# *Computer use exposure as a key risk factor for musculoskeletal symptoms*

## *Wellnomics® White Paper*

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November 2006
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Ref 1014/01/112006

## Introduction

Computer use is increasingly regarded as an important risk factor for the development of musculoskeletal symptoms amongst office workers.

Until recently computer use exposure has been difficult to measure, with researchers relying upon self-reported estimates from user questionnaires. Consequently, only scientific researchers have gone to the effort of measuring exposure levels in specific studies on computer use. With the introduction of software monitoring tools like Wellnomics WorkPace® this is now changing with organisations now able to easily and accurately monitor levels of computer use exposure across their office workers.

This paper summarises some of the recently published evidence linking computer use exposure with musculoskeletal symptoms amongst office workers. Evidence points to a dose-response relationship - the higher the level of computer use, the higher the risk of symptoms – and to a higher risk from mouse use in particular.

## Evidence for a dose-response relationship between computer use and symptoms

In a prospective cohort study in 2002 by Karlqvist et al[1] an association was found between greater than 2 hours per day of computer work, and greater than 2 hours per day of computer work without breaks at least twice per week, and neck/shoulder and elbow/forearm/hand symptoms. The duration of work with a non-keyboard input device (e.g. a mouse) was particularly associated with symptoms for men.

A cross-sectional study of computer users by Jensen et al (2002)[2] found that the duration of computer work was positively associated with neck and shoulder symptoms among women, and with hand/wrist symptoms among men. In particular mouse use among intensive computer users was associated with symptoms in the hand/wrist and shoulder regions, with the authors concluding

> *"The duration of computer use appears critical for the reporting of musculoskeletal symptom, but a further increase in hand/wrist and shoulder symptom prevalence may be due to intensive mouse use"*

It was interesting that these associations still persisted after adjusting for the effect of psychosocial factors, with the authors further concluding

> *"..the differences in psychosocial exposures, such as social support or possibilities for development, between respondents using a computer for a small or large fraction of their work time could not explain the higher prevalence of symptoms amongst the intensive computer users."*

Another study published in 2002 by researchers at the Dutch TNO Research Institute (Blatter and Bongers[3]) found that working with a computer more than 6 hours per day was associated with musculoskeletal symptoms in all body regions.

Blatter and Bongers also found that the strength of the association with symptoms was related to gender with men showing a moderate association when use was greater than 6 hours per day, and women showing moderately increased risk for greater than 4 hours per day and strongly increased risk for greater than 6 hours per day.

One of the largest longitudinal studies to date done on computer users is the Danish NUDATA study (www.nudata.dk), which used WorkPace to collect objective measurements of keyboard and mouse use across thousands of computer users.

Analysis of data from this study by Andersen et al (2006)[4] correlated computer use against discomfort levels measured with weekly pain questionnaires and found

> *"…a mostly linear association between mouse use and elbow pain"*

This linear, or 'dose-response' relationship is illustrated by the log-log chart below.

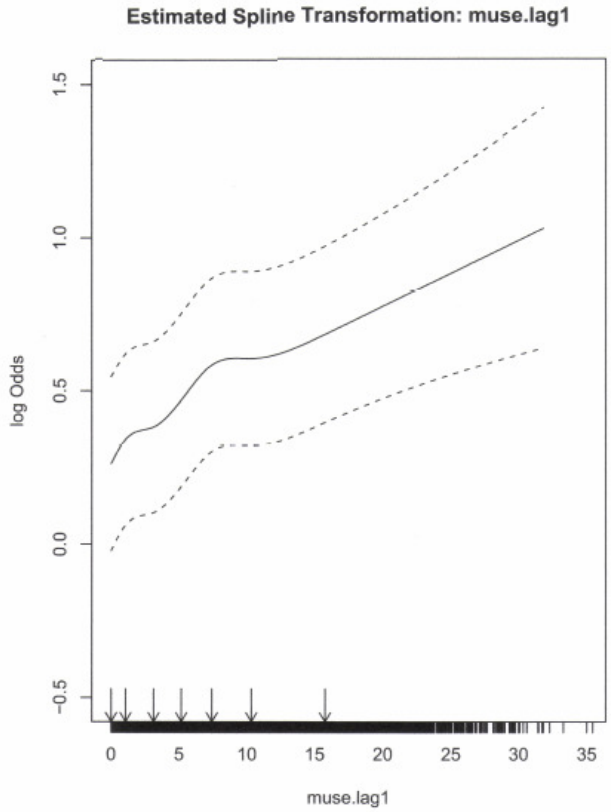


Fig.1: Log odds of elbow pain in relation to weekly mouse use.

Andersen et al found similar results for symptoms in other upper body areas, stating

> "*The associations regarding the other pain outcomes showed a similar association between mouse use and pain in the shoulder, the forearm and the hand/wrist.*"

A number of meta-analyses have been conducted covering this topic.

One by Gerr et at (2004)[5] reviewed five cross-sectional studies and one prospective study. They found significant associations between daily or weekly hours of keyboard use and hand and arm musculoskeletal symptoms and disorders.

A second meta-analysis was conducted by Ijmker et al (2006)[6] with an overall finding of moderate evidence for the association with duration of mouse use for hand-arm symptoms and disorders. There was a dose-response relationship found with this association i.e. there was an increase in risk as the duration of use increased. The authors concluded that

> *"Post-hoc comparisons showed that the duration of mouse use was overall more strongly and more consistently associated with hand-arm symptoms that other factors such as non-neutral working postures, psychosocial factors and individual factors."*

A common theme in many studies appears to be the increased risk posed by mouse use in particular, which seems to be higher than keyboard use. For example, another study by Kryger et al (2003)[7] found an increased risk of forearm pain was associated with use of a mouse device for more than 30 hours per week and with keyboard use more than 15 hours per week. The authors concluded that

> *"This study points towards duration of mouse device use and to a lesser extend keyboard use as the main work related risk factors for forearm pain"*

ending with the recommendation that

> *'…preventive actions should include efforts to reduce weekly usage to less than 20 to 25 hours'*

## *Conclusion*

Computer use and in particular mouse use is a key risk factor for musculoskeletal symptoms in office workers. Many studies have provided demonstrable evidence of a correlation between high levels of computer use and symptoms.

With it now being easy to accurately measure keyboard/mouse directly through WorkPace it is expected health and safety policies for office workers will make increasing use of this information as a guide in identifying risks and supporting an increasingly proactive approach to preventing musculoskeletal symptoms.

## *Accurate measurement of exposure using WorkPace*

Traditionally research on computer use exposure has relied upon self-report questionnaires i.e. asking users to estimate their computer use. A number of recent studies has now shown that other methods, such as direct measurement through monitoring software such as Wellnomics WorkPace are far more accurate (Homan et al (2003)[8] Heinrich et al (2004)[9], Blangsted et al (2004)[10], Douwes et al (2004)[11], Toivonen et al (2004)[12] and Ijmker et al (2004)[13]. WorkPace in particular has become the de-facto standard for measuring computer use, with many of these studies validating WorkPace's measurement of computer use. For example, Blangsted et al concluded that

> *'The [Wellnomics WorkPace] software may be used as a valid tool to measure exposure in large epidemiological studies or to provide objective feedback on time spent at the computer and usage of keyboard and mouse…'*

Accordingly, many of the new studies being conducted (such as the Danish NUDATA study, and Dutch PROMO study) have now been using WorkPace to measure exposure levels directly amongst computer users. The advantages of using WorkPace are many – with the software allowing the automated collection of accurate data on many aspects of computer use, including mouse/keyboard use, breaks and work intensity. This information can then be used to identify high risk users within the organisation.

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