihawong et16 and Del pozo-cruz et al5 , for neck and back pain respectively, is the prolonged duration for which this programs run (1 month to 12 months for Sihawong et al16 and 9 months for Del pozo-cruz et al5 ). Prolonged duration of programs may cause compliance problems on part of the employees. In this regard, Del pozo-cruz et al16 have suggested use of daily emails to help the employees with their compliance, but unfortunately, no such intervention has been suggested by Sihawong et al5.
* Implications to future research:
* Aas et al23 have suggested that future research is needed with high quality RCTs, systematic reviews with or without meta-analysis to study workplace intervention for relieving neck pain severity and neck pain prevalence, to improve the existing quality of evidence. They suggested ways on how the future research could be performed, to achieve good methodological quality– by following the same format of subgrouping that they had used (based on ICF terminology and components), would greatly help in putting the interventions performed in proper perspective; and by providing detailed information about the intervention used in the individual studies, would also help the reader to under the exact intervention implemented in the individual studies.
* Del pozo-cruz et al5 having themselves studied the web based intervention for back pain relief in only south European population, suggested the need for future research that would investigate the effectiveness of the web-based program in different demographics. Thus, further high quality RCTs are needed to study this web-based intervention in the population of United States, to be able to implement this intervention in the population of this country. For this future research to be effective, it should study not only the subacute back pain, like Del Pozo-cruz et al5 did, but should study acute, subacute and chronic back pain in computer workers. They should also analyse the impact of psychosocial factors, the work load, the cost-effectiveness of the program for the employers.
* Sihawong et alet al16 have suggested the need for further research with systematic reviews with or without meta-analysis that do not include the multiple methodological limitations that they had in their study – including heterogenous data, missing data, publication bias, etc. They also suggested more research to be focused on studying impact of flexibility and endurance exercises on primary prevention of the neck pain in computer workers. Also, to focus on studying the role of non-specific exercises in relieving non-specific neck pain in office workers, using computers.
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