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Review article

Prevalence and risk factors associated with musculoskeletal complaints among users of mobile handheld devices: A systematic review

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ABSTRACT

This systematic review aimed at evaluating the prevalence and risk factors for musculoskeletal complaints associated with mobile handheld device use. Pubmed, Medline, Web of Science, CINAHL and Embase were searched. The methodological quality of included studies was assessed. Strength of evidence for risk factors was determined based on study designs, methodological quality and consistency of results. Five high-quality, eight acceptable-quality and two low-quality peer-reviewed articles were included. This review demonstrates that the prevalence of musculoskeletal complaints among mobile device users ranges from 1.0% to 67.8% and neck complaints have the highest prevalence rates ranging from 17.3% to 67.8%. This study also finds some evidence for neck flexion, frequency of phone calls, texting and gaming in relation to musculoskeletal complaints among mobile device users. Inconclusive evidence is shown for other risk factors such as duration of use and human-device interaction techniques due to inconsistent results or a limited number of studies.

Contents

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1. Introduction

Mobile handheld devices, including personal digital assistants, keypad phones, touchscreen smartphones and tablet computers, are information technology (IT) instruments commonly used for communication and entertainment. Nowadays, nearly everyone, from children to adults of all ages, owns at least one type of mobile handheld device because of the low cost and convenience. Multiple usability options and fascinating applications of mobile handheld devices such as smartphones and tablet computers, together with easy access to internet encourage users especially youngsters to spend a large amount of time with their mobile devices. A survey in Canada among 137 university students, staff and faculty showed that the participants spent 4.65 hours daily on mobile handheld devices (Berolo et al., 2011). The intensive use of mobile devices has been reported to be associated with non-specific symptoms of ill-health and musculoskeletal complaints (Berolo et al., 2011; Chu et al., 2011). The association between electromagnetic field exposures from mobile phones and non-specific symptoms of ill-health such as headache, fatigue, depression, sleep disturbance and earache have been extensively investigated, according to several systematic reviews (Augner et al., 2012; Röösli et al., 2010; Valentini et al., 2007, 2010). However, there is a lack of systematic investigations of the prevalence and physical risk factors for musculoskeletal complaints associated with the use of mobile devices.

Musculoskeletal complaints affect a large number of people. Prevalence is a useful indicator of the extent of musculoskeletal complaints in a population and risk factors for musculoskeletal complaints serve as a basis for prevention and interventions (Walker, 2000). Several factors including excessive repetition, high physical and psychological demands, sustained awkward postures and poor workstation designs have been identified as important occupational factors associated with musculoskeletal complaints (Côté et al., 2009; da Costa and Vieira, 2010; van Rijn et al., 2010). Extensive research has been done in the past 2–3 decades on the relationship of computer use and musculoskeletal disorders, and these have also been summarized in a few systematic reviews (Mediouni et al., 2014; Thomsen et al., 2008; Waersted et al., 2010). These research studies were mainly conducted on the use of "desktop" computers, while more research has emerged about the effects of using "laptop" computers in recent years (Asundi et al., 2010; Gold et al., 2012; Malińska and Bugajska, 2010).

In the past 7–8 years, since the launch of the first generation of "iPhone", touchscreen handheld devices have dominated the IT market, and peoples' daily habits of using electronic devices have been significantly affected by this technology. However, research on risk factors and prevalence of musculoskeletal symptoms related to the use of these mobile touchscreen devices is only just emerging. Given the increasing reports on musculoskeletal complaints among users of mobile handheld devices (Ashurst et al., 2010; Fernandez-Guerrero, 2014; Williams and Kennedy, 2011), a comprehensive review is warranted to show a clear picture of the research about the relationship of musculoskeletal complaints and mobile handheld device use.

Furthermore, a review would help lay a foundation for the development of clinical management and ergonomic guidelines, which can in turn facilitate prevention strategies. The purpose of this systematic review is to (a) gain insight into the prevalence of musculoskeletal complaints among users of mobile devices; (b) evaluate the existing evidence on risk factors for musculoskeletal complaints associated with the use of these devices. For this purpose, mobile handheld devices studied include all items such as different types of keypad mobile phones, smartphones and tablet computers with touchscreens as well as handheld game devices.

2. Methods

2.1. Search strategies

Electronic database search and a reference search were the major strategies to identify published studies that reported the prevalence and/or risk factors associated with musculoskeletal complaints among users of mobile handheld devices. Electronic databases of Pubmed, Medline (1946 + via OvidSP), Web of Science, CINAHL (1982+) and Embase (1980+) were searched. Relevant studies were identified based on a combination of three groups of terms (MeSH and/or text word search terms). These three groups of terms pertained to mobile handheld devices, musculoskeletal complaints and prevalence/risk, respectively. The terms within each group were combined with "OR", and three groups were linked with "AND". Specific search terms used and full search syntax with truncation used in the Medline database is shown in Table 1. Similar strategies were performed in other databases. Studies that were not related to the objective of this systematic review and did not meet the eligibility criteria were eliminated through screening titles and abstracts of the articles. Regarding articles that could not be screened out through titles and abstracts, a detailed review of full texts was performed to determine their eligibility. Reference lists of papers which fulfilled the eligibility criteria were also systematically searched for additional relevant studies. Furthermore, a forward search using Google Scholar was conducted on May 4, 2016 to identify all related papers that made reference to the eligible articles. The article screening and selection were performed independently by two reviewers (YX and JD) and any disagreement was settled during a consensus discussion with the third reviewer (GS) (da Costa and Vieira, 2010; van der Windt et al., 2000).

2.2. Eligibility criteria

The inclusion criteria for paper selection were studies that: (1) had a primary purpose of examining the prevalence, or/and the risk factors associated with musculoskeletal complaints among users of mobile handheld devices; (2) published in peer-reviewed English language journals; (3) utilized cross-sectional, case-control, or prospective cohort study designs (4) reported results separately on prevalence of and/or risk factors for musculoskeletal complaints associated with the use of mobile devices. The exclusion criteria were as follows: (1) studies which investigated the use of mobile handheld devices such as phones as an intervention; (2) literature reviews, conference papers and case reports.