THE AETIOLOGY OF UPPER QUADRANT MUSCULOSKELETAL PAIN IN HIGH SCHOOL LEARNERS USING DESKTOP COMPUTERS: A PROSPECTIVE STUDY

by

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A thesis submitted in fulfilment of the requirements for the degree of MSc in Physiotherapy

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DECLARATION

"I, the undersigned, hereby declare that the work contained in this thesis is my original work, and that I have not previously in its entirety or in part submitted it at any university for a degree."

Signature: ____________________ Date:_________________

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ABSTRACT

Introduction

The Western Cape Education Department initiated a project that aims to provide all the learners from the province with computer access and to promote computer use in schools. Prolonged sitting in front of computers and psychosocial factors have been associated with musculoskeletal symptoms internationally. However, the impact of computer use on musculoskeletal pain among South African high school learners is yet to be determined.

Objective

The objective of the study was to determine whether sitting postural alignment and psychosocial factors contribute to the development of upper quadrant musculoskeletal pain in grade ten high school learners working on desktop computers.

Study design

An observational analytical study was performed on a sample of 104 asymptomatic high school learners.

Methodology

Six high schools in the Western Cape metropole were randomly selected 322 grade ten learners who are using desktop computers, were screened for upper quadrant musculoskeletal pain. Measurements at baseline were taken of the 104 asymptomatic learners, 49 girls and 55 boys. The sitting postural alignment was measured by using the Portable Posture Analysis Method (PPAM), which measured head tilt; cervical

angle; shoulder pro- and retraction angle and thoracic angle in the sagittal plane. Depression and anxiety were described by using the Beck Depression Inventory (BDI) and the Multidimensional Anxiety Scale for Children (MASC) respectively. The exposure to computer use was described in terms of duration and frequency of daily and weekly computer use. At three and six months post baseline, the onset and area of upper quadrant musculoskeletal pain was determined by using the Computer Usage Questionnaire.

Results

After six months, 27 of the 104 learners developed upper quadrant musculoskeletal pain due to seated or computer-related activities. There was no difference in computer exposure between the learners who developed upper quadrant musculoskeletal pain symptoms and the learners who remained asymptomatic. An extreme cervical angle (<34.75° or >43.95°; OR 2.6; 95% CI: 1.0-6.7) and a combination of extreme cervical and thoracic angle (<63.1° or >71.1°; OR 2.19; 95% CI: 1.0-5.6) were significant postural risk factors for the development of upper quadrant musculoskeletal pain. There was a tendency for boys to be at a greater risk for upper quadrant musculoskeletal pain than the girls (OR 1.94; 95% CI: 0.9-4.9). Weight greater than 54.15kg and a depression score greater than 11 was found to be significantly associated with a poor posture (OR 3.1; 95% CI: 1.0-9.7; OR 1.02; 95% CI: 1.0-1.1).

Discussion and conclusion

The study concluded that poor posture, relating to extreme cervical and thoracic angles, is a risk factor for the development of upper quadrant musculoskeletal pain in high

school learners working on desktop computers. South African boys were at a greater risk of developing upper quadrant musculoskeletal pain than the girls. However the study found no causal relationship between depression, anxiety and upper quadrant musculoskeletal pain among South African high school learners and computer usage.

ABSTRAK

Inleiding

Die Wes-Kaap Onderwysdepartement het ‘n projek van staple gestuur om alle leerders in die provinsie van rekenaartoeganklihe id te voorsien en om rekenaargebruik in skole te bevorder. Verlengde sitperiodes voor ‘n rekenaar en psigososiale faktore word reeds internasionaal met muskuloskeletale pyn geassosieer. Die impak van rekeneergebruik op Suid-Afrikaanse hoërskoolleerders moet egter nog bepaal word.

Doel

Die doel van die studie was om te bepaal of posturale belyning van leerders in ‘n sittende posisie, asook psigososiale faktore bydra tot die ontwikkeling van boonste kwadrant muskuloskeletale pyn van graad tien leerders wat rekenaars gebruik.

Studie ontwerp

‘n Analitiese waarnemingsstudie is op ‘n groep van 104 asimptomatiese hoërskoolleerders uitgevoer.

Metodologie

Ses hoërskole in die Wes-Kaap Metropool was lukraak gekies. 322 graad tien leerders wat rekenaars gebruik, is vir boonste kwadrant muskuloskeletale pyn getoets. By aanvangs van die studie is metinge van die 104 asimptomatiese leerders, 55 seuns en 49 dogters, geneem. Die posturale belyning van leerders in ‘n sittende posisie is met behulp van die ‘Portable Posture Analysis Method’ gedoen. Die apparaat het die kopkantel, die servikale hoek, die skouer pro-en retraksie hoek en die torakale hoek in

die sagitale as gemeet. Depressie en angs is met behulp van die Beck Depressie Inventaris (BDI) en die Multidimensionele Angs Skaal vir Kinders (MASK) onderskeidelik gemeet. Rekenaargebruik is beskryf in terme van die duur en frekwensie van daaglikse en weeklikse rekenaargebruik. Op drie en ses maande, na aanvangs van die studie, is die aanwesigheid en area van boonste kwadrant muskuloskeletale pyn met behulp van die Rekenaargebruik Vraelys bepaal.

Resultate

Na ses maande het 27 van die 104 leerders boonste kwadrant muskuloskeletale pyn ontwikkel weens sittende of rekenaarverwante aktiwiteite. Daar was geen verskil met betrekking tot rekenaarblootstelling tussen die groep leerders wat pyn ontwikkel het en die groep wat asimptomaties gebly het nie. ‘n Ekstreme servikale hoek (<34.75° or >43.95°; OR 2.6; 95% CI: 1.0-6.7) en ‘n kombinasie van ‘n ekstreme servikale en torakale hoek (<63.1° or >71.1°; OR 2.19; 95% CI: 1.0-5.6) was beduidende risiko faktore vir die ontwikkelling van boonste kwadrant muskuloskeletal pyn. Daar was ‘n geneigdheid vir seuns om ‘n groter risiko vir die ontwikkeling van boonste kwadrant muskuloskeletale pyn as die dogters (OR 1.94; 95% CI: 0.9-4.9) te hê. Massa groter as 54.15kg, en ‘n depressie telling groter as 11, het ‘n beduidende verwantskap met swak postuur getoon (OR 3.1; 95% CI: 1.0-9.7; OR 1.02; 95% CI: 1.0-1.1).

Bespreking en gevolgtrekking

In die studie is tot die slotsom gekom dat swak postuur, wat verband hou met ekstreme servikale en torakale hoeke, risiko faktore is vir die ontwikkelling van boonste kwadrant muskuloskeletale pyn in hoërskoolleerders wat rekenaars gebruik. Suid-Afrikaanse seuns het ‘n groter risiko om boonste kwadrant muskuloskeletale pyn te ontwikkel as dogters. Die studie het egter geen verwantskap tussen depressie, angs en boonste kwadrant muskuloskeletale pyn in Suid-Afrikaanse hoërskoolleerders, wat rekenaars gebruik, gevind nie.

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DEDICATION

I dedicate this thesis to the memory of:

My mother, Elsabé Prins

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CHAPTER 1

INTRODUCTION

"By the start of the 2012 academic year, every educator in every school of the Western Cape will be empowered to use appropriate and available technology to deliver curriculum to each and every learner in the province." (http://www.khanya.co.za/projectinfo/?catid=32). This is the primary goal of the Khanya Project, an initiative of the Western Cape Education Department as a means to address the shortage of educator capacity in schools. Already, 29 347 desktop computers have been deployed in 732 schools in the Western Cape. For children in developed countries, information technologies are widely available, used frequently for long periods at a time (Straker & Pollock 2005). Daily usage of computers for more than 90 minutes is common among learners and as these learners become more exposed to different information technologies from a young age they are subsequently exposed to a prolonged sitting posture (Briggs, Straker & Grieg, 2004; Grieg, Straker & Briggs, 2005; Ramos, James & Bear-Lehman 2005; Storr-Paulsen & Aagaard-Hensen 1994; Straker & Pollock 2005).

The prevalence of self-reported upper quadrant musculoskeletal pain among children and adolescents is high (Bakoula, Kapi, Veltsiste, Kavadias & Kolaitis 2006; Diepenmaat, Van der Wal & De Vet 2006; Cho, Hwang & Chen 2003; Feldman, Shrier, Rossignol & Abenhaim 2002; Hakala, Rimpela, Salminen, Virtanen & Rimpela 2002). Musculoskeletal pain experienced during childhood and adolescence may develop into chronic musculoskeletal pain syndromes that persist into adulthood (Brattberg 2004;

Siivola, Levoska, Latvala, Hoskio, Vanharanta & Keinanen-Kiukaanniemi 2004; Stahl, Mikkelsson, Kautiainen, Hakkinen, Ylinen & Salminen 2004). Although pain prevalence increases from childhood to adolescence and then to adulthood, pain symptoms do not persist in the same children, adolescents or adults. The result of persisting musculoskeletal pain among these children and adolescents, is the development of chronic pain patterns and the consequent high economic cost of treating these symptoms (Mikkelsson *et al.* 2004). The prevention of upper quadrant musculoskeletal pain is aimed at modifying the potential risk factors to prevent the occurrence of symptoms in an asymptomatic population (Staal, De Bie & Hendriks 2007). However the prevention of upper quadrant musculoskeletal pain in children and adolescents is poorly reported due to a lack of understanding of the causality of this pain.

A recent study revealed that almost 70% of high school learners in the Western Cape Metropole who use desktop computers suffer symptoms of musculoskeletal pain (Smith, Louw, Crous & Grimmer-Somers 2007). This study supports the possible association between musculoskeletal pain and computer use among high school learners, but it is yet to be ascertained whether computer use is a causative factor of musculoskeletal pain. There is limited literature available that assesses upper quadrant musculoskeletal pain and computer use in adolescents and cross-sectional study designs make it impossible to determine whether computer use is a causative factor for upper quadrant musculoskeletal pain (Diepenmaat *et al.* 2006; Jacobs & Baker 2002; Ramos *et al.* 2005). Prolonged static sitting posture, irrespective of computer use or specific postural angles, was found to be the most important associative factor for upper quadrant musculoskeletal pain among high school learners (Cho *et al.* 2003; Harris & Straker

2000; Jacobs & Baker 2002; Murphy, Buckle & Stubbs 2004; Ramos *et al*. 2005). The only study that measured the angles of static sitting posture and upper quadrant musculoskeletal pain simultaneously, was not a prospective study however, the study found that less trunk flexion movement, between 20º and 45º, was significantly associated with self-reported upper back and neck pain (Murphy *et al*. 2004).

The impact of psychosocial factors on the experience of musculoskeletal pain in children and adolescents is prominent in the current literature, with depression, anxiety and psychosomatic symptoms being the most common associative psychosocial factors found to influence the prevalence of musculoskeletal pain in children and adolescents (Brattberg 2004; Diepenmaat *et al.* 2006; Feldman *et al*. 2002; Mikkelson, Sourander, Salminen, Kautiainen & Piha 1999; Niemi, Levoska, Rekola & Keinanen-Kiukaanniemi 1997). Psychosomatic symptoms such as headache and abdominal pain form part of the child or adolescent's psychological profile and depression has a strong association with these psychosomatic symptoms (Egger, Costello, Erkanli & Angold 1999; Mikkelson *et al.* 1999). Egger *et al.* (1999) found that depressed girls and depressed boys had a 13 times and a 10 times greater risk respectively of developing musculoskeletal pain. Niemi *et al*. (1997) concluded that higher stress and depression levels were associated with girls and boys who complained of neck and shoulder pain.

The aim of this study was to measure sitting postural alignment, anxiety and depression prospectively in order to determine if these components are risk factors for the development of upper quadrant musculoskeletal pain and, if so, it implicates that these factors should be addressed in a preventative and curative capacity.

CHAPTER 2

SYSTEMATIC REVEIW

A systematic review of posture and psychosocial factors as contributors to upper quadrant musculoskeletal pain in children and adolescents

2.1 **Introduction**

A systematic review of the association between sitting posture, psychosocial factors and the development of upper quadrant musculoskeletal pain among children and adolescents will be presented in this chapter. The review was conducted between January and April 2007.

The most common associative factors for upper quadrant musculoskeletal pain among children and adolescents are reported to be age, gender, psychosocial factors and posture (Bakoula *et al*. 2006; Briggs *et al*. 2004; Egger *et al*. 1999; Grieg *et al*. 2005; Hakala *et al*. 2002; Jacobs & Baker 2002; Mikkelson *et al.* 1999; Siivola *et al.* 2004; Wedderkopp, Leboeuf-Yde, Andersen, Froberg & Hansen 2001). This review investigates static sitting posture because children and adolescents mimic the poor static sitting postural alignment seen in the adult population (Briggs *et al.* 2004; Grieg *et al*. 2005; Harris & Straker 2000). Ariens, Van Mechelen & Bongers (2000) and Ariens, Bongers & Hoogendoorn (2001) have confirmed that neck flexion, arm position and the duration of sitting have a positive association with the occurrence of neck pain in the adult population. This review also investigates psychosocial factors because social, psychological and emotional factors have been reported to increase the experience of musculoskeletal pain in children and adolescents (Brattberg 2004; Diepenmaat *et al*. 2006; Egger *et al*. 1999; Feldman *et al*. 2002; Mikkelson *et al.* 1999; Niemi *et al.* 1997).

A review of epidemiologic literature regarding the association between upper quadrant musculoskeletal pain and workplace factors, including psychosocial factors, presented strong evidence to support a relationship between static posture, psychosocial factors and neck or shoulder pain in the adult population (National Institute for Occupational Safety and Health, 1997). However, there is no systematic review that presents a comprehensive view of the contribution of posture and psychosocial factors to the experience of upper quadrant musculoskeletal pain among children and adolescents. The aim of this review was to ascertain the evidence for the association of posture and psychosocial factors with upper quadrant musculoskeletal pain in children and adolescents. This review addresses the following questions:

1) What measurement tools are used to evaluate musculoskeletal pain, posture and psychosocial factors in children and adolescents?
2) Is sitting posture (alignment, frequency and duration) associated with the experience of upper quadrant musculoskeletal pain in children and adolescents?
3) Are psychosocial factors associated with the experience of upper quadrant musculoskeletal pain in children and adolescents?

The following definitions apply to this review:

1) Musculoskeletal pain: Symptoms of soreness, tingling, burning and numbness pertaining to the skeleton and muscles (Cho *et al*. 2003).

2) Upper quadrant: The upper quadrant consists of the occiput, cervical spine and the upper extremities, including the clavicles and the scapulae (Donatelli 1987).

3) Static sitting posture: Maintaining for a period of time the alignment of the body and its segments in a sitting position (Norkin & Levangie 2005).

4) Psychosocial factors: Involving aspects of social (relating to human society and its modes of organization) and psychological (relating to the mind or emotions) behavior (http://www.thefreedictionary.com/psychosocial).

2.2 **Review Method**

Prior to commencing this study, seven electronic databases (CINAHL, BIOMED CENTRAL, PEDRO, PROQUEST, PUBMED, PsycINFO and SCIENCE DIRECT) were searched to verify that there is no published systematic review that describes the relationship between sitting posture, psychosocial factors and upper quadrant musculoskeletal pain among children and adolescents.

2.2.1 Inclusion criteria for selection of studies

This systematic review sought epidemiological studies that included descriptive or analytical observational studies utilizing a prospective or cross-sectional time frame (Portney & Watkins 2000). A language restraint was set and only papers published in English and presented in full-text format were accepted. No limit was set on the publication date. The participants included male and female children aged 6 to 12 years and adolescents aged 13 to 18 years.

Articles that reported on static sitting posture and/or psychosocial factors were eligible for inclusion in this review. Static sitting posture could be evaluated either by direct measurement of postural angles, by observing frequency and duration of sitting or by a descriptive assessment of school-based and recreational seated activities via a questionnaire or interview. Psychosocial factors could be assessed via a questionnaire or interview. Articles in which psychosocial factors were appropriately defined by the authors, as aspects of social and psychological behavior, were eligible for this review.

Articles were included if the outcome of the study measured and reported on upper quadrant musculoskeletal pain in terms of the onset, area, frequency, intensity or duration of pain. The measurement tool, either an interview or questionnaire, had to measure one or more of the above-mentioned aspects of pain.

2.2.2 Exclusion criteria for selection of studies

Articles were excluded (1) if only headache was measured, because headache is regarded as a psychosomatic symptom rather than a musculoskeletal symptom (Harma, Kaltiala-Heino, Rimpela & Rantanen 2002; Mikkelson *et al*. 1999; Vikat, Rimpela, Salminen, Rimpela, Salvolainen & Virtanen 2000); (2) if musculoskeletal pain was due to a systemic condition e.g. juvenile arthritis, chronic fatigue syndrome or fibromyalgia; (3) if musculoskeletal pain and psychosomatic pain were grouped and measured together; (4) if the results of upper quadrant musculoskeletal pain were not reported on separately to the results of lower limb or lower back musculoskeletal pain; (5) if only psychosomatic symptoms, and no other aspects of psychosocial factors, were measured and (6) if a study sample was within the age limit at baseline measures, but exceeded this age limit when follow-up measures were taken.

2.2.3 Search strategies

Two independent reviewers searched seven electronic databases that were available at the Stellenbosch University Library. The databases were BioMed Central, CINAHL, PEDRO, PROQUEST, PUBMED, PsycINFO and SCIENCE DIRECT. All the databases were searched up to April 2007. No restriction was set on the publication date. The search was limited to full-text articles published in English. MESH terms were used only in PUBMED and when applicable. The following keywords were used: pain, neck and/or shoulder pain, musculoskeletal pain, upper limb pain, upper extremity pain, posture, sitting posture, children, adolescents, learner, student and psychosocial factors. The limits child, adolescence, human and English were used in the CINAHL, PsycINFO and PUBMED databases. In addition, secondary searching (pearling) was performed on the reference list of retrieved articles. Experts in this field of research were contacted to ensure that all eligible articles were retrieved for this review.

For including articles for this review, two reviewers selected the eligible articles by firstly screening all the possible hits, secondly reading the abstract and, finally, reading the full text article. A list of all the most successful hits from the seven databases appears in Appendix A. Figure 2.1 illustrates the procedure followed to select the eligible studies.

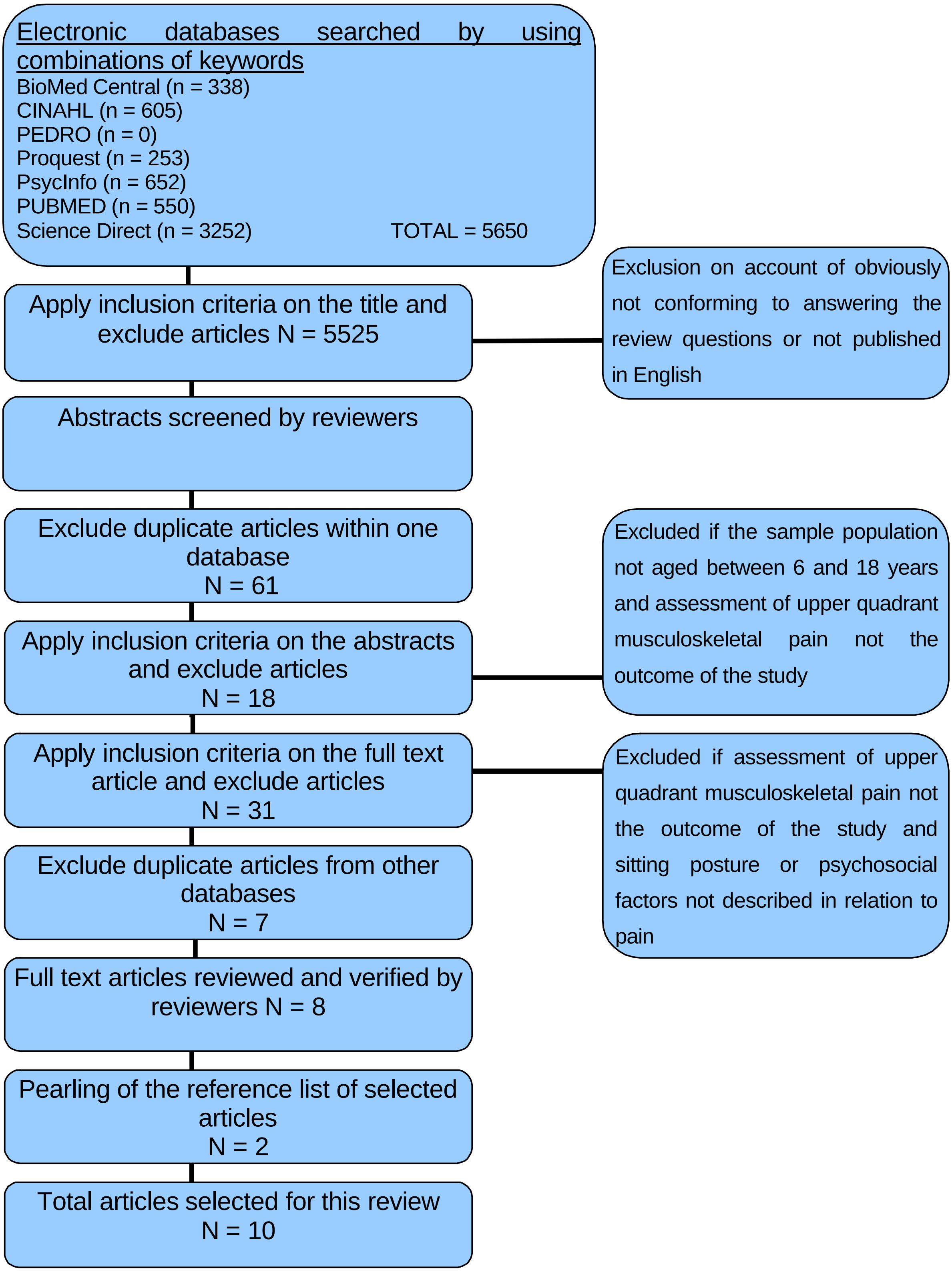


Figure 2.1 Flow chart to demonstrate the selection of studies

2.2.4 Methodological quality appraisal

The full text version of the selected articles was obtained and assessed by two reviewers according to the Critical Appraisal Form - Quantitative Studies (Law, Stewart, Pollock, Letts, Bosch & Westmoreland 1998). The form consists of 16 questions and allowed for a total score of 16. The questions appear in Appendix B. All the yes answers scored 1 and the no answers scored 0, except for questions 3 and 4, where a no answer scored 1 and a yes answer scored 0.

2.3 **RESULTS**

2.3.1 Search results

Two independent reviewers searched the databases presented in Table 2.1. Fifteen articles were considered eligible for this review. Seven of the 15 articles were duplicates and therefore excluded. An additional two articles (Harris & Straker, 2000; Ramos *et al*. 2005) were obtained after screening the reference lists of the eight eligible articles. No articles were included after experts in this field of research had been contacted. Ten articles therefore were finally included in this review.

Table 2.1 The selection of studies from different databases

Database	Hits	Exclude title	Exclude duplicates within database	Exclude abstract	Exclude article	Studies remaining	Duplicates in other databases
CINAHL	605	573	15	4	7	3	1
BIOMED CENTRAL	338	334	3	0	1	0	0
PEDRO	0	0	0	0	0	0	0
PROQUEST	253	251	1	0	1	0	0
PsycINFO	652	621	17	2	8	1	0
PUBMED	550	521	14	5	2	2	6
SCIENCE DIRECT	3252	3225	11	7	7	2	0
TOTAL	**5650**	**5525**	**61**	**18**	**31**	**8**	**7**

2.3.2 Critical appraisal of methodological quality

The methodological quality of the eligible articles was considered good, as the average score was 12 out of a possible 16 (76%). The articles adhered to the criteria for questions 1-2, 5, 8, 12-13 and 15-16. A discrepancy between the scores of the two reviewers was found for criterion 6 for the article by Diepenmaat *et al.* (2006) and was discussed until consensus was reached. Four articles scored 81% (Cho *et al*. 2003; Diepenmaat *et al.* 2006; Murphy *et al*. 2004; Niemi, Levoska, Kemila, Rekola & Keinanen-Kiukaanniemi 1996), four articles scored 75% (Harris & Straker 2000; Murphy, Buckle & Stubbs, 2007; Niemi *et al*. 1997; Vikat *et al*. 2000) and two articles scored 68% (Feldman *et al*. 2002; Ramos *et al*. 2005). The two articles (Feldman *et al*. 2002; Ramos *et al*. 2005) that scored less than the required 70% were not excluded because of the low number of articles retrieved that were eligible for review (Walker 2000). There were sample biases (criterion 3) in five articles, either due to non-randomization of the selected schools (Feldman *et al*. 2002; Harris & Straker 2000; Ramos et al. 2005) or to an opportunistic sample chosen on the day of the study (Murphy *et al.* 2004), or to a low response rate of 20% for the participating schools (Murphy *et al*. 2007). Measurement biases (criterion 4) were detected in four articles, mainly due to the pain recall period being six and 12 monthly (Cho *et al*. 2003; Feldman *et al*. 2002; Niemi *et al*. 1997; Vikat *et al*. 2000). In none of the articles was a sample size calculation (criterion 7) done to justify the sample size, although all the authors described the sample and sampling method in detail (criterion 6) except for Murphy *et al*. (2004) and Diepenmaat *et al.* (2006). Harris & Straker (2000) and Ramos *et al*. (2005) failed to describe their method of outcome measurement (criterion 9) sufficiently.

Only two articles reported on both the reliability and validity of all the measurement tools used in the study (Cho *et al*. 2003; Murphy *et al*. 2004). Three articles explained the validity (criterion 11) but not the reliability (criterion 10) of the measurement tools (Diepenmaat *et al.* 2006; Harris & Straker, 2000; Ramos *et al.* 2005). The remaining five articles did not report on either the validity or reliability of the measurement tools.

Two articles did not discuss the impact and the relevance of their findings on clinical practice (criterion 14) (Cho *et al.* 2003; Ramos *et al.* 2005). Figure 2.2 presents a summary of the responses to the methodological criteria.

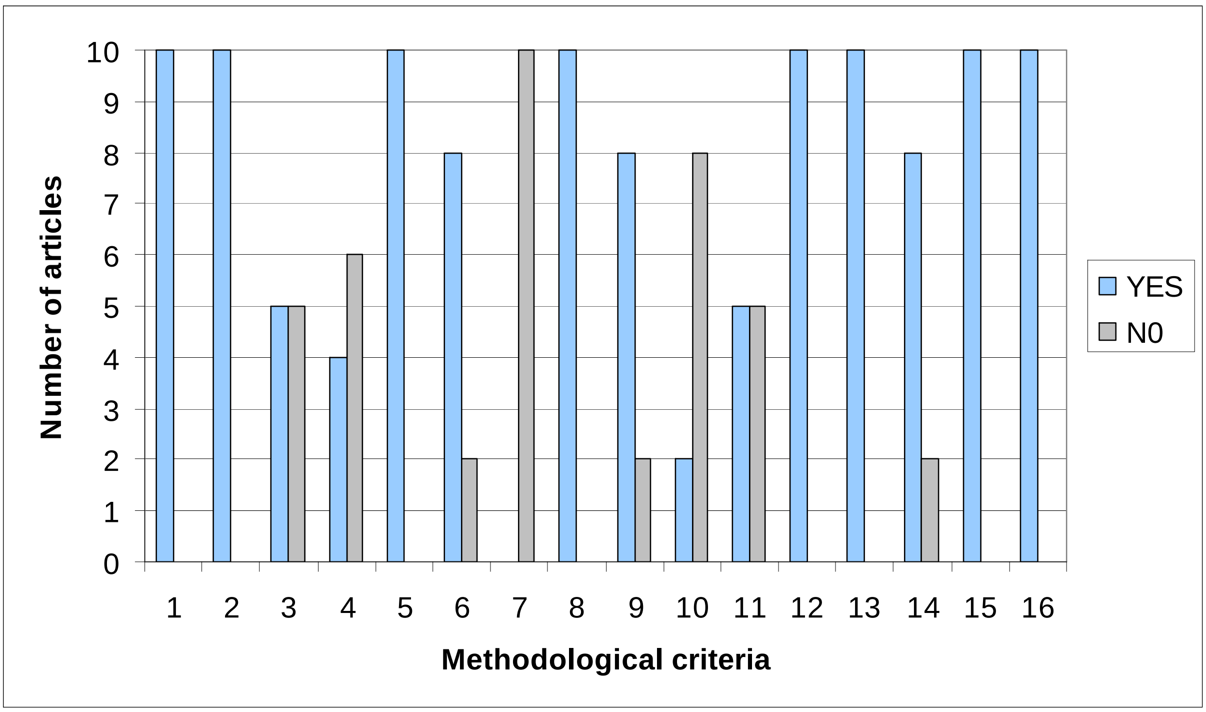


Figure 2.2 Summary of the methodological critical appraisal

2.3.3 Study design and sample description

The studies, as summarized in Table 2.2, were conducted from 1996 to 2006 and six of the ten studies were done in Western Europe. One study was conducted in each of Australia, Canada, USA and Taiwan. An analytical observational study design utilizing a cross-sectional time frame was used in nine studies, except for that by Feldman *et al*. (2002) who used an analytical observational prospective design.

The participants were either elementary and/or high school students and within the age range that defines preadolescents (6 to 12 years old) and adolescents (13 to 18 years old). The sample size varied, ranging from 66 to 10 302, as described in Table 2.2. The response rate of four of the studies, namely those by Vikat *et al*. (2000); Feldman *et al.* (2002) Ramos *et al.* (2005) and Diepenmaat *et al*. (2006) was 77%, 62%, 68.6% and 71.2% respectively. The remaining studies had a response rate greater than the required 80% (Liddle, Williamson & Irwig 1996).

2.3.4 Study aims

The ten eligible studies measured upper quadrant musculoskeletal pain when exposed to either poor sitting posture or psychosocial factors. The aims of seven studies (Cho *et al*. 2003; Diepenmaat *et al*. 2006; Feldman *et al.* 2002; Murphy *et al*. 2007; Niemi *et al.* 1996; Niemi *et al.* 1997; Vikat *et al*. 2000) were similar in ascertaining the prevalence or incidence of upper quadrant musculoskeletal pain and associated factors. The remaining three studies (Harris & Straker 2000; Murphy *et al*. 2004; Ramos *et al*. 2005) had a different aim which is presented in Table 2.2.

Table 2.2 Summary of the study aims and the musculoskeletal pain outcome measurement tools

Author	Age	Sample size	Response rate	Aims	Measurement tool for pain	Pain recall period	Pain definition
Niemi et al. 1996	15-18	714	87%	❖ To describe the prevalence of neck and shoulder pain among high school students ❖ To describe the relationship between pain and static versus dynamic loading of neck and shoulder muscles during leisure-time activities	Nordic Musculoskeletal Questionnaire	weekly and monthly	according to the frequency of pain group 1 = no symptoms group 2 = 1-2 times or less per month group 3 = **once or more per week**
Niemi et al. 1997	adolescents	714	87%	❖ To describe the prevalence of neck and shoulder symptoms among high school students ❖ To determine the relationship between neck and shoulder pain and psychosocial factors such as stress, self-efficacy and depressive symptoms	Nordic Musculoskeletal Questionnaire	12 months	according to the frequency of pain symptom group = pain **more than once a week**
Vikat et al. 2000	14-18	10 302	77%	❖ To determine the prevalence and determinants of self-reported neck or shoulder pain and low back pain among adolescents	Adolescent Health and Lifestyle Survey of Finland	6 months	according to the frequency of pain group 1 = seldom or not at all; group 2 = about once a month; group 3 = once a week; group 4 = almost daily
Feldman et al. 2002	adolescents	502	62%	❖ To determine the incidence of neck and upper limb pain in a cohort of adolescents ❖ To determine whether poor mental health and certain activities are risk factors for developing neck or upper limb pain	Self-designed questionnaire	6 months	according to the frequency of pain pain occurring **once a week**
Cho et al. 2003	16	471	86%	❖ To determine the prevalence of musculoskeletal symptoms during six months ❖ To identify the contributing factors associated with these symptoms ❖ To describe the relationship between psychological distress and musculoskeletal pain among Chinese adolescents	Musculoskeletal Symptom Questionnaire (Nordic Musculoskeletal Questionnaire)	12 months	according to the frequency of pain 1) **symptom** - tingling, numbness, soreness, burning 2) **frequency** - seldom, sometimes, always 3) **intensity** - mild, moderate, severe

Table 2.2 Summary of the study aims and the musculoskeletal pain outcome measurement tools (continued)

Author	Age	Sample size	Response rate	Aims	Measurement tool for pain	Pain recall period	Pain definition
Diepenmaat et al. 2006	12-16	3 485	71.2%	❖ To examine the prevalence of neck and shoulder, low back and arm pain within different socio-demographic groups ❖ To examine the association of pain with computer use, physical activity, depression and stress	Self-designed questionnaire	1 month	according to the duration of pain pain that **lasts for longer than 4 days per month**
Murphy et al. 2007	11-14	679	97%	❖ To report the rates of musculoskeletal pain ❖ To identify possible physical and psychological factors in schools ❖ To evaluate the relationship between pain and physical and/or sychological factors	Nordic Musculoskeletal Questionnaire	weekly and monthly	according to the frequency of pain 1) pain present **in the last week or the last month?** 2) intensity on 3-point scale 3) duration in terms of hours/days
Harris and Straker 2000	10-17	314	N/A	❖ To investigate postures adapted for laptop use and the length of time laptops are used ❖ To determine if musculoskeletal pain is associated with the above	Self-designed questionnaire	none	not mentioned in article
Murphy et al. 2004	11-14	66	N/A	❖ To record postural behavior during static sitting ❖ To identify the extent of neck pain, upper back pain and low back pain ❖ To establish a relationship between sitting posture and pain	Nordic Musculoskeletal Questionnaire	weekly and monthly	according to the frequency of pain 1) pain present **in the last week or the last month?** 2) intensity on 3-point scale 3) duration in terms of hours/days
Ramos et al. 2005	6-14	479	68.6%	❖ To determine the average time children spend on computers either working or playing electronic games ❖ To describe how children use computers or electronic games ❖ To describe the discomfort children may experience while using computers or playing electronic games	Self-designed questionnaire	none	according to the intensity of pain 1) just aches 2) enough to make mistakes 3) enough to take a break 4) enough to stop

2.3.5 Outcome measurement tools for assessing pain

A modified version of the Nordic Musculoskeletal Pain Questionnaire was used in five of the studies (Cho *et al*. 2003; Murphy *et al*. 2004; Murphy *et al*. 2007; Niemi *et al* 1996; Niemi *et al.* 1997). In four studies, the researchers used self-designed pain questionnaires (Diepenmaat *et al.* 2006; Feldman *et al*. 2002; Harris & Straker 2000; Ramos *et al*. 2005). Vikat *et al.* (2000) utilized a modified version of Finland's health and lifestyle survey for adolescence. All the studies used the frequency of pain to classify symptomatic groups of children or adolescents, except for those by Ramos *et al*. (2005) and Diepenmaat *et al.* (2006), which used the duration of pain and the intensity of pain respectively. Participants had frequent pain if symptoms occurred more than once a week. However Cho *et al*. (2003) used descriptive words, i.e. seldom, sometimes and always, to describe the frequency of pain.

The duration of pain was addressed in only three studies (Diepenmaat *et al*. 2006; Murphy *et al*. 2004; Murphy *et al*. 2007) and was determined either in terms of pain persisting for a certain number of hours or days. The intensity of pain was assessed in five studies, using either descriptive words (Cho *et al*. 2003; Ramos *et al*. 2005), a point-scoring scale (Murphy *et al*. 2004; Murphy *et al.* 2007) or weekly reports of pain (Diepenmaat *et al*. 2006).

The pain recall period of this age group varied, from one week to 12 months. Two studies (Cho *et al*. 2003; Niemi *et al*. 1997) required the students to recall pain symptoms for the preceding 12 months. Two studies (Feldman *et al*. 2002; Vikat *et al*. 2000) asked questions about pain for the preceding six months. Four studies

(Diepenmaat *et al*. 2006; Murphy *et al*. 2004; Murphy *et al*. 2007; Niemi *et al*. 1996) used monthly and weekly reports of pain. Harris & Straker (2000) and Ramos *et al*. (2005) did not set a certain time frame within which the students should recall their pain symptoms. The different pain measurement tools, pain recall periods and definitions of pain are summarized in Table 2.

The Nordic Musculoskeletal Pain Questionnaire was not re-tested for validity and reliability, but it is assumed by the researchers to have good validity and reliability because of its frequent use in published reports on pain assessment. Three other studies that used self-designed pain questionnaires (Diepenmaat *et al*. 2006; Harris & Straker 2000; Ramos *et al.* 2005) tested for validity by means of conducting pilot studies or determined concurrent validity. None of the ten eligible studies reported on the reliability of the pain measurement tool.

2.3.6 Postural measurement tools

Sitting posture was evaluated in five of the eligible studies and these studies conducted the evaluation in either a classroom or home setting (Cho *et al.* 2003; Harris & Straker 2000; Murphy *et al*. 2004; Niemi *et al*. 1996; Ramos *et al*. 2005). These five studies aimed to determine the relationship between static sitting posture and musculoskeletal pain. The measurement tools to measure posture varied in each of the five studies. Niemi *et al.* (1996) utilized a self-designed questionnaire to assess the type, frequency and intensity of leisure time activities that involve the static use of the upper extremity, e.g. needlework, computer, etc. However, they did not report the validity and reliability of the posture evaluation questionnaire. Harris & Straker (2000) utilized a self-designed questionnaire for measuring posture and also conducted direct observation of the sitting posture. These tools were used to evaluate the different postures when laptops were used (sitting, lying prone, sitting on the floor) and at different locations (school, home, boarding house). The time spent per session and the frequency of laptop use at home or at school were also recorded. Direct observation of laptop use served as cross-validation of the questionnaire. Cho *et al*. (2003) utilized a checklist that allowed the participants to indicate whether posture was a contributing factor for musculoskeletal pain. This checklist was not validated.

One study (Murphy *et al*. 2004) assessed the sitting posture of schoolchildren by using the Portable Ergonomic Observation (PEO) method, which allows for direct observation of postures in real time in the classroom setting. The PEO measures neck flexion/rotation, trunk flexion/rotation, supported or unsupported sitting and working at a desk. The postures were recorded in relation to upright sitting, e.g. trunk flexion of more than 20º was recorded when the subject's torso was at an angle of 20º or more from the vertical. This measurement tool had been validated in a previous study (Murphy, Buckle & Stubbs 2002). Ramos *et al*. (2005) used a 23-item self-designed questionnaire to assess the duration of static sitting while using a computer or electronic game. The questionnaire was piloted using four children aged six to 11 years to assess whether the construction of the sentences was clear.

2.3.7 Psychosocial measurement tools

Six studies measured psychosocial factors and used a variety of different measurement tools. Three studies utilized commonly used tools, including the five-item MOS–36 Short

Form Health Survey (Feldman *et al.* 2002); the 20-item Centre of Epidemiology Depression Scale (Diepenmaat *et al.* 2006) and the Strengths and Difficulties Questionnaire (Murphy *et al*. 2007). Vikat *et al*. (2000) conducted their study in Finland and utilized the Adolescent Health and Lifestyle Survey of Finland. Cho *et al*. (2003) used the 12-item Chinese Health Questionnaire in a Chinese population. A self-designed questionnaire was utilized in one of the studies (Niemi *et al*. 1997). Depression, stress and psychosomatic symptoms were the most commonly measured variables to determine if adolescents were experiencing psychosocial issues and whether these issues influenced the experience of upper quadrant musculoskeletal pain (Cho *et al*. 2003; Diepenmaat *et al*. 2006; Feldman *et al*. 2002; Murphy *et al*. 2007; Niemi *et al.* 1997; Vikat *et al*. 2000). The other psychosocial aspects measured included family and social factors (Murphy *et al*. 2007; Vikat *et al*. 2000), health behaviors (Feldman *et al*. 2002; Murphy *et al*. 2007; Vikat *et al*. 2000) and academic performance at school (Vikat *et al*. 2000).

Two studies tested for the validity of the psychosocial measurement tools (Cho *et al*. 2003; Diepenmaat *et al*. 2006). Niemi *et al*. (1997) used a self-designed questionnaire without verifying its validity and reliability in detecting psychosocial factors. Vikat *et al.* (2000) used a modified version of Finland's health and lifestyle survey for adolescents and did not retest its validity and reliability. Feldman *et al.* (2002) used a five-item questionnaire derived from the MOS-36 Short Form Health Survey, but did not report whether the modified version was valid and reliable. Murphy *et al.* (2007) utilized the well-known Strengths and Difficulties Questionnaire, but did not report on its validity and reliability in the particular population included in their study. Cho *et al.* (2003) were the only authors to report on the reliability of the psychosocial measurement tool used.

2.3.8 Risk factors for upper quadrant musculoskeletal pain

This review identified the six most common factors associated with the development of upper quadrant musculoskeletal pain among children and adolescents. Static postures, depression, stress, psychosomatic symptoms, gender and age may be associated with the prevalence of musculoskeletal pain.

The association between static sitting posture and upper quadrant musculoskeletal pain among children and adolescents was reported by five of the studies reviewed (Cho *et al*. 2003; Harris & Straker 2000; Murphy *et al*. 2004; Niemi *et al*. 1996; Ramos *et al.* 2005). A study by Niemi *et al*. (1996) found that reports of weekly neck and shoulder pain were significantly associated with static sitting posture that involved static loading of the upper extremities during leisure-time activities among girls ($p<0.001$), but not among boys. Harris & Straker (2000) found a significant association between the maximum time on task for static sitting while using a laptop computer and neck or shoulder discomfort ($X^2=16.51$, $p=0.0024$). Students reported that they considered posture to be the most important contributing factor for neck (43%) and shoulder (15.1%) pain on the checklist administered by Cho *et al*. (2003). Murphy *et al*. (2004) conducted a study in which less trunk flexion movement, between 20º and 45º observed with the Portable Ergonomic Observation method, was significantly associated with self-reported upper back pain in the previous month ($p=0.006$) and week ($p=0.033$), as well as with self-reported neck pain in the previous week ($p=0.047$). Ramos *et al*. (2005) demonstrated an association between the duration of sitting in front of a computer and the prevalence of discomfort. An increase from one hour to more than four hours on the computer equaled an increase of 43% to 71% in discomfort experienced in the neck and shoulders. Neck discomfort was statistically significant for time on the computer at school (p=0.001) and at home (p=0.008).

Niemi *et al*. (1997) found that both adolescent boys and girls with neck and shoulder pain also exhibited relatively higher stress and depressive scores compared with asymptomatic adolescents. The mean difference in the stress score was 1.87 (95% CI: 1.33-2.4) for girls and 0.89 (95% CI: 0.13-1.65) for boys. The stress scores were thus significantly associated with pain in both sexes. However, depression had an association with pain only among girls (mean difference: 0.63; 95% CI: 1.4-0.85), and was less obvious among boys (mean difference: 0.22; 95% CI: 0.14-0.57). Diepenmaat *et al*. (2006) found that high levels of depression and stress were associated with the prevalence of neck, shoulder and arm pain. A depression score of 16 or more was considered to classify a depressed adolescent. Depression in adolescents was significantly associated with the prevalence of neck, shoulder and arm pain. Adolescents with regular or daily stress had a greater chance of experiencing upper musculoskeletal pain than adolescents who never experienced stress (Diepenmaat *et al*. 2006). Diepenmaat *et al.* (2006) also observed that students not living with both their parents had a greater chance of experiencing neck and shoulder pain (OR 1.4; 95% CI: 1.1-1.8). Cho *et al.* (2003) found that students with high psychological distress had significant more neck symptoms (X^2=9.0355, P=0.003) compared with those with low psychological distress scores. Feldman *et al.* (2002) found that lower levels of mental health had a significant influence on the prevalence of upper quadrant musculoskeletal pain. However, after exploring the possible interaction of mental health and working status of the adolescent, it was found that lower mental health was only significantly associated with pain for the adolescents with part-time employment compared with those without part-time employment (OR 1.64; 95% CI: 1.29-2.10). The odds ratios for neck, shoulder and arm pain with perceived depression and stress are presented in Table 2.3.

Vikat *et al.* (2000) reported that the presence of psychosomatic symptoms, e.g. headache, recurrent abdominal pain and tiredness, were significantly associated with neck and shoulder pain. Their findings indicate that adolescents experiencing three or more psychosomatic complaints have a greater chance of having neck and shoulder pain simultaneously. Murphy *et al*. (2007) showed that psychosomatic symptoms experienced at least twice per month, were positively associated with neck pain and upper back pain. The odds ratios for neck and shoulder pain with perceived psychosomatic complaints are presented in Table 2.3.

Table 2.3 Odds ratios for upper quadrant musculoskeletal pain with exposure to depression, stress and psychosomatic complaints

	Neck pain	Upper back pain	Shoulder pain	Arm pain
Depression crude OR (95%)	1.9 (1.5-2.5) Diepenmaat, et al. 2006			2.1 (1.5-2.7) Diepenmaat et al. 2006
Depression adjusted OR (95%)	1.8 (1.42-2.31) Feldman et al. 2002	1.41 (1.16-1.88) Feldman et al. 2002	1.67 (1.29-2.17) Feldman et al. 2002	1.71 (1.23-2.38) Feldman et al. 2002
Stress crude OR (95%)	2.0 (1.5-2.7) Diepenmaat et al. 2006			
Psychosomatic complaints crude OR (95%)	3.4 (2.05-5.64) Murphy et al. 2007	5.24 (2.61-10.51) Murphy et al. 2007		
Psychosomatic complaints adjusted OR (95%)	4.4 Vikat et al. 2000		4.4 Vikat et al. 2000	

More girls reported neck and shoulder pain compared with boys (Diepenmaat *et al*. 2006; Niemi *et al*. 1996, Niemi *et al*. 1997; Vikat *et al*. 2000). The findings of five of the studies reviewed illustrate that pain prevalence increases with age (Harris & Straker 2000; Niemi *et al*. 1996; Niemi *et al*. 1997; Ramos *et al*. 2005; Vikat *et al*. 2000).

2.4 Discussion

This systematic review illustrates that there may be an association between posture and psychosocial factors and the development of upper quadrant musculoskeletal pain in children and adolescents. Only ten eligible studies concerned with children and adolescents that had been conducted in this field of research could be retrieved for this review. The inclusion criteria were applied strictly, especially the criterion concerning the age of the children and adolescents and the outcome measure of upper quadrant musculoskeletal pain.

Epidemiological studies are imperative to understand the etiology of and to recognize the possible risk factors for a disorder (Goodman & McGrath 1991). All eligible studies were observational in design and, although the study by Feldman *et al*. (2002) collected measures prospectively, the study findings did not provide insight into the causality of the upper quadrant musculoskeletal pain. There is a dearth of research that longitudinally establishes the causation of upper quadrant musculoskeletal pain in children and adolescents. It is thus important to focus on conducting well-designed prospective studies to explore causation of upper quadrant musculoskeletal pain. Six of the nine cross-sectional studies acknowledged this study design limitation. The authors of the reviewed studies also emphasized that prospective longitudinal studies must be conducted to investigate causation. (Diepenmaat *et al*. 2006; Murphy *et al*. 2004; Murphy *et al*. 2007; Niemi *et a.l* 1996, Niemi *et al*. 1997; Vikat *et al.* 2000). The aim of cross-sectional studies is to ascertain associations between the variables under study i.e. musculoskeletal pain, psychosocial factors and sitting posture. It is also notable that none of the eligible studies investigated the association between psychosocial factors and sitting posture and further research is warranted.

2.4.1 Measurement tools for musculoskeletal pain

The studies scored high for the appraisal of methodological quality, although it was concerning to note that many studies did not adhere to the criteria regarding methodological biases and the validity and reliability of the measurement tools. The results of the selected studies should therefore be interpreted with caution, especially the pain measurements, because none of the studies defined the frequency, duration or intensity of pain in the same manner. This could create either an under- or an overestimation of the associations made between risk factors and pain. The studies used self-reported musculoskeletal pain measurements and these could be influenced by psychosocial and cultural components (Ming, Narhi & Siivola 2004). However, Schierhout & Myers (1995) stated that subjective measures or self-reports of pain, have good construct validity, good field utility and the ability to assimilate a variety of symptom patterns when used as an outcome measurement tool. The literature states that the validity of that measurement will increase if more aspects of pain are measured (Goodman & McGrath 1991). The recall period for experiencing musculoskeletal pain also varied from weekly to twelve-monthly reports of pain. It is yet unclear what the optimal time frame is within which high school students can accurately recall musculoskeletal pain, but previous research has found a high accuracy of recalled pain intensities over a one-week time interval for children, and this accuracy increases with age (Zonneveld, McGrath, Reid & Sorbi 1997). A standardized approach to measuring musculoskeletal pain in adolescents is lacking and this compromises the comparability between studies.

2.4.2 Measurement tools for sitting posture

The measurement tools for assessing static sitting posture varied from direct observation of sitting posture and direct measurement of postural angles (Harris & Straker 2000; Murphy *et al*. 2004) to self-reported questionnaires (Cho *et al*. 2003; Niemi *et al*. 1996; Ramos *et al*. 2005). Vieira & Kumar (2004) reported that biomechanical measures were the more preferred manner to report posture however, these are more time consuming and the sample sizes are very small. One of the five studies that reported on sitting posture (Murphy *et al*. 2004), quantitatively measured the postural angles of 66 children in the classroom and might give a better indication of the association between posture and pain. The results of the self-reported posture questionnaires showed significant associations between static sitting posture and upper quadrant musculoskeletal pain. Static sitting posture was not adequately assessed in the eligible studies and it consequently is difficult to conclude if sitting posture is a risk factor for upper quadrant musculoskeletal pain.

2.4.3 Measurement tools for psychosocial factors

Each study used a different measurement tool and assessed different psychological and social aspects of behavior. Two studies measured psychosomatic symptoms when assessing musculoskeletal pain and found a strong association between these two types of pain. Vikat *et al.* (2000) suggested that neck pain could be more of a psychosomatic complaint than a musculoskeletal symptom. When psychosocial elements are assessed in a population experiencing pain, any somatic items must be excluded from the questionnaire to avoid subsequent inflated psychological scoring (Pincus, Burton, Vogel & Field 2002). The opposite might also occur when a patient with psychosocial issues somatizes and presents as a patient experiencing musculoskeletal pain or discomfort. Somatization is a process by which psychological distress is expressed as physical symptoms (http://www.medterms.com).

2.4.4 Risk factors for upper quadrant musculoskeletal pain

Three studies found that the duration of static sitting was associated with upper quadrant musculoskeletal pain (Harris & Straker 2000; Murphy *et al.* 2004; Ramos *et al.* 2005). This has a definite implication for prevention and management strategies of upper quadrant musculoskeletal pain among children and adolescents. The National Institute for Occupational Health and Safety (1997) found that physical exposure, e.g. lifting, forceful movements, awkward posture and static work postures, increase the development of neck and shoulder symptoms among the adult population. Some of these exposures might be present in schools, e.g. carrying heavy school bags and prolonged static sitting. This review presented evidence to support that the duration of static sitting increases upper quadrant musculoskeletal pain among children and adolescents, and that this was the only physical exposure that was similar to that of the adult population. This review illustrates that depression, mental distress and psychosomatic complaints are the most common psychosocial factors influencing the experience of upper quadrant musculoskeletal pain. High job demands, low social support from co-workers, monotonous work, limited job control and work-related stress are psychosocial risk factors for neck and upper extremity pain among adults (NIOSH 1997; Van den Heuvel, Van der Beek, Blatter, Hoogendoorn & Bongers 2005), which is in contrast with the psychosocial factors found among children and adolescents. The measured psychosocial factors in children and adolescents were related more to the emotional and social behavior.

The impact of posture and psychosocial factors on the experience of upper quadrant musculoskeletal pain also depend on gender and age (Niemi *et al*. 1997). Niemi *et al*. (1997) found an association between upper quadrant musculoskeletal pain and static sitting posture for girls and between upper quadrant musculoskeletal pain and depression for girls. Harris & Straker (2000) and Ramos *et al*. (2005) found an interaction between increased age and the duration of static sitting. A recent review by Trevelyan & Legg (2006) regarding the risk factors associated with back pain, found similar trends as those seen in this review. Trevelyan & Legg (2006) reported that a prolonged static sitting posture was a common provoking factor for low back pain, and that psychosocial factors, especially depression, loneliness, somatic complaints, anxiety and an abnormal family structure, increase the prevalence of musculoskeletal pain among children and adolescents. Grimmer, Nyland & Milanese (2006) found that the odds of girls reporting low back pain five years later was 4.4 (95% CI: 1.9-10.9), and that gender and age consequently also influence low back pain.

2.4.5 Clinical implications

This review encourages researchers to define psychosocial factors that have an influence on the experience of musculoskeletal pain in children and adolescents and to utilize measurement tools for psychosocial factors, static sitting posture and upper quadrant musculoskeletal pain that have adequate validity and reliability. The outcome of this review stresses the multidisciplinary approach needed to address musculoskeletal pain experienced by children and adolescents because of its diverse associations with postural and psychosocial factors. The management of upper quadrant musculoskeletal pain should include an assessment of psychosocial factors, e.g. depression, stress and psychosomatic complaints in order to refer children and adolescents to the appropriate health professional and to assess the duration of static sitting posture in order to encourage children and adolescents to minimize the length of static sitting.

2.5 Conclusion

It is evident that psychosocial factors, especially depression, mental distress and psychosomatic complaints, have an influence on the development of upper quadrant musculoskeletal pain in children and adolescents. Due to limited studies on the influence of sitting posture, it was difficult to conclude whether seated postural alignment has any effect on upper quadrant musculoskeletal pain, although the duration of static sitting was found to be significantly associated with musculoskeletal pain. There is a lack of consistency regarding the assessment of upper quadrant musculoskeletal pain as an outcome measure and there is a need to further explore the relationship between static sitting posture and musculoskeletal pain.

CHAPTER 3

METHODOLOGY

This study is one component of an epidemiological research project aimed at promoting spinal health among adolescent high school learners. The comprehensive research project comprised a series of consecutive studies to describe the prevalence of musculoskeletal pain and associated factors and to investigate risk factors causing upper quadrant musculoskeletal pain in adolescent high school learners using desktop computers.

3.1 **Research Question**

The study methodology presented in this chapter describes the procedures that were followed in order to answer the research question: Are postural alignment and psychosocial factors associated to the development of upper quadrant musculoskeletal pain in high school learners who use desktop computers?

3.2 **Aim of the Study**

The aim of the study was to determine whether postural alignment (head tilt, cervical angle, thoracic angle and shoulder pro- and retraction angle) and psychosocial factors (depression and anxiety) are associated to the development of upper quadrant musculoskeletal pain in grade ten high school learners working on desktop computers.

3.3 **Objectives**

The objectives of this study were:

- ❖ To describe the sitting postural alignment of the grade ten school learners by using the Portable Posture Analysis Method (PPAM). This method measures the following angles in the sagittal plane: head tilt; cervical angle; shoulder protraction/retraction angle and thoracic angle. (Van Niekerk, Louw & Vaughn 2007)

- ❖ To assess psychosocial factors by using the standardised Beck Depression Inventory (BDI) to assess depression and the Multidimensional Anxiety Scale for Children (MASC) to assess anxiety.

- ❖ To determine the onset and area of upper quadrant musculoskeletal pain repeatedly at three and six months, using the Computer Usage Questionnaire (Smith *et al.* 2007).

3.4 **Study Design**

An observational analytical study design was used to conduct a prospective study over a six-month period.

3.5 **Study Population**

The population consisted of a cohort of grade ten high school learners, both boys and girls aged between 15 and 17 years, who had commenced with Computer Studies as part of their curriculum at the beginning of the 2007 academic school year.

3.6 **Sampling Method**

3.6.1 <u>Recruitment of schools</u>

The government schools of the Western Cape of South Africa are divided into seven regions, called Educational Management Development Centres (EMDC), of which four are in the Cape Metropole. The study was conducted in these four EMDCs due to their easy accessibility. The geographical layout of the EMDCs appears in Appendix C.

Permission was obtained from the Western Cape Education Department (WCED) for the study to be conducted in the four regions of the Cape Metropole. The letter of consent from the WCED appears in Appendix D. High schools in the four EMDCs of the Cape Metropole that had fully functional computer rooms and offered either Computer Studies or Compu-typing for curriculum delivery were eligible for selection. The list of all the eligible schools were pooled and randomised statistically (Smith 2006). Six high schools were selected on this basis. Because the schools were selected randomly, the sample of participants was representative of the high school population of the Western Cape Metropole. The selected schools reflected the range of socio-economic conditions and the geographical spectrum of Cape Metropole high school learners.

The principal researcher approached the selected high schools in the last term of 2006 and invited the principals and representative teachers of Computer Studies and Compu-typing to attend an information session held at Stellenbosch University. The researcher supplied each principal with a document that gave a detailed description of the purpose of the project, what was expected of the participating learners and the time frame in which data collection would take place at the school. The principals that were unable to attend the session were contacted telephonically and the document was faxed or e-mailed to the respective schools. All six principals gave their consent for the school learners to participate in the study. Figure 3.1 gives a diagrammatical layout of the procedure used to recruit the six high schools.

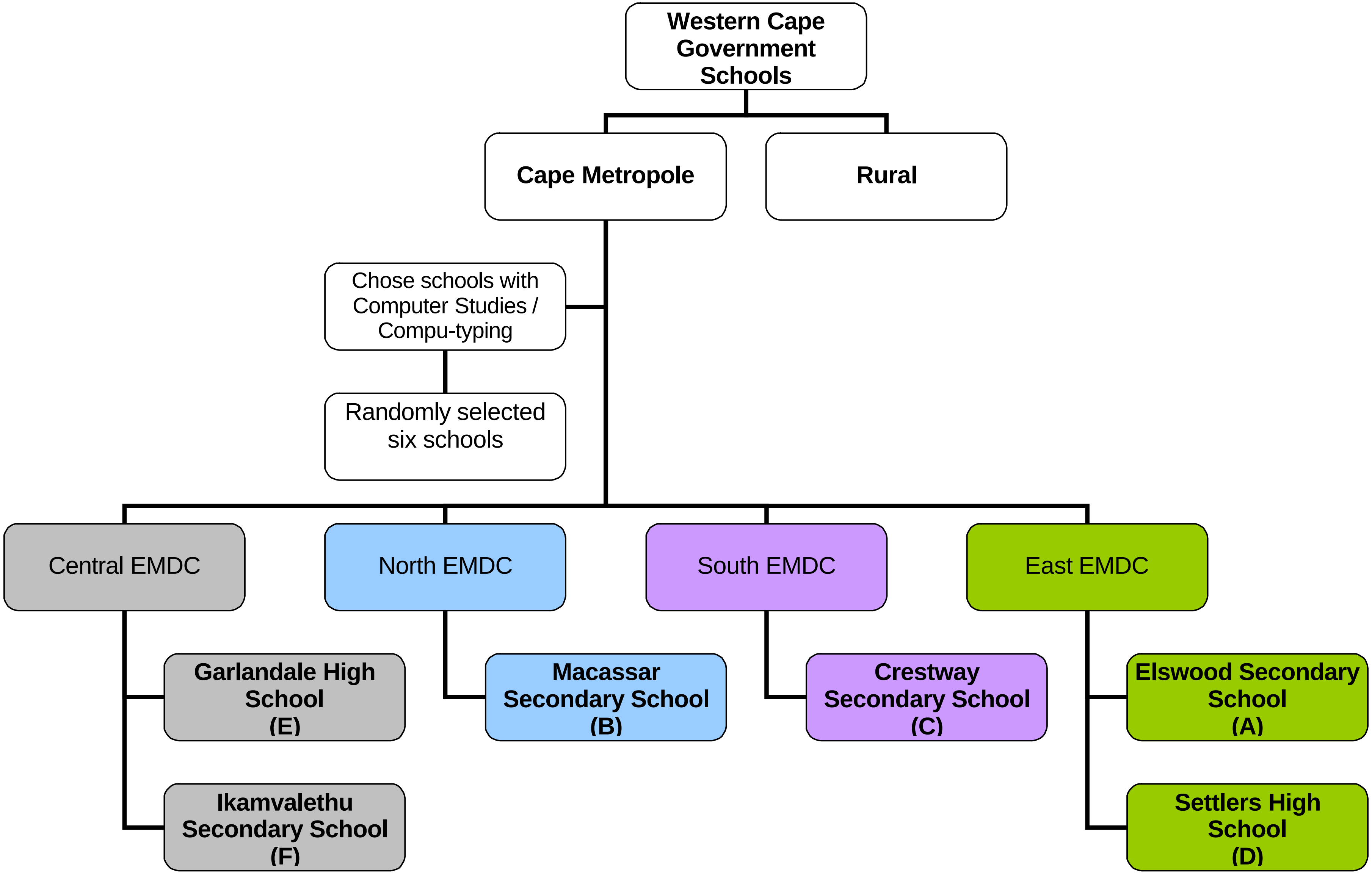


Figure 3.1 A flow chart to describe the recruitment procedure of the selected six high schools

3.6.2 Recruitment of the school learners

The grade ten high school learners who chose Computer Studies or Compu-typing at the beginning of the academic year (January 2007) received tuition on desktop computers in the school computer room. This was the first time that these grade ten learners received curriculum delivery via computers. The principal researcher contacted the various representative teachers of Computer Studies or Compu-typing at each school and consulted them for a suitable time to come to the school and present information about the study to the learners. In January 2007, 322 grade ten learners from the six selected high schools were addressed by the researcher concerning the proposed study. On the same day, the learners were screened for musculoskeletal symptoms or discomfort by administering the pain assessment component of the Computer Usage Questionnaire that dealt with the onset, area and intensity of musculoskeletal symptoms (Smith *et al.* 2007). A body chart was used so that the learners could indicate the area of their pain. This is presented in Appendix E. The Computer Usage Questionnaire (CUQ) was designed to determine the prevalence and associative factors for musculoskeletal symptoms among South African high school learners. The CUQ was peer reviewed by a panel of nine experts in the field of ergonomics and by children for its face, content and construct validity. The CUQ was also given to a learner focus group to determine if all the questions were stated clearly and unambiguously. This instrument was shown to be a stable, reliable and valid tool for assessing musculoskeletal dysfunction among a South African high school learner population and to determine associative factors related to the dysfunction (Smith *et al.* 2007). The questionnaire took 15 minutes to complete. Once the inclusion and exclusion criteria, as presented in sections 3.6.3 and 3.6.4, were applied, 187 learners were excluded. Two learners were repeating their grade ten school year, 124 learners suffered from slight musculoskeletal pain or discomfort, 38 learners complained of severe musculoskeletal symptoms and 23 learners fell outside the age restriction. The 135 **asymptomatic** learners were invited to participate and letters of informed consent (Appendix F) were given to each learner in his/her mother language. The researcher obtained 109 written informed consent letters from the parents or legal guardians and the participating learners prior to commencing with data collection. The sample size was not calculated statistically prior to the screening process, because only six high schools were randomly selected and invited to participate in the study. There was limited time available at the schools due to academic programmes and the lengthy data collection at baseline made it possible to collect data from 120 learners. The participating learners were monitored for six months. This period was chosen due to the time frame in which the project needed to be completed and because of the prospective nature of the study design.

3.6.3 Inclusion criteria

The following inclusion criteria were applied to the sample population:

- Male and female learners who commenced with Computer Studies or Compu-typing as a subject at the beginning of the 2007 academic year
- Learners that were in grade ten, aged 15 to 17 years old
- Learners who had no history of musculoskeletal pain or discomfort in the month prior to data collection
- Learners from whom parental/legal guardian consent had been obtained

- Learners who were present at school on the day of data collection

3.6.4 Exclusion criteria

The following exclusion criteria were applied to the sample population:

- Learners who were unable to read or write in English, Afrikaans or Xhosa because the questionnaires were presented in these three languages
- Learners who did not understand English or Afrikaans because the instructions were given only in these two languages
- Learners diagnosed with movement disorders or with severe fixed skeletal abnormalities, as investigations into disease and severe postural abnormalities did not conform with the aims of the study
- Learners, who had failed Computer Studies or Compu-typing in or before 2006 and were repeating the subject, since they had already been exposed to curriculum delivery via the computer.

Figure 3.2 demonstrates the recruitment procedure used to form the study sample.

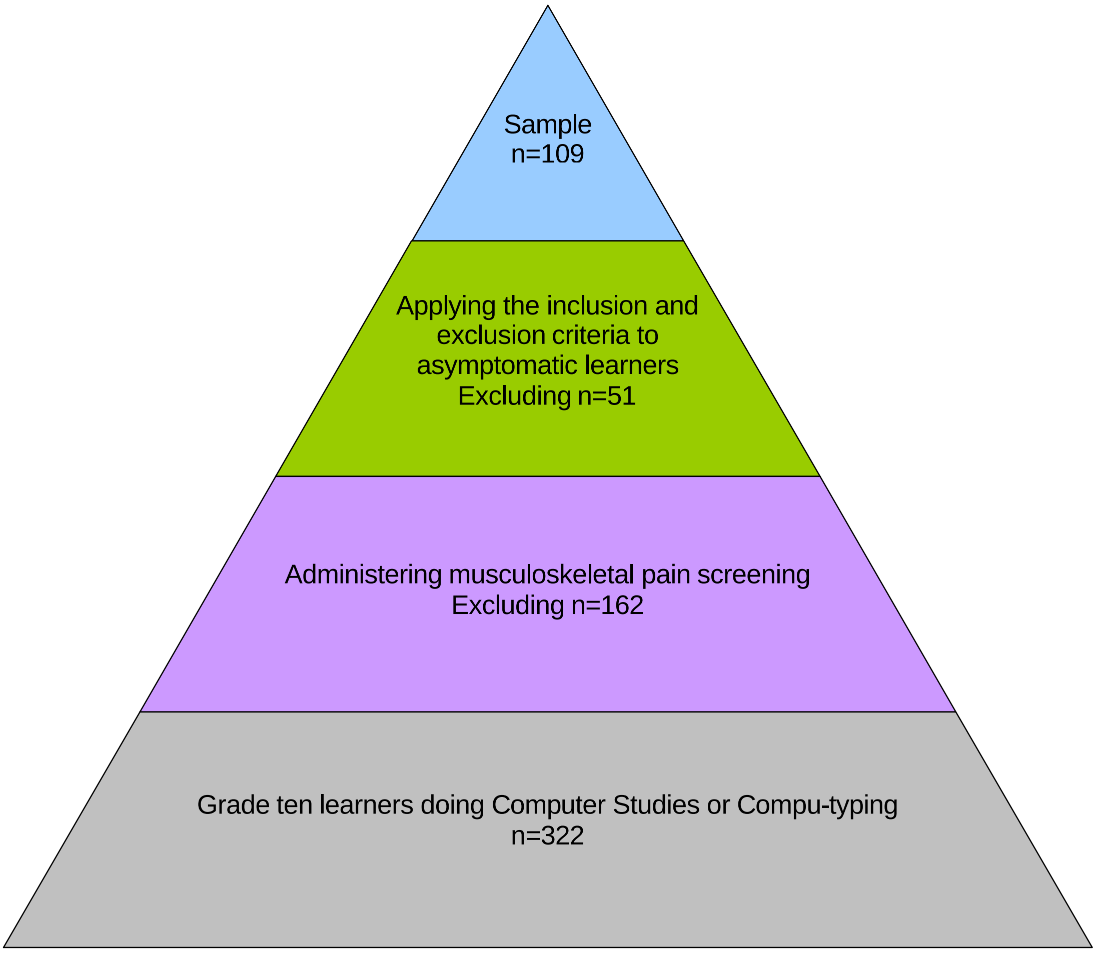


Figure 3.2 A pyramid to describe the procedure by which the high school learners were selected

3.7 Measurement Tools and Measurement Variables

3.7.1 Measurement tool for height and weight

Height was measured with a steel tape measure that was mounted against the wall and weight was measured with a calibrated digital scale.

3.7.2 Measurement tool for describing sitting postural alignment

Sitting postural alignment was measured at baseline by using the Portable Posture Analysis Method (PPAM). This measurement tool was developed to measure the sitting postural alignment of school learners while they sit in front of desktop computers (Van Niekerk *et al*. 2007). The PPAM consists of a digital camera (Fujifilm Finepix S5100), Intellect Software (Version 1.2.2), retro-reflective markers and a computer that is compatible with Windows 2000 or Windows XP. This tool measured the following four postural angles in the sagittal plane (also see Figure 3.3 and Figure 3.4):

- **Head tilt** – the angle between a line drawn from the canthus of the eye to the midpoint of the tragus of the ear and the horizontal line through the tragus of the ear (Raine & Twomey 1997; Straker & Mekhora 2000)
- **Cervical angle** – the angle between a line drawn from the midpoint of the tragus of the ear to the C7 spinous process and the horizontal line through the C7 spinous process (Raine & Twomey 1997)
- **Shoulder protraction/retraction angle** – the angle between a line drawn from the midpoint of the humeral head to the C7 spinous process and the horizontal line through the midpoint of the humerus (Raine & Twomey 1997)

- **Thoracic angle** – the angle between a line drawn from the C7 spinous process to the midpoint of the superior border of the manubrium and a line drawn from the T8 spinous process to the midpoint of the superior border of the manubrium (Szeto, Straker & O'Sullivan, 2005b)

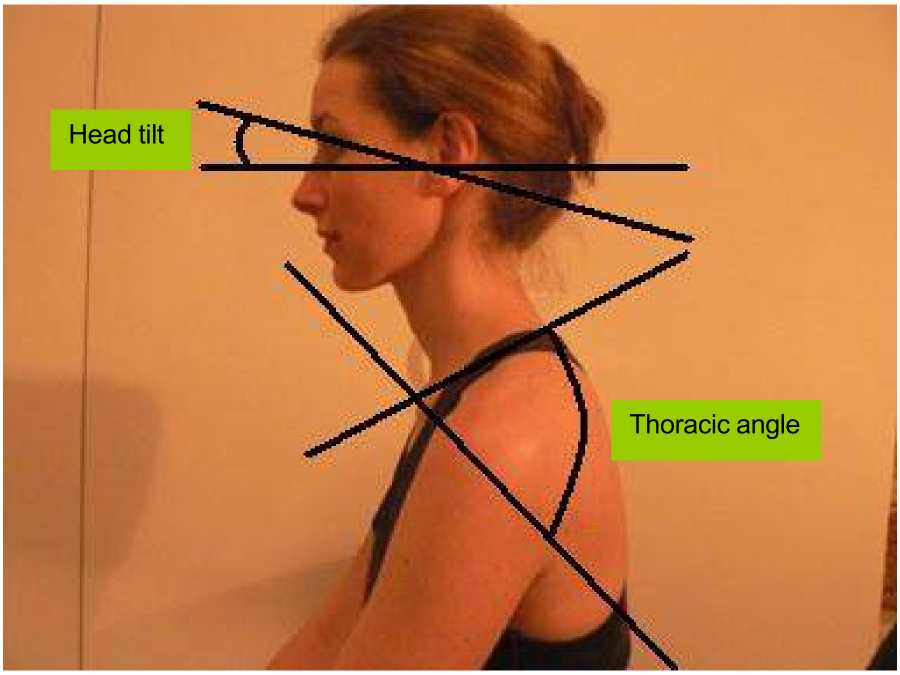


Figure 3.3 The head tilt angle and the thoracic angle in the sagittal plane

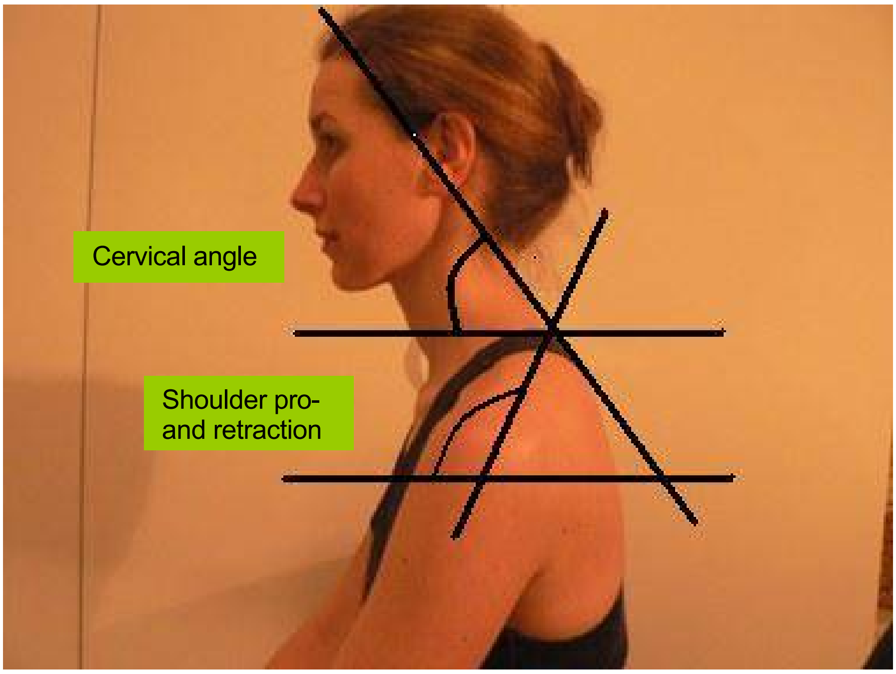


Figure 3.4 The cervical angle and the shoulder pro- and retraction angle in the sagittal plane

The PPAM enabled postural assessment in the sagittal plane by taking photographs of the subject's dominant side. Only the dominant side was photographed to minimize the effect of muscle imbalances between the dominant and non-dominant sides. In order for the photographs to capture the landmarks in the sagittal plane, retro-reflective markers were placed on the learner's canthus of the eye, the midpoint of the tragus of the ear, the spinous processes of C7 and T8, the superior border of the manubrium and the midpoint of the humeral head. The retro-reflective markers for the spinous processes of C7 and T8 and the manubrium were required to be positioned away from the body in order to be visible on the photograph and were thus positioned on a 10 cm wooded stick perpendicular to the surface of the skin. Figure 3.5 shows a learner with the retro-reflective markers in position.

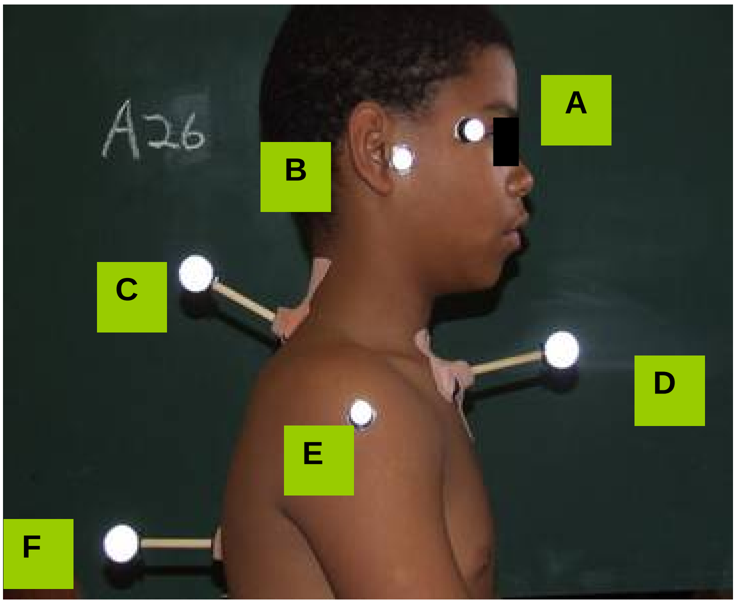


Figure 3.5 A photograph showing the placement of the retro-reflective markers on a learner

A: Canthus of the eye

B: Trachus of the ear

C: C7 spinous process

D: Superior border of the manubrium

E: Midpoint of the humeral head

F: T8 spinous process

Intellect Software was designed to calculate the four abovementioned postural angles. A project to establish the validity and reliability of this tool was conducted in 2006. The intra-class correlations (ICC) for the validity of the postural angles, as measured against the Low Dose Radiation X-ray System (LODOX), were 0.91, 0.93, 0.87 and 0.91 for head tilt, cervical angle, shoulder pro- and retraction angle and thoracic angle respectively and illustrated excellent reliability with an ICC ranging between 0.94 and 0.99 (Van Niekerk et al. 2007).

3.7.3 Measurement tool for assessing psychosocial factors

Psychosocial factors such as depression and anxiety were evaluated at baseline by using the standardised 21-item Beck Depression Inventory (BDI) (Beck & Steer 1987) and the 39-item Multidimensional Anxiety Scale for Children (MASC) (March, Parker, Sullivan, Stallings & Conners 1997). The BDI and the MASC appear in Appendix G and Appendix H respectively.

The BDI has 21 items measuring cognitive, affective, somatic and behavioural symptoms of depression. Each item has four statements rated from 0 to 3. The BDI has excellent screening measure properties and can differentiate depressed from non-depressed adolescents. Higher scores would indicate more severe depression. Among an adolescent school sample a total score of 16 and above had 100% sensitivity and 93% specificity (Barrera & Garrison-Jones 1988). The MASC is a 39-item questionnaire with a four point Likert-style scale. It measures four subdivisions of anxiety - Physical symptoms, Harm avoidance, Social anxiety and Separation/Panic. The MASC demonstrates satisfactory to excellent reliability across age and gender and is sufficiently stable to use in a research setting (March & Sullivan 1999). Both the BDI and the MASC have been used in previous studies in a South African adolescent population (Fincham, Schickerling, Temane, Nel, De Roover & Seedat 2007; Seedat, Nyamai, Njenga, Vythilingum & Stein 2004).

3.7.4 Measurement tool for assessing computer usage

The Computer Usage Questionnaire (CUQ) was administered at baseline to determine computer use at home and at school. Exposure to computer use was described in terms of the duration per sitting session, the frequency of weekly usage and the amount of hours per week. This section of the CUQ appears in Appendix I and its validity and reliability are discussed in section 3.6.2.

3.7.5 Measurement tool for determining onset and area of pain

Musculoskeletal pain response was measured at three and six months (Karels, Bierma-Zeinstra, Burdorf, Verhagen, Nauta & Koes 2007) by completing the musculoskeletal pain section of the CUQ. The learners were asked to recall any upper quadrant musculoskeletal pain during the preceding month (Diepenmaat *et al*. 2006). This was the same questionnaire that was utilised for the musculoskeletal pain screening (section 3.6.2), except for two questions from the original questionnaire that were added to this musculoskeletal pain questionnaire. These two questions asked whether learners wanted to stop using the computer or doing any other activities due to musculoskeletal pain or discomfort (Smith *et al*. 2007). The questionnaire for determining upper quadrant musculoskeletal pain appears in Appendix J and the validity and reliability are discussed in section 3.6.2.

3.8 Ethical Considerations

Approval for this study was obtained from the Committee for Human Research of Stellenbosch University (Appendix K). The study was conducted according to internationally accepted ethical standards and guidelines. Written informed consent was obtained from the Western Cape Education Department (Appendix D) and written informed consent was obtained from the child and his/her parents/legal guardians prior to the child's acceptance to participate in the project (Appendix F). Each child had the right to withdraw at any time by notifying the researcher.

3.9 **Study Procedure**

3.9.1 Arrangement for data collection at baseline

The researcher consulted with the computer teachers of each school a month in advance to set dates for data collection in February 2007. For the postural measurements to be taken, the computer room of the school had to be available to the researcher. According to the number of eligible learners at one school, the researcher established a time frame within which the data collection would take place, and this was submitted to the respective teachers. For 20 learners it would take up to three hours to complete the assessment at baseline.

3.9.2 The research team and their responsibilities

Three assistants accompanied the principal researcher in February 2007 to do the baseline measurements. The principal researcher conducted a detailed training session with all three assistants prior to collection of data. The two assistants who operated the digital cameras were trained in the preparation of the learner's workstation, the setting up of the digital cameras and the taking of the photographs in order for postural photographs to be taken in the same manner. The third assistant received instructions for assisting the learners while they completed the questionnaires.

The role of each team member was as follows:

- **Principal researcher**: Explained the study procedure to the learners in the computer room of the school; placed and removed the retro-reflective markers; digitised the photographic data
- **Assistant 1**: Operated the first digital camera; measured weight and height of the school learners

- **Assistant 2**: Operated the second digital camera; measured weight and height of the school learners
- **Assistant 3**: Explained and administered the three questionnaires to the learners and supervised them while they complete the questionnaires

3.9.3 Measurements at baseline

3.9.3.1 ***Preparation of classroom and equipment for postural measurements***

Postural evaluation was conducted in the school's computer room. The postural alignment of two learners was measured simultaneously using two digital cameras according to the Portable Posture Analysis Method as described in section 3.7.2. The two cameras were operated by two research assistants. The digital camera was mounted on a tripod 1m to the right of the learners and perpendicular to their sagittal plane. The learners were all right dominant. Six reflective markers were visible on the photographs. One camera captured the angles of one subject. A green board was placed on the non-dominant side of the learner and was visible behind the learner. This board also displayed the learner's identification number for the study. Figure 3.7 illustrates the setup of the green boards.

Figure 3.7 The set up of the green board behind the learner

Prior to assembling the learners, the research assistants helped the principal researcher to set up the two digital cameras and the two green boards at the two work stations in the computer room.

The study sample at each school was divided into two groups, one for girls and one for boys. The one group completed the weight, height and postural alignment assessment in the computer room while the other group completed the questionnaires on psychosocial factors and computer use in another classroom. The third assistant accompanied the latter group, which allowed the learners to ask questions if necessary. Once all the learners from the two groups have completed either the postural alignment or the psychosocial assessment they exchanged settings to allow for the other measurements to be completed.

3.9.3.2 ***Height and weight measurements***

Two assistants took the height and weight measurements before commencing with the postural evaluation. The assistants measured the height by using a steel tape measure (Panamedic stature meter) that was mounted against the wall and weight was measured with a calibrated digital scale (Terrailon Electronic Scale).

3.9.3.3 ***Subject preparation for evaluation of sitting postural alignment***

The female learners wore tops with thin straps and the male learners were without tops to adequately expose the landmarks where the retro-reflective markers were to be placed. The specified landmarks included the canthus of the eye, the midpoint of the tragus of the ear, the spinous processes of C7 and T8, the midpoint of the superior border of the manubrium and the midpoint of the humeral head. These areas were firstly cleaned with alcohol to allow proper contact of the markers with the skin. The retro-reflective markers for the canthus, the tragus and the humeral head were attached to the skin using double-sided tape. The markers for C7, T8 and the manubrium were mounted on a 10cm wooden stick and inserted in a foam holder before fastening them to the skin with elastoplast (refer to Figure 3.5). All the retro-reflective markers were placed on the dominant side of the learners by the principal researcher. The participating learners were all right handed and therefore markers were only placed on the right side. The learners were instructed to sit in front of their computers as they normally did when performing a curriculum activity on the computer.

3.9.3.4 ***Postural evaluation***

The two learners measured simultaneously were instructed to perform a 10-minute curriculum-specific task (Szeto, Straker & Raine 2002) while the postural measurements were taken. Ten minutes were chosen in order to minimise disruption of the academic programme of the school. Three photographs were taken during the ten minute curriculum-specific task. The first photograph was taken after the learner was settled behind his/her computer and had assumed with the task. Both assistants had stop watches in order to take the second photograph at five minutes and the third photograph at ten minutes. The first two photographs were taken to accustom the learners to the postural assessment proceedings, but only the photograph taken at the 10-minute interval was used for data processing. The postural measurements took 15 minutes for each set of two learners to complete. After the learners had completed their

10-minute typing task, the principal researcher removed the retro-reflective markers and the markers were prepared for the next set of two learners.

3.9.3.5 *Psychosocial measurements and computer usage*

The third assistant administered the Beck Depression Inventory, the Multidimensional Anxiety Scale for Children and the Computer Usage Questionnaire to the learners in another classroom adjoining the computer room. It took 30 minutes to complete all three questionnaires.

3.9.3.6 *Time period for data collection per school*

Six days were spent assessing sitting postural alignment and psychosocial factors. The learners were assessed in the morning, during school hours. Elswood Secondary School, Crestway Secondary School, Ikamvalethu Secondary School and Garlandale High School took one morning each to complete the baseline data collection. Settlers High School and Macassar Secondary School were assessed on the same day. The research team went back to Macassar Secondary School on the sixth day to measure those learners whose letters of informed consent were outstanding on the initial day of assessment. It took one learner approximately 45 minutes to complete the full assessment at baseline. If a total of 20 learners per school took part, it took three hours to complete the assessment at one school.

3.9.4 Measurements three- and six-months post baseline

In May 2007, the onset and area of upper quadrant musculoskeletal pain of the same study sample were measured. The representative teachers were contacted by the principal researcher one month in advance to set a date for the three-month data collection. The principal researcher collected all the follow-up data at the participating schools. The learners were asked to complete the musculoskeletal pain section of the Computer Usage Questionnaire as described in section 3.7.4 (Appendix J). This questionnaire took 15 minutes to complete.

In August 2007, six months post baseline, the researcher contacted each school in advance and collected repeat measurements of the onset and area of upper musculoskeletal pain. The same learners completed the musculoskeletal pain questionnaire as described for the three-month interval data collection. This took 15 minutes for the learners to complete. Figure 3.8 is a diagrammatical presentation of the specific measurements taken at baseline, and at three and six months.

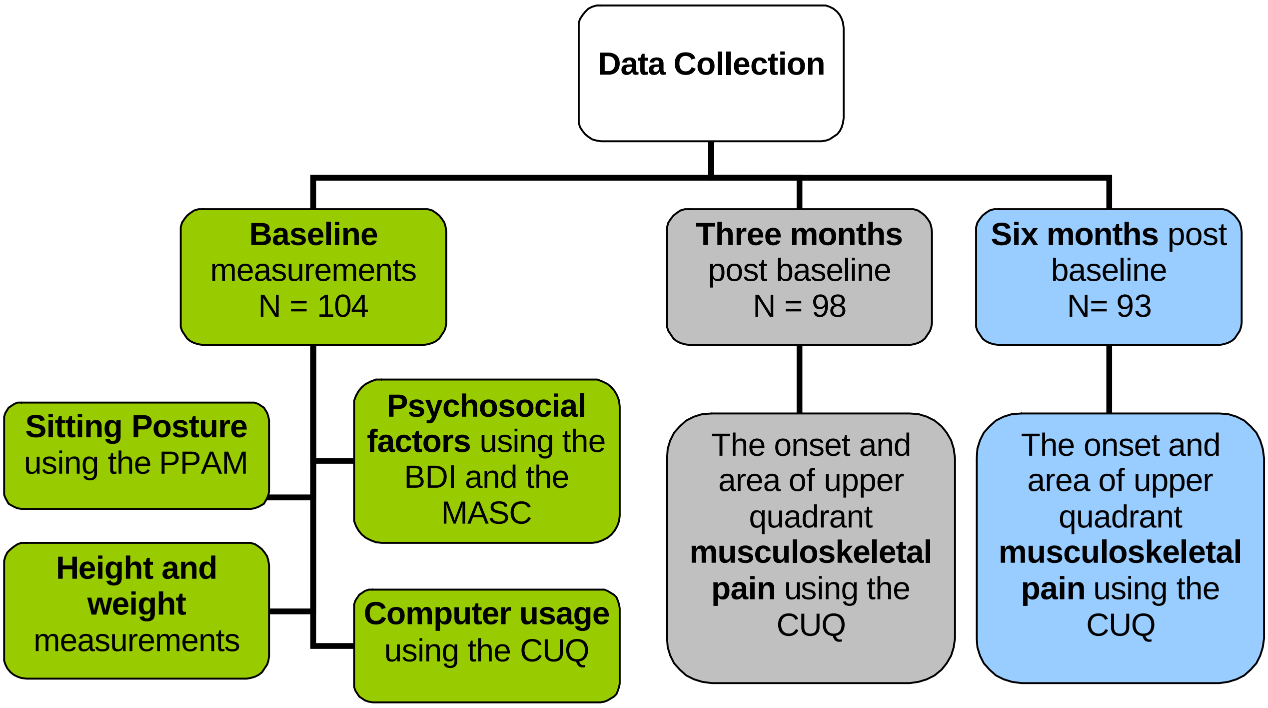


Figure 3.8 Flow chart to demonstrate the measurements taken at various time intervals

3.10 **Processing of Data**

3.10.1 Portable Posture Analysis Method (PPAM)

The four postural angles were analysed in a similar manner to the process followed in the validity and reliability testing of the PPAM (Van Niekerk *et al.* 2007). The photographic data were imported to the Intellect 1.2.2 software (DVT Corporation) on a laptop computer via a USB data-transfer cable and to DVT cameras were not used in this project, therefore the emulator function was utilised to process the images from the hard drive. The Intellect software automatically displayed softsensors for each spherical retro-reflective marker and marker stem (wooden stick) on the photograph. The principal researcher manually fitted the corresponding softsensor on the centre of the spherical marker as well as on the edge of the marker stem. By means of edge detection the software fitted a circle to the spherical marker and a straight line to the marker stem in order to generate X and Y coordinates for the six spherical markers. In order to ensure exact fitting of the markers, the markers had to be clearly visible against a contrasting background, hence the use of a green board behind the learners. Spherical reflective markers were utilized to minimise the presence of shadows behind the markers and with an operational flash, it enhanced the precision of the digitising process. Figure 3.9 illustrates the automatically displayed softsensors for each spherical retro-reflective marker and marker stem (wooden stick) on the photograph.

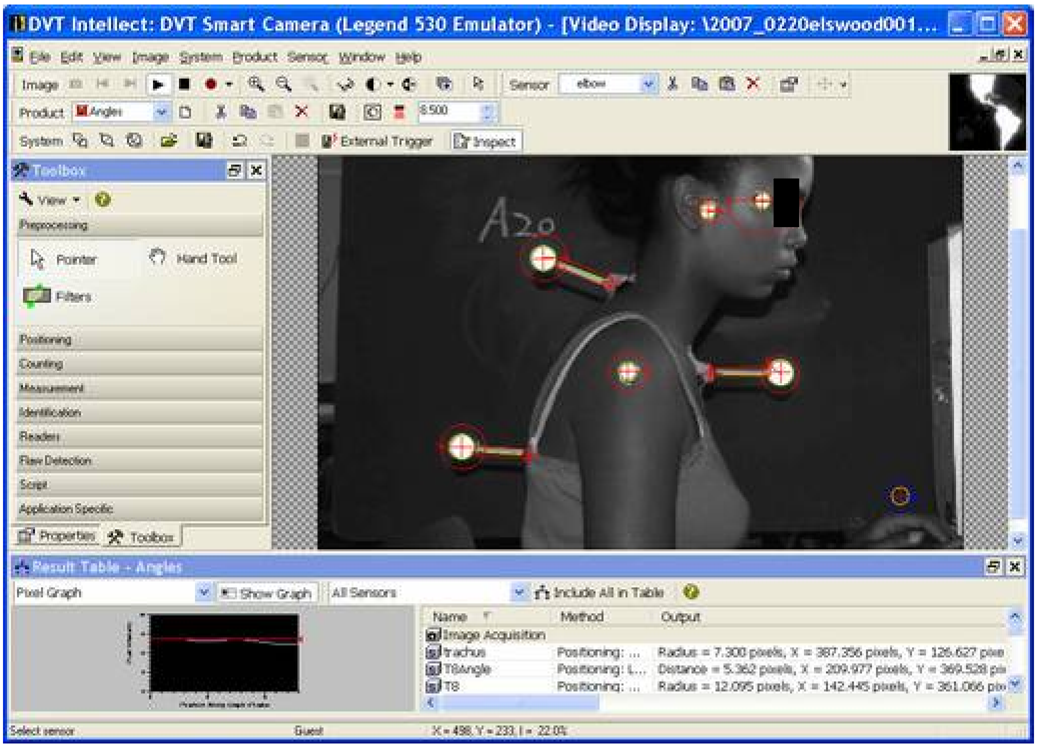


Figure 3.9 DVT Intellect Interface: Edge Detection Function

Once the X and Y coordinates of the six retro-reflective markers were calculated, these values were exported to the DVT Reader, which was used to calculate the four postural angles (the DVT Reader is a program developed for this project to automate the data transfer and calculations.) Figure 3.10 illustrates the DVT Reader interface. Due to possible rotational differences in the sagittal plane between photographs, the length, in image pixels, of the marker stems were estimated so that the actual point on the learner's body could be calculated (manubrium, C7 spinous process and T8 spinous process). The positions on the body were used to calculate the postural angles as described in section 3.7.2.

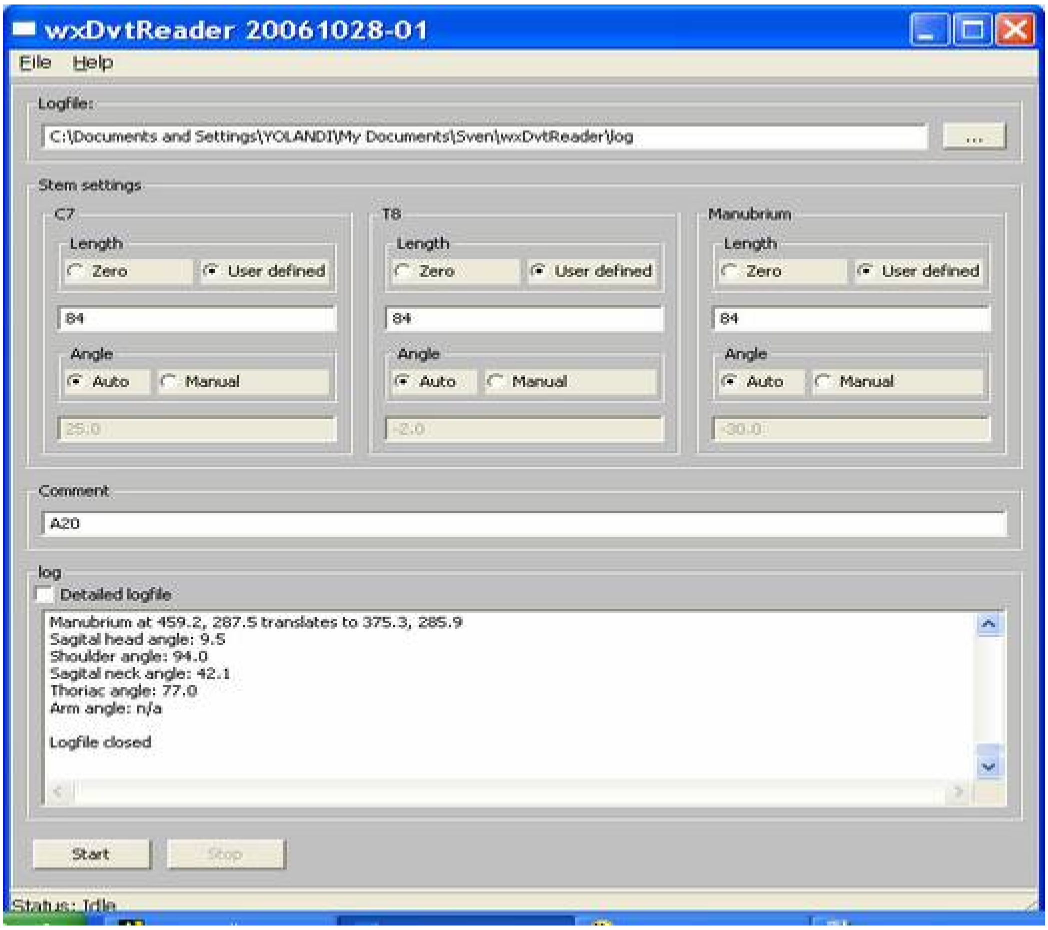


Figure 3.10 DVT Reader Interface

This project measured the sitting postural alignment of learners in a classroom, i.e. in a real-life situation where the learners use the desktop computers for curriculum delivery. The classroom setting was different from the laboratory setting used in the validity and reliability testing of the PPAM. In the classroom, the learners could type for ten minutes whereas the laboratory setting did not include computer usage. After inspecting the data, the cervical angle measurements of three learners were calculated as negative angles. Due to possible software limitations the angles were calculated manually using the specified formulas. The formulas to calculate the postural angles are presented in Appendix L.

The principal researcher performed all the digitising of the photographic data, while a research collaborator, Dr Kristiaan Schreve, a mechanical Engineer of Stellenbosch University, assisted during this process. The final phases of the data processing involved exporting the DVT-generated text file containing the processed photographic data to Microsoft Excel (2002) for statistical analysis.

3.10.2 Psychosocial factors

The BDI and MASC were used in a non-psychiatric population of high school learners and not for diagnostic purposes, therefore only one score generated for each learner for the respective BDI and MASC was used. For the BDI, the score for each item was added and the total score could range from 0 to 63. A cut-off score of 16 and above was considered 100% sensitive to detect a case of depression (Barrera & Garrison-Jones 1988). The Multidimensional Scale for Children generated 12 raw scores, which were converted into 12 T-scores on the MASC profile form. The T-scores from the MASC total column were used to present a score for anxiety. A cut off point of 70 and above was used to describe very anxious learners (March 1997)

3.10.3 Height, weight and BMI

The height and weight data were imported to MS Excel and the BMI was calculated as follows:

BMI = kg/m^2

3.10.4 Onset and area of pain

The learners were allocated to the group experiencing pain if at three- and six-month intervals they responded that they had experienced upper quadrant musculoskeletal pain while or after using a computer at home or at school in the preceding month. The area of pain symptoms was also described by using a body chart.

The cumulative pain incidence was calculated as follows:

Cumulative incidence = (number of new cases in a specified time period) / (total population at risk at the start of the time period)

The incidence rate was calculated as follows:

Incidence rate = (number of new cases during a specified time period) / (total disease free person-time of observation in the at-risk population)

3.11 Statistical Analysis

The data was entered into MS Excel. Descriptive statistics were conducted in MS Excel. Means, Standard Deviations, percentages and standard errors with 95% confidence intervals were calculated. Associations between the primary exposures (postural angle, anxiety, depression and anthropometrics) and upper quadrant musculoskeletal pain were expressed as odds ratios (95% confidence intervals). The associations were tested in a stepwise constructed multivariate logistic regression predictive model.

CHAPTER 4

RESULTS

The aim of the study was to describe the sitting postural alignment and assess psychosocial factors of grade ten high school learners and to determine whether these components are risk factors for the onset of upper quadrant musculoskeletal pain. This chapter presents the main findings according to the objectives of the study.

4.1 Sample Description

Of the 135 eligible, asymptomatic learners, 109 returned their informed consent from the parents or legal guardians. Table 4.1 shows the age and gender of the 26 learners who were excluded because they did not provide informed consent.

Table 4.1 Learners from who consent was not obtained

	15 years old	16 years old	17 years old	Total
Boys	2	8	10	20
Girls	0	3	3	6
Total	**2**	**11**	**13**	**26**

On the day of baseline data collection in February, five learners, two girls aged 16 and 17; two boys aged 17 and one boy aged 15, were absent from school and therefore excluded from the study. Thus 104 learners, 49 girls and 55 boys, participated in the baseline data collection and the response was 77%. The mean age was 16.0 (± 0.70).

The gender and age distribution of the participating grade ten learners are presented in Table 4.2 and Table 4.3. Refer to Chapter 3 Figure 3.1 for identifying the schools that are coded as schools A, B, C, D, E and F.

Table 4.2 Gender and age distribution across the different schools at baseline

Age	**School A**		**School B**		**School C**		**School D**		**School E**		**School F**	
	Boys	Girls	Boys	Girls	Boys	Girls	Boys	Girls	Boys	Girls	Boys	Girls
15	1	0	5	2	2	5	0	0	4	2	0	4
16	6	5	5	3	7	8	2	0	8	6	2	1
17	3	0	3	1	3	0	0	0	1	3	3	9
Total	**10**	**5**	**13**	**6**	**12**	**13**	**2**	**0**	**13**	**11**	**5**	**14**

Table 4.3 Gender and age of the participating learners at baseline

	15 years old	**16 years old**	**17 years old**	**Total**
Girls	13	23	13	**49**
Boys	12	30	13	**55**
Total	**25**	**53**	**26**	**104**

4.2 Measurements at Baseline

4.2.1 Height and weight measurements

The tallest learner was a 16 year old girl with a height of 1.84m. The shortest learner was a 16 year old girl with a height of 1.47m. The mean height for the total group was 1.63m (± 0.07). The maximum weight measured was 135.70kg for a 15 year old boy and the minimum weight measured was 39.50kg for a 15 year old girl. The mean weight for the total group was 56.86kg (± 13.08). The maximum BMI was 43.81 and the minimum BMI was 14.87. The mean BMI for the group was 21.49 (± 4.76). The median, 25% and 75% quartiles for the group is presented in Table 4.4.

Table 4.4 Descriptive values for height, weight and BMI (n=104)

	Height	Weight	BMI
Median	1.63m	54.15kg	20.37
75% Quartile	1.68m	62.15kg	23.33
25% Quartile	1.57m	47.85kg	18.42

The mean height for girls was 1.59m (± 0.07) and for boys 1.66m (± 0.06). The mean weight for girls was 56.21kg (± 11.20) and for boys 57.10kg (± 14.65). The mean BMI for girls was 22.43 (± 4.57) and for boys 20.66 (± 4.82).

4.2.2 Sitting postural alignment

Four postural angles, as described in section 3.7.2, were measured for each of the 104 learners. The minimum, maximum, mean, median, 75% quartile and 25% quartile values for the group are presented in Table 4.5.

Table 4.5 Descriptive values for the postural angles

	Head tilt angle	**Cervical angle**	**Shoulder pro- and retraction angle**	**Thoracic angle**
Minimum	-13.1°	18.8°	81.4°	35.3°
Maximum	34.7°	59.1°	173.5°	89.6°
Mean	13.78°	39.27°	128.65°	67.10°
SD	9.66	7.99	17.18	8.27
Median	14.65°	39.60°	127.60°	67.70°
75% Quartile	18.60°	43.95°	141.40°	71.10°
25% Quartile	6.90°	34.75°	117.40°	63.10°

The frequency distribution of the four postural angles is shown in Figures 4.1 to 4.4 by means of scatter plot graphs.

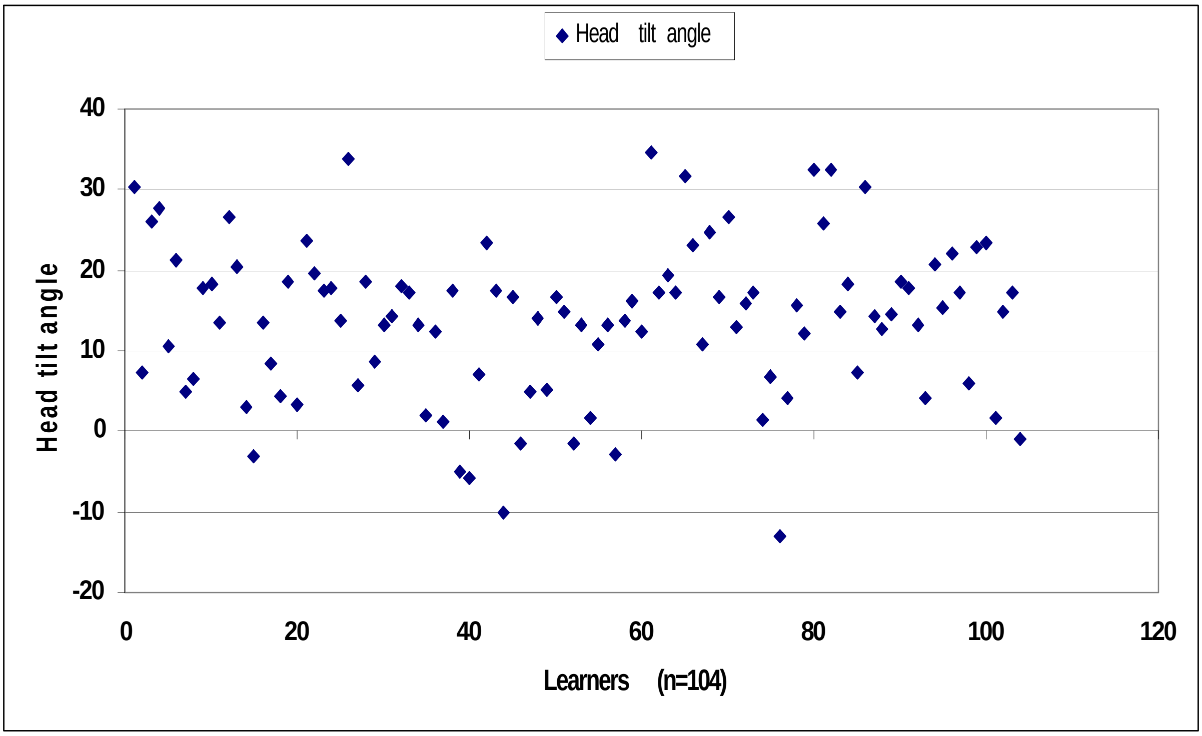


Figure 4.1 Scatter plot diagram for the head tilt angles

Figure 4.1 illustrates the variability in head tilt angle. This angle also had the second highest SD (9.66) compared to the other angles.

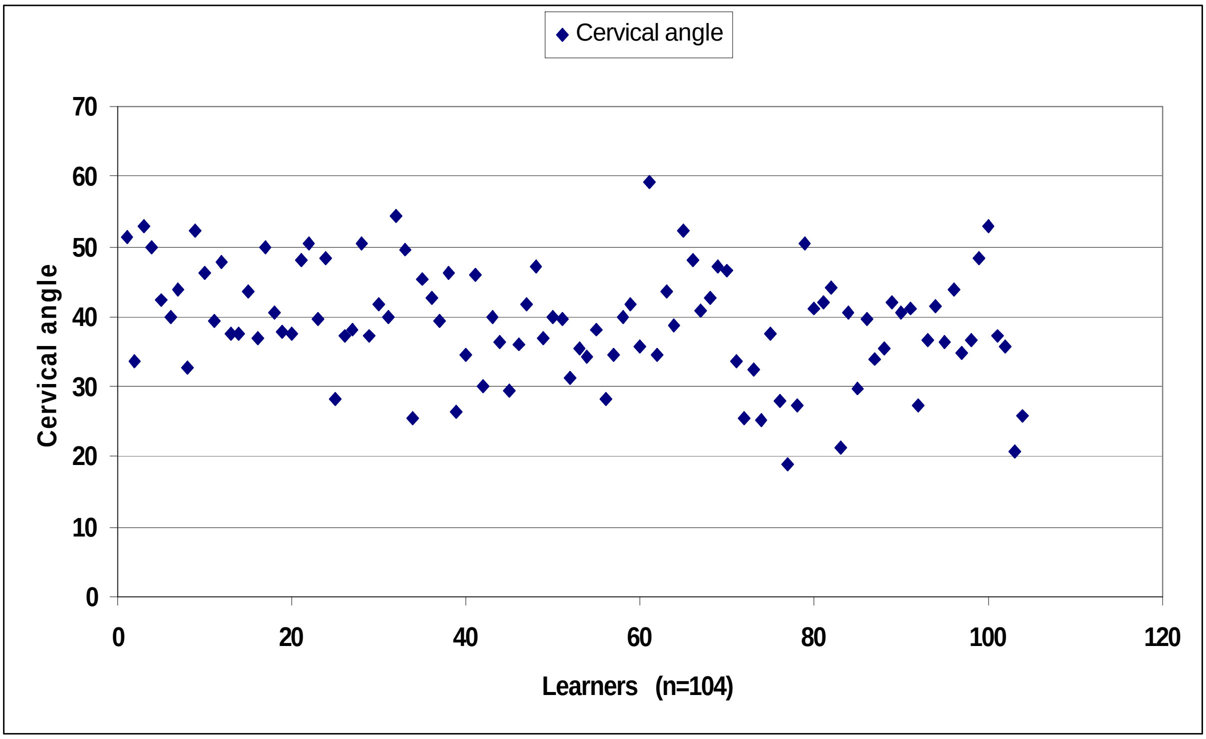


Figure 4.2 Scatter plot diagram for the cervical angles

The SD for the cervical angle was relatively less compared to the other angles measured. Thus more learners had cervical angle values approximately the mean (M=39.27º ± 7.99). This angle thus illustrated the least variability.

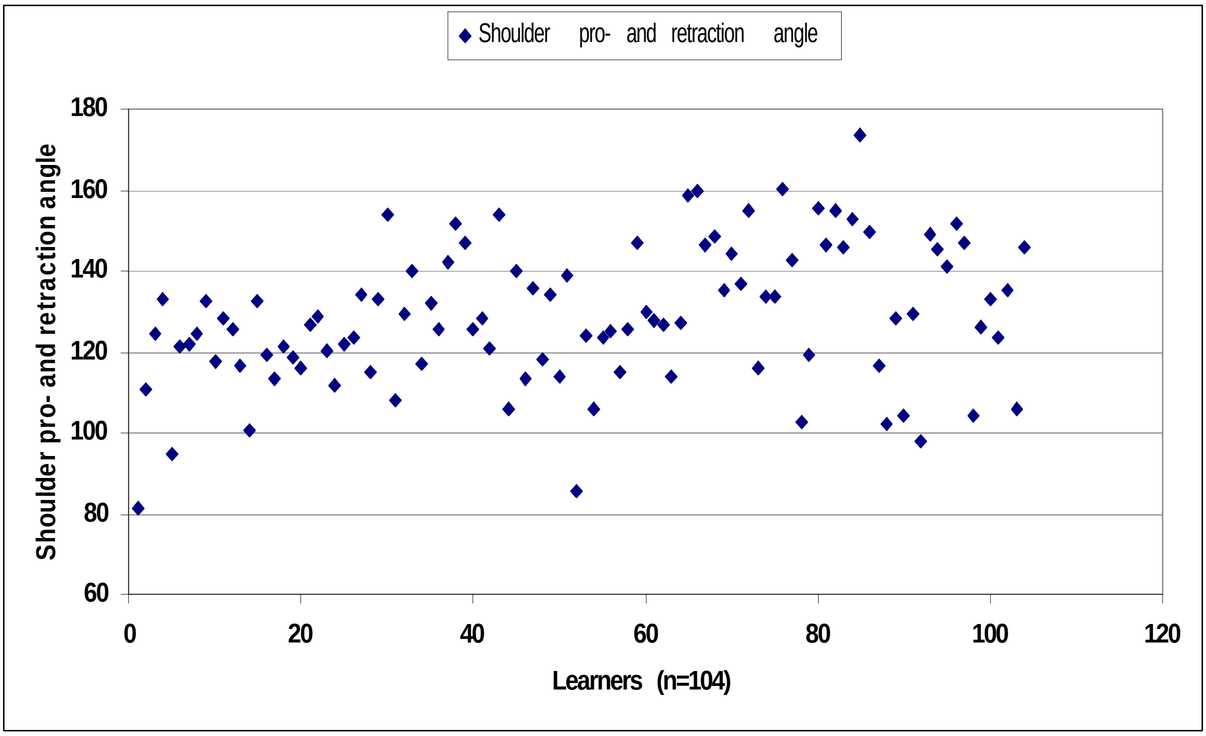


Figure 4.3 Scatter plot diagram for the shoulder pro- and retraction angles

This angle showed the greatest variability of all the angles measured, demonstrated by the largest SD (17.18) compared to the other angles measured.

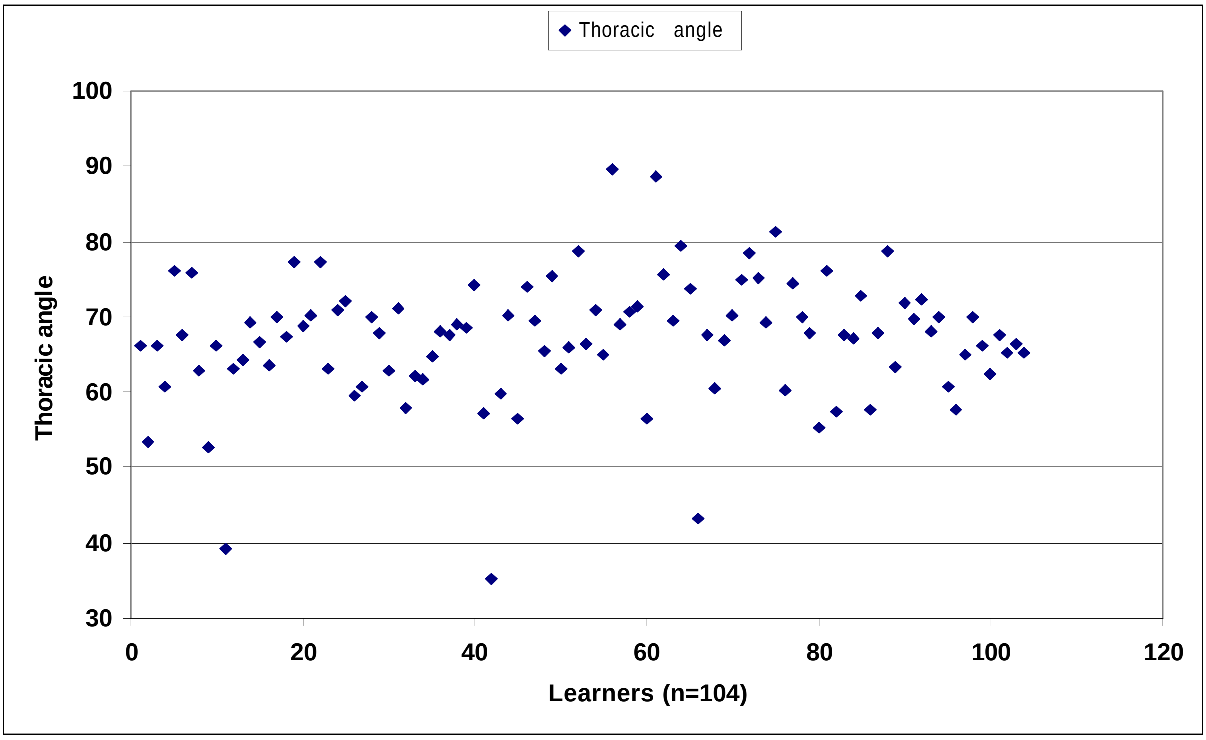


Figure 4.4 Scatter plot diagram for the thoracic angles

This angle demonstrated less variability compared with the head tilt and shoulder pro- and retraction angles (SD 8.27). (See Table 4.5)

4.2.2.1 **Negative angle and exceptional angle values**

All the angles were measured as positive angles except for nine head tilt angles. If the head tilt angle is measured as a negative angle, then the line connecting the canthus of the eye and the midpoint of the tragus of the ear is positioned below the horizontal line going through the midpoint of the tragus of the ear. It means that the canthus of the eye is positioned lower than the midpoint of the tragus of the ear. Figure 4.5 demonstrates four learners whose head tilt angles were negative values.

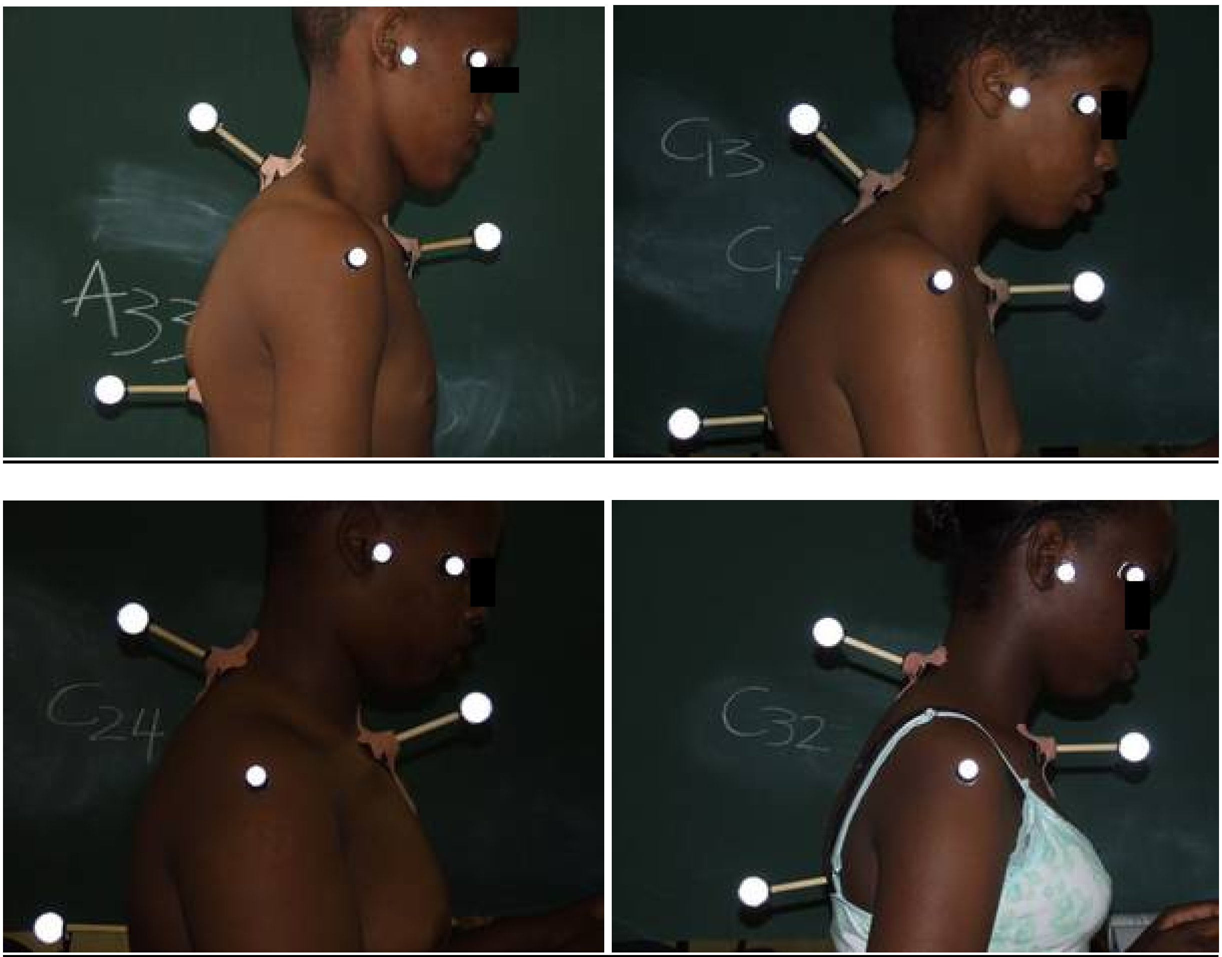


Figure 4.5 Four photographs representing four learners with negative head tilt angles

102 of the shoulder protraction/retraction angles were measured between 90° and 180°. Two learners had angles less than 90°. If the shoulder protraction/retraction angle value was less than 90°, then the C7 spinous process was positioned anteriorly to the midpoint of the humeral head. Figure 4.6 shows two learners where the shoulder pro- and retraction angle is less than 90°.

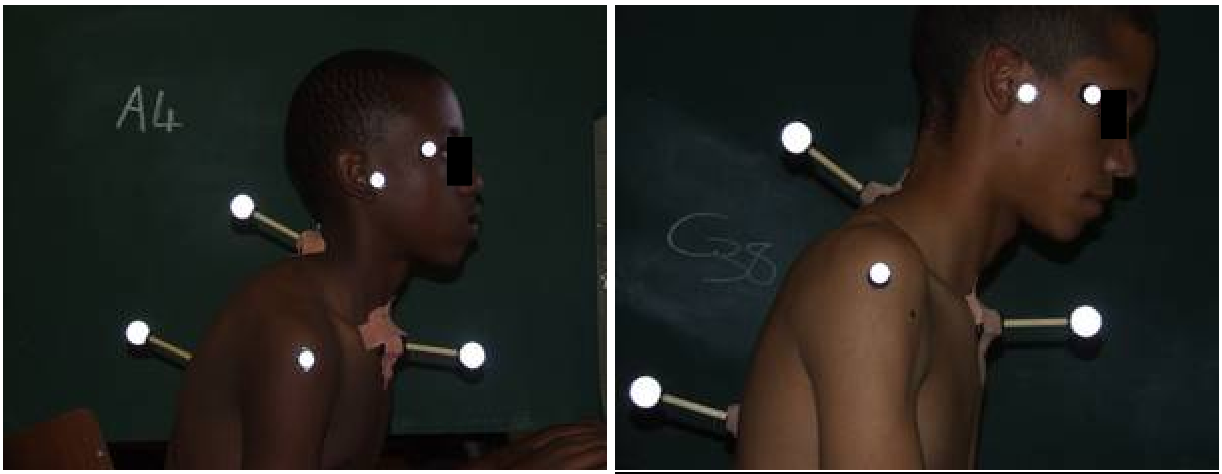


Figure 4.6 Two photographs representing two learners with shoulder pro- and retraction angles less than 90°

4.2.3 Psychosocial measurements

The mean score for anxiety for the group was 51 (± 9.92) with the lowest score 29 and the highest 71. Four learners scored 70 and above on the MASC. The cut-off point of 70 and above is used as the criteria for anxiety among adolescents (March 1997). The mean score for depression for the group was 15 (± 13.27) with the lowest score 0 and the highest 63. A score of 16 and above was considered reliable to detect depression (Barrera & Garrison-Jones 1988). Thirty eight learners scored 16 and above for the BDI. Table 4.6 shows the median, 75% quartile and the 25% quartile for anxiety and depression of the 104 learners.

Table 4.6 Descriptive values for anxiety and depression (n=104)

	Anxiety	**Depression**
Median	51.50	11.0
75% Quartile	59.0	20.5
25% Quartile	43.5	6.0

The mean anxiety score for boys was 51 (± 10.61) and for depression 13 (± 12.76). The mean anxiety score for girls was 52 (± 9.17) and for depression 18 (± 13.38). The mean anxiety and depression scores for age and gender appear in Figures 4.7 and 4.8. It illustrates a trend for both anxiety and depression to be greater for the girls than the boys at all three ages except for anxiety at 15 years where the boys scored higher than the girls. The mean scores for anxiety and depression increased as the age increased for girls. The mean score for depression increased as age increased for boys. However the mean anxiety score for boys did not show a similar trend as for depression.

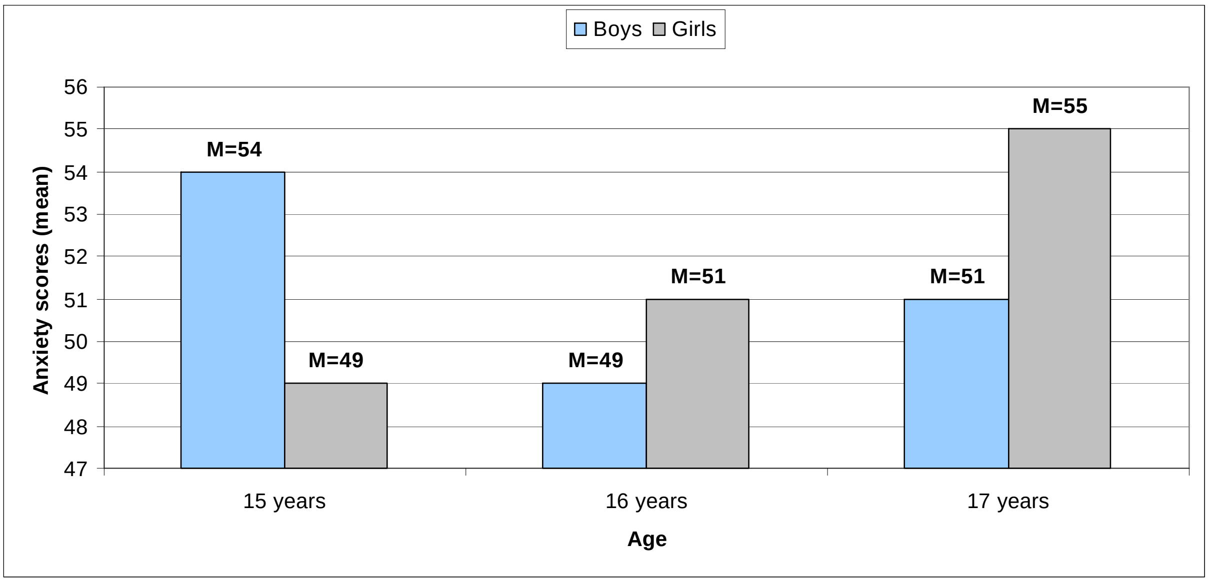


Figure 4.7 Anxiety scores according to age and gender (n=104)

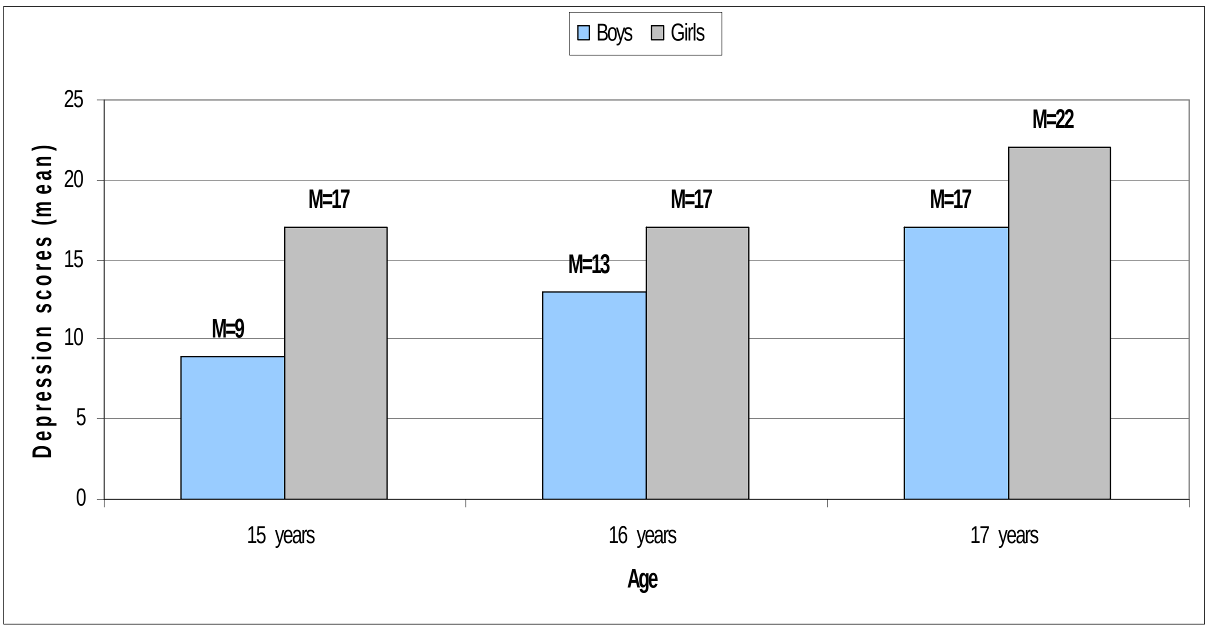


Figure 4.8 Depression scores according tot age and gender (n=104)

4.2.4 Computer usage

4.2.4.1 ***Years of exposure***

All the participants commenced with computer studies or compu-typing in 2007 as part of their curriculum. Computers at these schools were used for curriculum delivery of subjects such as computer studies (61%), compu-typing (41%), mathematics (20%) and languages (4%). Learners would type, view lessons or interact via email during these lessons. Most learners (74%) stated that they had less than one year's experience working on a computer at school. Ninety two of the 104 learners also utilized computers outside of the school environment either at home (42%), at a relative/friend's house (39%), at the library (18%), at the internet café (7%) or elsewhere not stated (3%). Although ten learners had more than 5 years usage of computers outside of school, 46% of the learners had less than one year's usage of a computer elsewhere. Figure 4.9 shows the years of exposure to computers either at school or elsewhere.

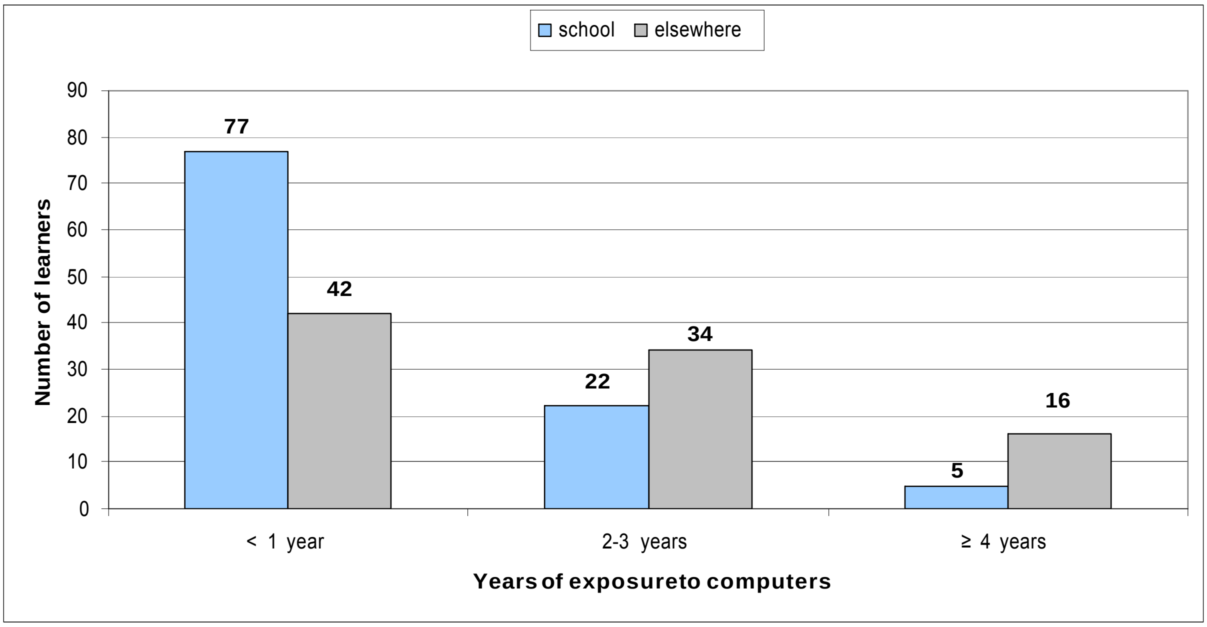


Figure 4.9 Exposure to computers at school and elsewhere (n=104)

4.2.4.2 ***Duration of computer use per session***

Seventy four percent of the 104 learners reported that the duration of a lesson is 45 minutes, however six learners had lessons that extended to 60 minutes and four learners reported 90 minutes per lesson at school. Seventy two percent of the learners who use computers at home spend an hour or less per session on the computer. The boys reported 134 minutes (±73.3) and the girls 99 minutes (±49.3) computer use per day.

4.2.4.3 ***Frequency of computer use per week***

Sixty six percent of the 104 learners spend five times or more per week on their computers at school and 33% of learners spend five times or more on their computers elsewhere. The frequency per week of working on computers is presented in Figure

4.10. The mean weekly computer usage at school and elsewhere was 7.6 hours (±5.06). The boys reported an average of 8.8 hours (±6.0) whereas the girls reported 6.2 hours (±3.2) per week computer usage.

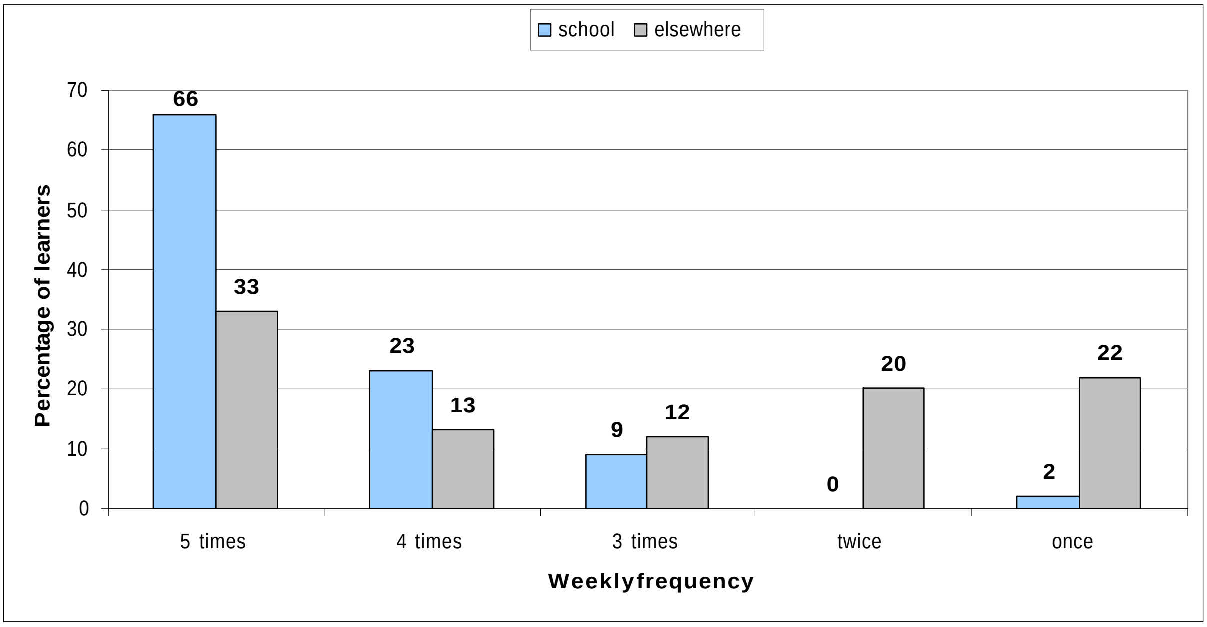


Figure 4.10 Weekly use of computers at school and elsewhere (n=104)

4.2.4.4 ***Additional information regarding computer use***

Sixty five percent of the 104 learners did receive guidelines mainly from their teachers on the optimal sitting posture in front of a computer. However more learners (70%) stated they received no instruction regarding appropriate exercises and stretching techniques during short breaks.

Desktop computers were more frequently used by the 104 learners (84%). Ten percent learners used laptop computers and 6% learners reported use of both desk top and laptop computers. Eighty eight percent computers were positioned on a table or a desk, however 4% of laptop computers were either positioned on the floor (1%) or on their laps (3%). Learners also indicated that they listen to music (55%), talk to friends (33%), write (32%) or talk on the phone (4%) while using the computer.

One learner wore contact lenses and three learners wore spectacles. Nine learners suffered from a medical condition of whom only four were taking medication. Ten learners reported having been in an accident or suffered a sporting injury. Four learners stated to have undergone surgery related to muscle or bone.

4.2.5 The relationship between variables measured at baseline (weight, height, postural angles, anxiety and depression)

Learners, whose postural angle values were above the 75% quartile or below the 25% quartile, were grouped as learners with "extreme angles". The 104 learners were divided into five groups according to the number of "extreme angles" exhibited per learner. The relationship between having none, one, two, three or four extreme postural angles and height, weight and BMI is demonstrated in Figure 4.11 to 4.13. The mean values for height, weight and BMI increased for the learners with four 'extreme angles'.

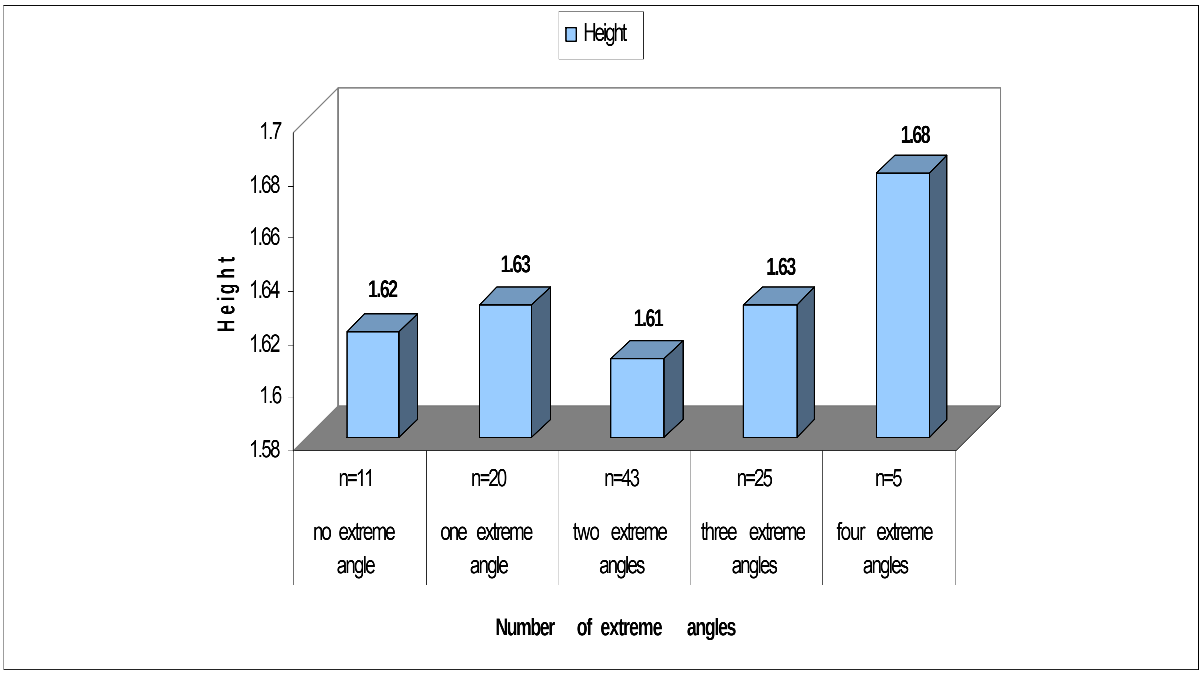


Figure 4.11 The relationship between height and the number of extreme angles (n=104)

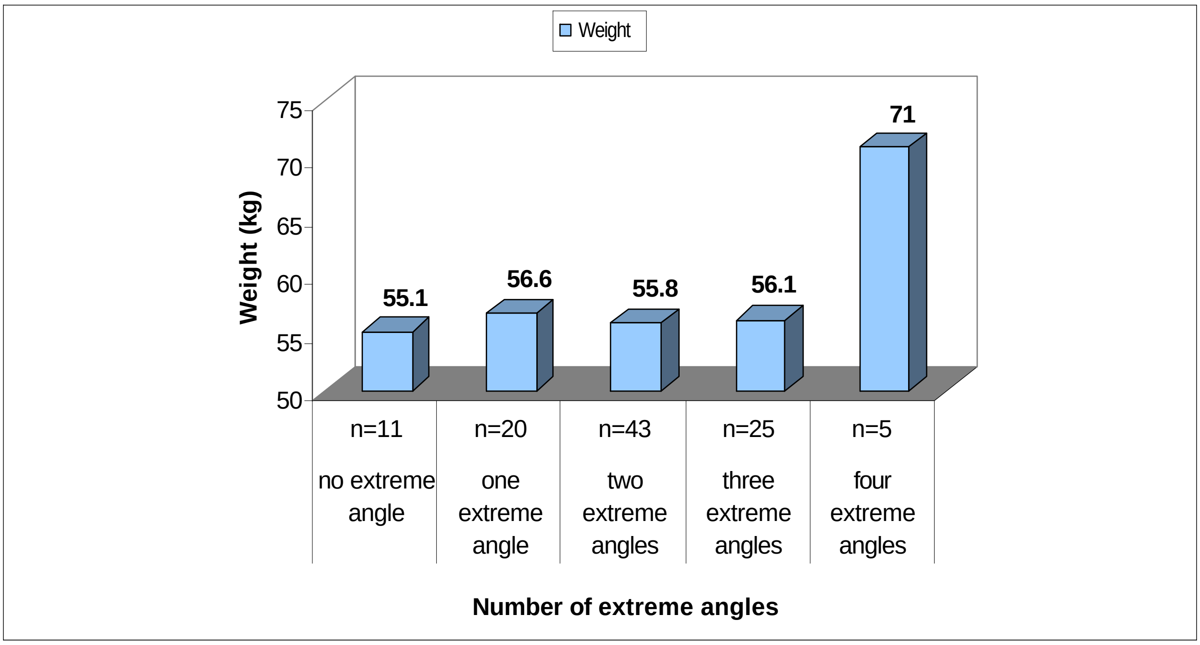


Figure 4.12 The relationship between weight and the number of extreme angles (n=104)

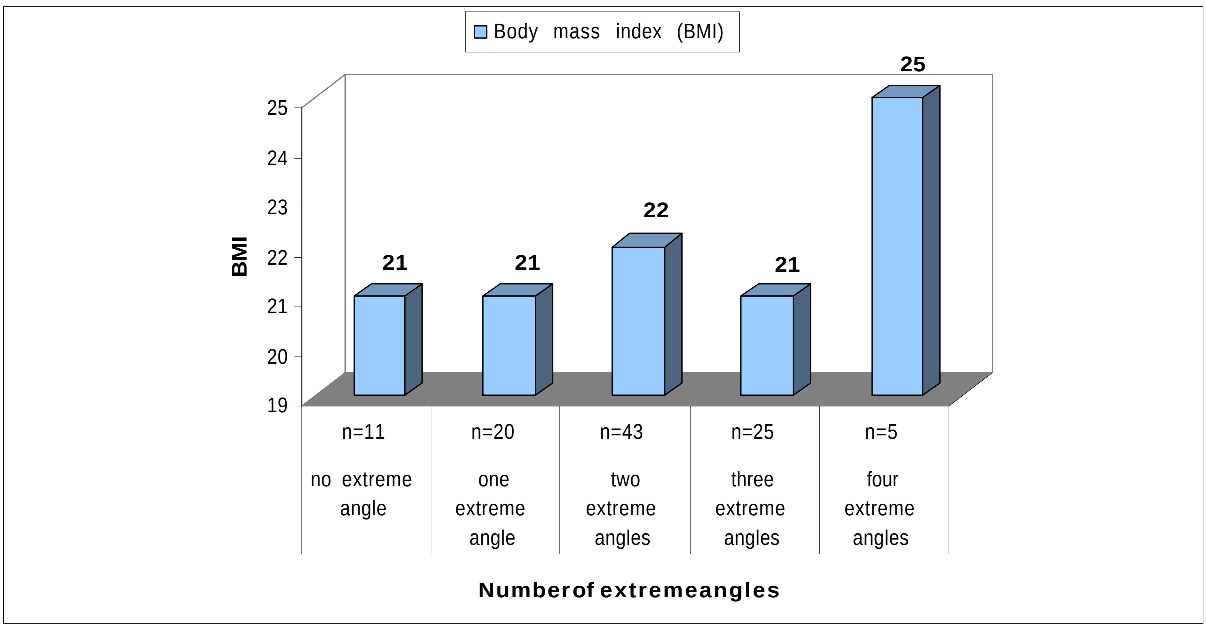


Figure 4.13 The relationship between BMI and the number of extreme angles (n=104)

The relationship between having none, one, two, three or four postural extreme angles and anxiety and depression is demonstrated in Figure 4.14. However the anxiety levels were greater for the learners with two ‘extreme angles’. High levels of depression were the greatest for learners with no ‘extreme angles’.

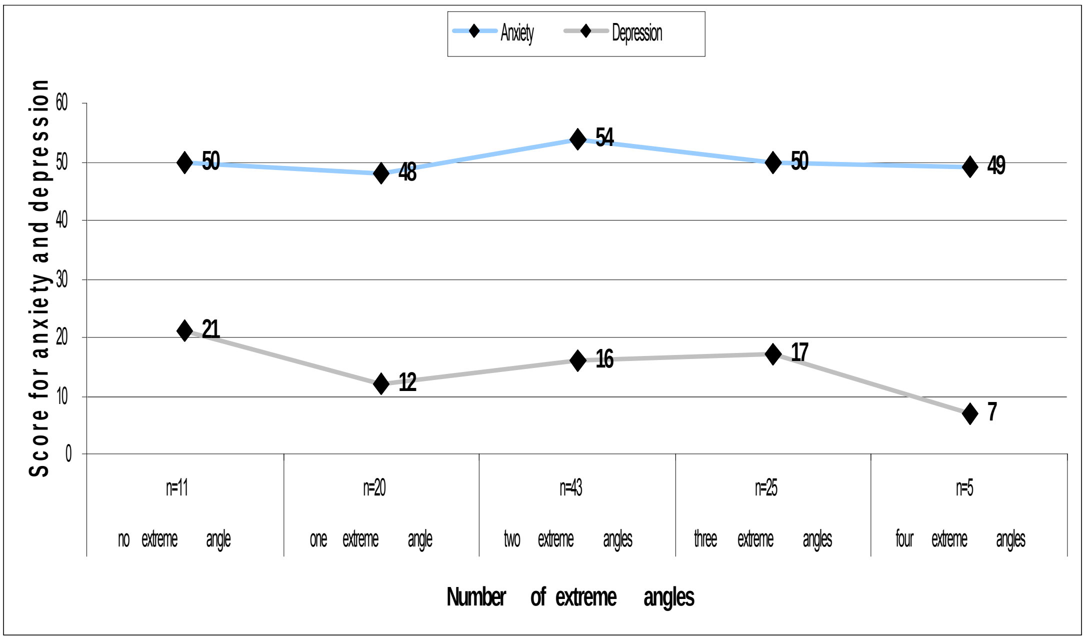


Figure 4.14 The relationship between anxiety and depression and the number of extreme angles

4.3 **Three-month Upper Quadrant Musculoskeletal Pain Assessment**

4.3.1 Sample description of musculoskeletal pain

In May 2007, three months after the baseline measurements, the learners completed the musculoskeletal pain questionnaire (Appendix J). Six learners, four boys and two girls, left the schools they were attending at the time of the initial data collection and therefore 98 learners, 51 boys and 47 girls, completed the assessment at three months. The response rate was 73% (n=98). Seventeen learners complained of musculoskeletal pain after three months post baseline. Two learners suffered sport related injuries and one learner complained of lower back pain due to a sport injury. These three learners were excluded from the pain sample because their pain did not relate to either upper quadrant musculoskeletal pain or to seated postural activities. Fourteen learners, 11 boys and three girls, complained of upper quadrant musculoskeletal pain or discomfort that was related to seated activities such as sitting behind a computer or school desk (See Figure 4.17)

The areas that these 14 learners indicated on the body chart included the head, neck, upper back, shoulder(s), elbow(s) and wrist(s). In total 30 areas were indicated by 14 learners and gives an average of 2.1 (±1.17) areas indicated per learner. The frequency distribution of the areas is presented in figure 4.15.

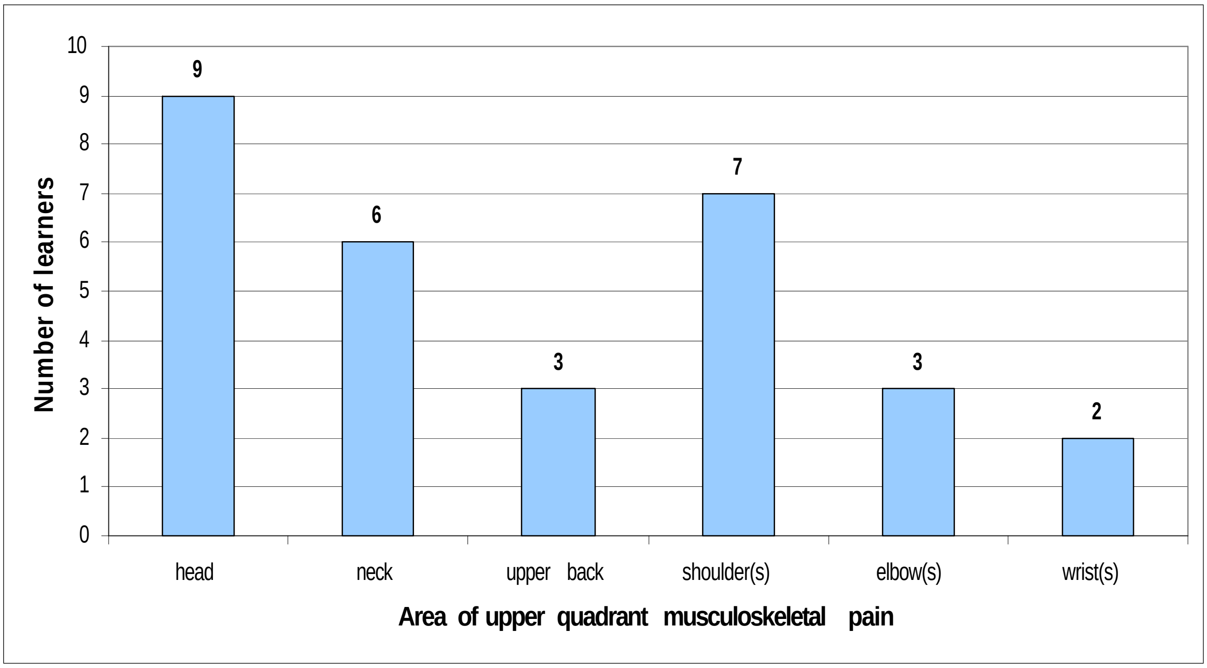


Figure 4.15 The frequency distribution of the upper quadrant musculoskeletal pain areas (n=30 areas)

4.3.2 Comparison between the pain and no pain groups for sitting posture and psychosocial factors

The means of the variables measured (height, weight, BMI, anxiety, depression, head tilt, cervical angle, shoulder pro- and retraction angle and thoracic angle) of the learners who developed pain after three months did not differ from the means of the variables measured of the group that developed no pain during the course of the study. The data is presented in table 4.7 and 4.8. The no pain group refers to the 67 learners who did not develop pain either at three months or at six months follow up period (See Figure 4.17). The 95% confidence interval, calculated by using the sample estimate and the standard error (SE) of the no pain group, was used to determine a range of values plausible for a population of asymptomatic high school learners. This 95% confidence interval describes the population parameter for asymptomatic high school learners (Joubert & Ehrlich 2007)

Table 4.7 The mean values for height, weight, BMI, anxiety and depression and the 95% CI of the pain group compared to the no pain group at three months

	Height (m)	Weight (kg)	BMI	Anxiety	Depression
No pain group (N=67) **95% confidence interval**	1.61-1.65	54.1–59.5	20.52-22.68	49-53	13-19
Pain group (N=14) **mean**	1.65	58.68	21.5	**57***	**11***

The mean values in bold print marked with a (*) shows the values for the pain group that fall outside the 95% confidence intervals calculated for the no pain group population estimate.

The means of height, weight and BMI for the pain group fell within the 95% confidence intervals calculated for the no pain group. The means for anxiety and depression for the pain group fell outside the 95% confidence intervals calculated for the no pain group.

Table 4.8 The mean values for the postural angles and the 95% CI of the pain group compared to the no pain group at three months

	head tilt angle (°)	cervical angle (°)	shoulder pro- and retraction angle (°)	thoracic angle (°)
No pain group (N=67) 95% confidence interval	11.8-16.4	38.1-41.4	123.9-131.7	65.3-69.3
Pain group (N=14) mean	15.4	40.2	128.5	68.7

The means of the four postural angles for the pain group fell within the 95% confidence intervals calculated for the no pain group.

4.3.3 Comparison between the pain and no pain groups for exposure to computer usage

The mean weekly hours spent working on the computer, either at school or elsewhere, for the no pain group was 7.6 hours. The mean for the 14 learners who complained of upper quadrant musculoskeletal pain after three months was also 7.6 hours.

4.4 Six-month Upper Quadrant Musculoskeletal Pain Assessment

4.4.1 Sample description of musculoskeletal pain

In August 2007, six months after baseline measurements, 93 of the 98 learners at three month assessment completed the musculoskeletal pain questionnaire for a second time. One boy left the school and two girls and two boys were absent on the day of data collection. Forty eight boys and 45 girls completed the questionnaire. The response was 69% (n=93). 30 learners complained of musculoskeletal pain however two learners suffered only low back pain and six learners suffered sport related injuries. 22 learners, 13 boys and nine girls, met the criteria of upper quadrant musculoskeletal pain that is due to seated activities. In nine cases the same learners that had pain at three months complained again of pain at six months. Four learners who had pain at three months were now pain free. 13 new cases of upper quadrant musculoskeletal pain presented at six months (See Figure 4.17).

The areas that these 22 learners indicated on the body chart included the head, neck, upper back, shoulder(s), elbow(s) and wrist(s). The areas indicated by six of the nine learners, with persisting pain, differed from the areas indicated at three months. In total 40 areas were indicated by 22 learners and gives an average of 1.8 (± 1.26) areas indicated per learner. The frequency distribution of the areas is presented in figure 4.16.

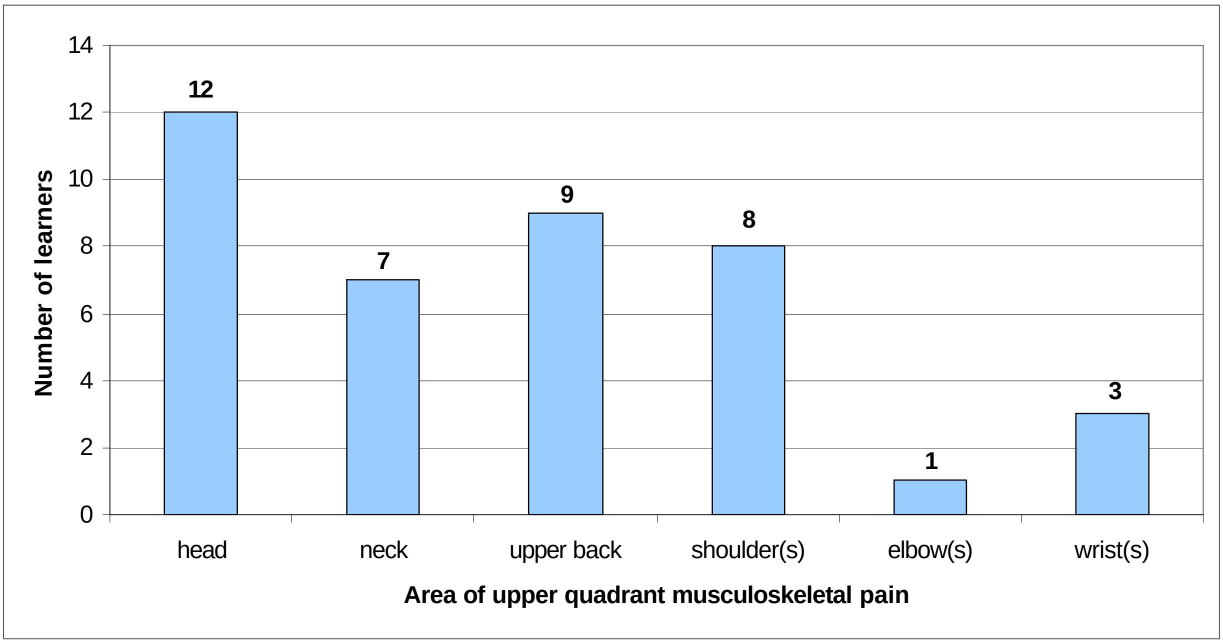


Figure 4.16 The frequency distribution of upper quadrant musculoskeletal pain areas (n=40 areas)

4.4.2 <u>Comparison between the pain and no pain groups for sitting posture and psychosocial factors</u>

The means of the variables measured of the learners who developed pain after six months did not differ from the means of the no pain group. The data is presented in table 4.9 and 4.10. The 95% confidence interval around the standard error (SE) for the no pain group was utilized as described at three months. The means of three of the four postural angles, height, weight, BMI, anxiety and depression fell within the 95% confidence interval calculated for the no pain group. The mean for the cervical angle of the pain group fell outside the 95% CI calculated for the no pain group and was greater by 0.1°.

Table 4.9 The mean values for height, weight, BMI, anxiety and depression and the 95% CI of the pain group compared to the no pain group at six months

	Height (m)	Weight (kg)	BMI	Anxiety	Depression
No pain group (N=67) **95% confidence interval**	1.61-1.65	54.1–59.5	20.52-22.68	49-53	13-19
Pain group (N=22) **mean**	1.63	55.38	20.8	52	13

Table 4.10 The mean values for the postural angles and the 95% CI of the pain group compared to the no pain group at six months

	head tilt angle (°)	cervical angle (°)	shoulder pro- and retraction angle (°)	thoracic angle (°)
No pain group (N=67) **95% confidence interval**	11.8-16.4	38.1-41.4	123.9-131.7	65.3-69.3
Pain group (N=22) **mean**	15.3	**41.5***	129.7	67.5

The mean values in bold print marked with a (*) shows the values for the pain group that fall outside the 95% confidence intervals calculated for the no pain group population estimate.

4.4.3 Comparison between the pain and no pain groups for exposure to computer usage

The mean weekly hours spent working on the computer, either at school or outside of school, for the 22 learners who complained of upper quadrant musculoskeletal pain after six months was 7.8 hours compared to the 7.6 hours for the no pain group.

4.5 Upper Quadrant Musculoskeletal Pain Experienced during the Six-month follow-up period

4.5.1 Sample description

The learners who developed upper quadrant musculoskeletal pain at three months were grouped with the 13 new cases at six months to form a pain group that comprised of 27 learners (See figure 4.17). The researcher found a cumulative pain incidence of 26% after six months, and the incidence rate was five new cases of upper quadrant musculoskeletal pain per six months per 100 learners using computers.

The mean age for the pain group was 15.96 (± 0.65) and the mean age for the no pain group was 16.03 (± 0.73). More boys (n=18) reported pain than girls (n=9). The pain prevalence for the different ages was 24%, 30.2% and 19.2% for 15-, 16- and 17 year olds respectively.

The eleven learners lost to follow up at three and six months was equal in gender and age to the 93 learners that completed both three and six month's assessments. One 17 year old boy complained of upper quadrant musculoskeletal pain at three months but was absent at the six month follow up assessment. He is accounted for in the 11 learners lost to follow up but is included in the 27 learners constituting the pain group (See Figure 4.17). Henceforth subsequent data analysis was performed on a group of 94 high school learners. Figure 4.17 illustrates the number of participating and excluded learners at all three assessments.

Table 4.11 Gender and age of the learners who were lost to follow up

		15 years old	16 years old	17 years old	Total
Three month	Girls		2		**2**
	Boys	2	2		**4**
Six month	Girls		1	1	**2**
	Boys		1	2	**3**
Total		**2**	**6**	**3**	**11**

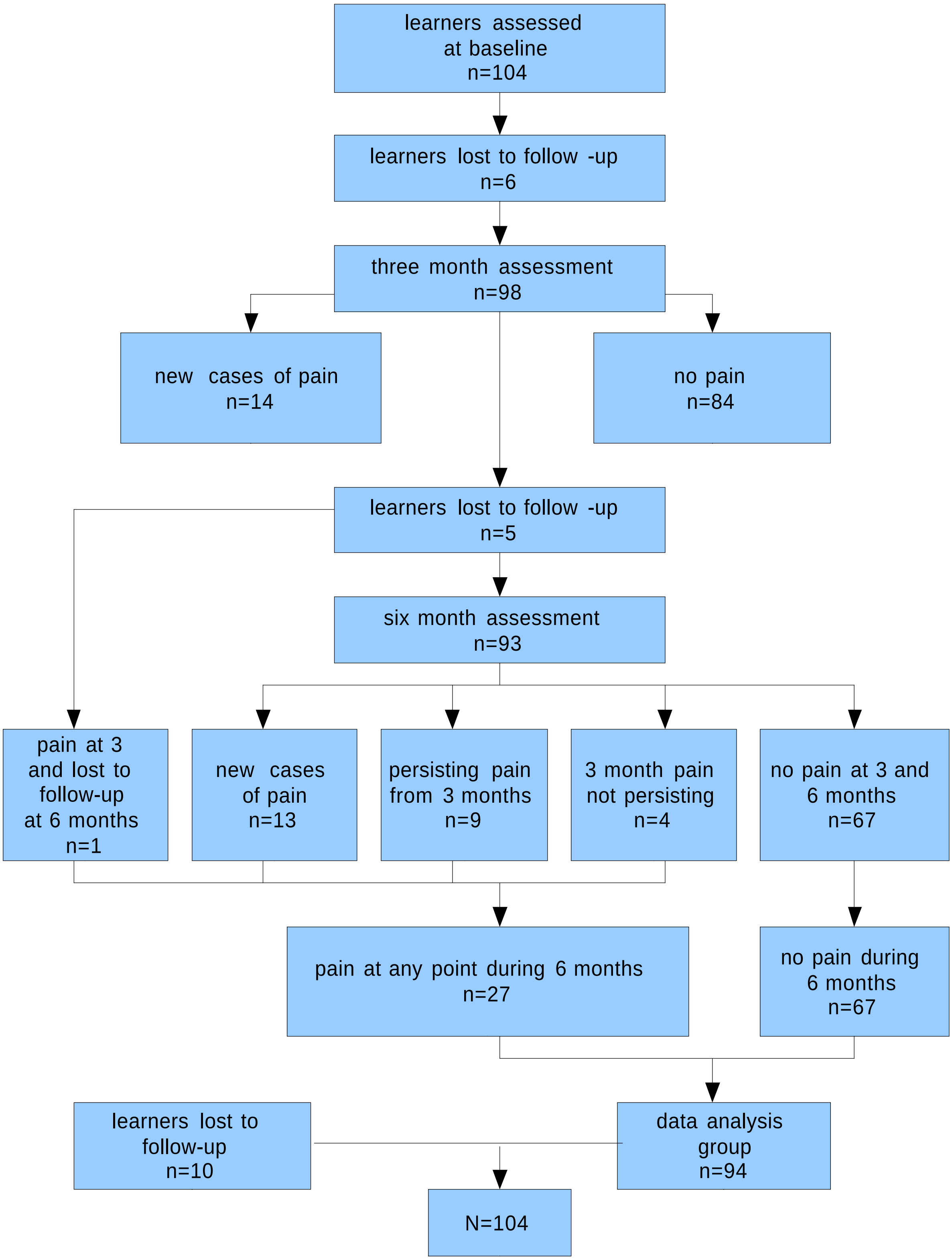


Figure 4.17 Participating and excluded learners at all three assessments

4.5.2 Comparison between the pain and no pain groups for height, weight and BMI

The learners who experienced pain at any time during the six months were grouped according to gender, age, number of pain areas, most common pain areas and persisting pain. The number of pain areas was further divided into one, two and three or more areas. The most common areas of pain were divided into head for one group and neck, upper back and shoulders for the second group. The persisting pain group consisted of the nine learners who experienced pain at three and six month intervals. The 95% confidence interval around the SE was calculated for the no pain group for height, weight and the BMI. The mean values for height, weight and the BMI was calculated for each pain subgroup. The data is presented in table 4.12.

Table 4.12 The mean values for height, weight and BMI of the pain subgroups compared to the 95% CI for the no pain group.

			Height (m)	Weight (kg)	BMI
No pain group (N=67) 95% confidence interval	**Total**	n=67	1.61-1.65	54.1–59.5	20.5-22.7
	Gender	Boys (n=32)	1.65-1.68	53.0-60.0	19.1-21.9
		Girls (n=35)	1.57-1.61	53.4-60.8	21.1-24.2
	Age	15 years (n=17)	1.59-1.65	52.2-62.5	19.9-24.2
		16 years (n=31)	163-1.68	52.2-60.4	19.2-22.3
		17 years (n=19)	1.57-1.62	52.6-61.6	20.5-24.6
Pain subgroups (N=27) mean	**Group**	n=27	1.64	57.6	21.4
	Gender	Boys (n=18)	1.66	57.2	20.4
		Girls (n=9)	1.59	58.5	23.4
	Age	15 years (n=6)	1.65	**70.8***	**25.5***
		16 years (n=16)	**1.62***	54.7	20.7
		17 years (n=5)	**1.68***	53.5	**18.9***
	Number of pain areas	1	1.63	**52.0***	**19.5***
		2	1.61	57.2	22.2
		3 or more	**1.66***	**63.6***	**22.9***
	Most common pain areas	Head (n=18)	1.63	**60.1***	22.3
		Neck/ shoulders/ upper back (n=22)	1.65	59.1	21.7
	Persisting pain	n=9	1.64	**53.7***	**20.2***

The mean values in bold print marked with a (*) shows the values for the pain group that fall outside the 95% confidence intervals calculated for the no pain group population estimate.

4.5.3 Comparison between the pain and no pain groups for sitting postural alignment

The pain subgroups remain as discussed in section 4.5.2. The 95% confidence interval around the SE was calculated for the no pain group for the four postural angles. The mean values of the four postural angles were calculated for each pain subgroup. The data is presented in table 4.13.

Table 4.13 The mean values for the four postural angles of the pain subgroups compared to the 95% confidence intervals for the no pain group

			head tilt angle (°)	cervical angle (°)	shoulder pro- and retraction angle (°)	thoracic angle (°)
No pain group (N=67)	**Total**	N=67	11.8-16.4	38.1-41.4	123.9-131.7	65.3-69.3
	Gender	Boys (n=32)	11.0-18.4	37.8-42.5	123.9-134.8	65.7-70.4
		Girls (n=35)	10.7-16.5	36.9-41.5	120.8-132.1	63.3-69.7
	Age	15 years (n=17)	9.2-17.1	34.2-40.9	122.5-138.2	65.1-72.1
95% confidence interval		16 years (n=31)	8.9-17.1	37.4-42.0	118.7-129.9	63.5-70.0
		17 years (n=19)	14.0-19.6	38.4-44.6	123.8-138.8	63.3-70.5
	Group	n=27	13.9	40.0	130.8	67.4
	Gender	Boys (n=18)	13.8	39.0	134.6	67.5
		Girls (n=9)	14.0	**42.1***	123.2	67.2
	Age	15 years (n=6)	**5.1***	40.1	137.6	68.6
		16 years (n=16)	**17.3***	40.6	**131.7***	68.3
		17 years (n=5)	**13.6***	**38.3***	**119.8***	**63.0***
Pain subgroups (N=27)	**Number of pain areas**	1	15.8	**43.1***	127.6	**70.9***
		2	12.6	**37.4***	**132.3***	66.5
		3 or more	15.2	39.2	128.2	**63.6***
mean	**Most common pain areas**	Head (n=18)	**11.7***	39.6	128.7	65.7
		Neck/ shoulders/ upper back (n=22)	14.7	39.9	130.4	67.2
	Persisting pain	n=9	**19.6***	**43.8***	124.5	**69.7***

The mean values in bold print marked with a (*) shows the values for the pain group that fall outside the 95% confidence intervals calculated for the no pain group population estimate.

The number of postural angles per learner, that fell outside of the 95% confidence interval around the standard error (SE) as calculated for the no pain group, was calculated for both the pain and no pain group and is presented in table 4.14.

Table 4.14 Percentage of learners of whom the number of angles fell outside the 95% confidence interval

Number of angles	Four angles	Three angles	Two angles	One angle
No Pain Group **n=67**	39% (26)	39% (26)	16% (11)	6% (4)
Pain Group **n=27**	48% (13)	26% (7)	19% (5)	7% (2)

4.5.4 Comparison between the pain and no pain groups for psychosocial factors

The pain subgroups remain as discussed in section 4.5.2. The 95% confidence interval around the SE was calculated for the no pain group anxiety and depression. The mean values for anxiety and depression were calculated for each pain subgroup. The data is presented in table 4.15.

Table 4.15 The mean values for anxiety and depression of the pain subgroups compared to the 95% confidence intervals for the no pain group

			anxiety	depression
No pain group (N=67) **95% confidence interval**	**Total**	N=67	49-53	13-19
	Gender	Boys (n=32)	46-54	8-17
		Girls (n=35)	49-54	14-24
	Age	15 years (n=17)	46-55	7-21
		16 years (n=31)	46-53	10-8
		17 years (n=19)	49-58	12-27
Pain subgroups (N=27) **mean**	**Group**	n=27	53	**12***
	Gender	Boys (n=18)	51	10
		Girls (n=9)	**57***	17
	Age	15 years (n=6)	54	9
		16 years (n=16)	53	13
		17 years (n=5)	52	12
	Number of pain areas	1	**54***	13
		2	50	13
		3 or more	**54***	**9***
	Most common pain areas	Head (n=18)	51	**12***
		Neck/ shoulders/ upper back (n=22)	53	**11***
	Persisting pain	n=9	**57***	13

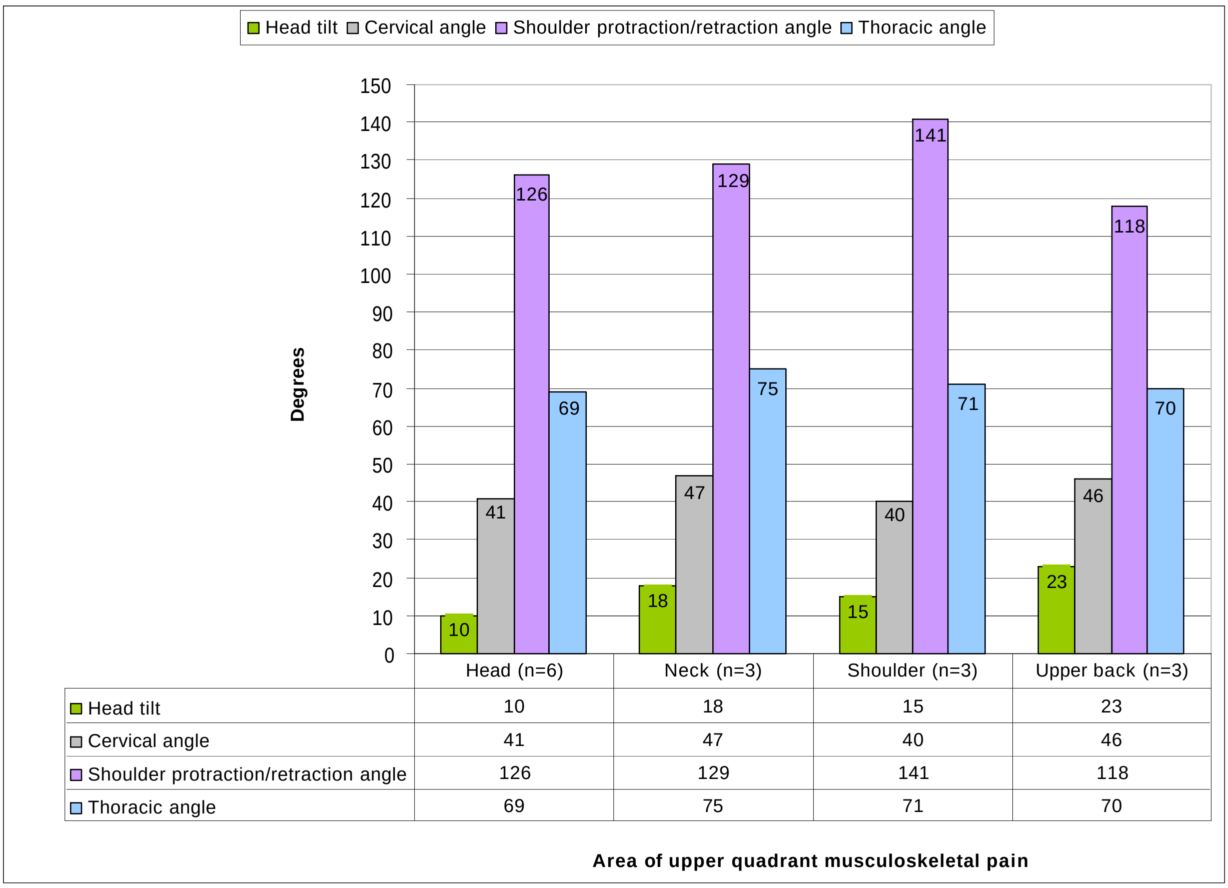
The mean values in bold print marked with a (*) shows the values for the pain group that fall outside the 95% confidence intervals calculated for the no pain group population estimate.

4.5.5 Comparison between the pain and no pain groups for computer use

Time per sitting session at school for the pain group (mean 50 minutes) did not differ much from the no pain group (mean 44 minutes). The minutes per sitting session elsewhere did also not reveal any differences. There was only a two minute difference between the total minutes per day (school and elsewhere) for the pain and the no pain group with a mean of 120 minutes and 118 minutes respectively.

4.5.6 Comparison between different pain subgroups and sitting postural alignment

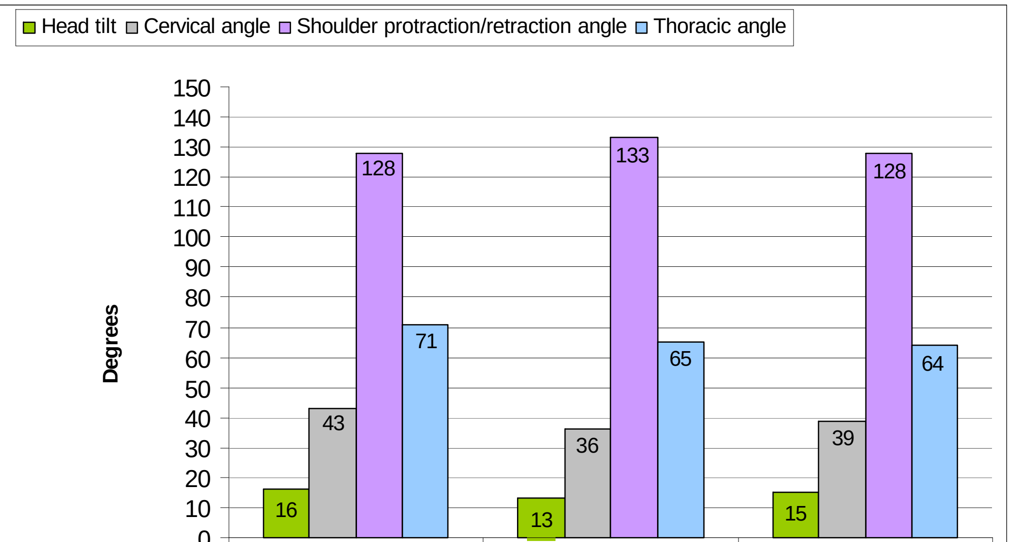
The pain group was divided into subgroups. Figure 4.18 demonstrate the variety of postural angles for learners who complained only of a single pain area such as head, neck, shoulder or upper back pain. 15 learners complained of a single area of pain. The learners who complained of multiple areas of pain were excluded.



	Head (n=6)	Neck (n=3)	Shoulder (n=3)	Upper back (n=3)
Head tilt	10	18	15	23
Cervical angle	41	47	40	46
Shoulder protraction/retraction angle	126	129	141	118
Thoracic angle	69	75	71	70

Figure 4.18 Postural angles for head, neck, shoulder and upper back pain (n=15)

Figure 4.19 illustrates the postural angles for learners who complained of one, two, three or more areas of pain. The 16 learners who complained of only on area of pain constituted the 15 learners mentioned above as well as one learner who complained of wrist pain. Six of the nine learners who complained of pain at three and six months indicated different number of pain areas at the different time intervals. Thus there are 33 number of pain areas accounted for.



	Only one area (16)	Two areas (n=7)	More than three areas (n=10)
Head tilt	16	13	15
Cervical angle	43	36	39
Shoulder protraction/retraction angle	128	133	128
Thoracic angle	71	65	64

Number of upper quadrant musculoskeletal pain areas

Figure 4.19 Postural angles for one, two or three and more pain areas (n=33)

4.6 Risk Factors Associated with the Development of Upper Quadrant Musculoskeletal Pain

The data analysis group consisted of the pain group (n=27) and the no pain group (n=67). (See section 4.5.1 and Figure 4.17). However the quartiles were based on the data of the 104 learners measured at baseline.

4.6.1 Exposure to gender, height, weight and BMI

The odds ratio of upper quadrant musculoskeletal pain when exposed to gender, height, weight and BMI is presented in Table 4.16. The values lesser than the 25% quartile and greater than the 75% quartile for height, weight and BMI were used and referred to as extreme height, weight and BMI. This is similar to the analysis by Vikat *et al.* (2000). There was only a tendency for boys to be at a greater risk for developing upper quadrant musculoskeletal pain however this risk factor did not reach significance (OR 1.94; 95% CI: 0.9-4.9). There was also a tendency that extreme BMI could be related to pain (OR 2.28; 95% CI: 0.8-5.93). The effect of gender on height, weight and BMI was considered but the results showed no significance.

Table 4.16 The association of upper quadrant musculoskeletal pain by gender, height, weight and BMI

		Group OR	Group 95% CI	Boys OR	Boys 95% CI	Girls OR	Girls 95% CI
Gender	Boys	**1.94***	**0.9-4.9**				
	Girls	0.51	0.2-1.3				
Height	<1.57m or >1.68m	1.26	0.5–3.1	1.26	0.5–3.1	0.5	0.1–2.7
Weight	<47.85kg or >62.15kg	1.1	0.5-2.7	0.9	0.3-2.8	2.1	0.5-9.4
BMI	<18.42 or >23.33	**2.28***	**0.8–5.92**	1.7	0.5–5.9	2.66	0.5–13.8

The OR in bold print marked with a (*) shows a tendency to reach significance at the 95% confidence interval.

4.6.2 Exposure to sitting postural alignment

The postural angles that were either lesser than the 25% quartile or greater than the 75% quartile were considered to represent the ‘extreme angles’ for the sample of 94 high school learners (See Table 4.5). The odds ratio of upper quadrant musculoskeletal pain when exposed to these extreme postural angles is presented in Table 4.17. The learners with a cervical angle greater than 43.95° (75% quartile) or lesser than 34.75° (25% quartile) have a 2.6 greater chance to develop upper quadrant musculoskeletal pain (95% CI: 1.0–6.7). The learners with a thoracic angle greater than 71.1° (75% quartile) or lesser than 63.1° (25% quartile) also have a 1.86 greater chance to develop upper quadrant musculoskeletal pain (95% CI: 0.8-4.7). However this was not statistically significant because the lower confidence interval was not equal or greater than one. After considering the effect of gender on postural angles the results revealed that the extreme cervical angle was more a risk factor for boys than it was for girls. The

OR for cervical angle for boys showed a tendency to reach significance (OR 3.3; 95% CI: 0.9-11.8).

Table 4.17 The association of upper quadrant musculoskeletal pain by postural angles

Angles		Group OR	Group CI	Boys OR	Boys CI	Girls OR	Girls CI
head tilt	<6.9° or >18.6°	0.78	0.3 –1.9	1.1	0.3-3.5	0.4	0.1-1.9
cervical	<34.75° or >43.95°	**2.6****	**1.0–6.7**	**3.3***	**0.9-11.8**	1.9	0.5-7.8
shoulder pro- and retraction	<117.4° or >141.4°	0.78	0.3–1.9	1.8	0.5-5.9	0.3	0.1-1.2
thoracic	<63.1° or >71.1°	**1.86***	**0.8–4.7**	1.3	0.4-4.5	2.4	0.6-9.9

The OR in bold print marked with a (**) shows significance at the 95% confidence interval. The OR in bold print marked with a (*) shows a tendency to reach significance at the 95% confidence interval.

4.6.3 Exposure to psychosocial factors

The odds ratio for upper quadrant musculoskeletal pain when exposed to anxiety and depression is presented in Table 4.18. The median values for anxiety and depression were used instead of the cut off values described in section 3.7.3 for when utilizing the MASC and BDI because these questionnaires were not used for diagnostic purposes but only to describe anxious and depressive tendencies. The results did not reveal any statistically significance for the group as well as for gender.

Table 4.18 The association of upper quadrant musculoskeletal pain by anxiety and depression

		Group OR	Group CI	Boys OR	Boys CI	Girls OR	Girls CI
Anxiety	>51.5	1.37	0.6–3.6	1.41	0.4–4.7	1.87	0.4–8.4
Depression	>11	0.64	0.3–1.6	0.65	0.2–2.5	1.0	0.2–4.0

4.6.4 Exposure to computer use

The odds ratio for upper quadrant musculoskeletal pain, when exposed to daily and weekly computer use, is presented in Table 4.19. The median values for daily and weekly computer use was utilized for the analysis. The results did not reveal any statistically significance for the group as well as for gender.

Table 4.19 The association of upper quadrant musculoskeletal pain and computer use

		Group OR	Group CI	Boys OR	Boys CI	Girls OR	Girls CI
Computer use (minutes per day)	>105 minutes per day	1.0	0.4-2.6	1.0	0.3-3.4	0.5	0.1-4.3
Computer use (hours per week)	>8.75 hours per week	1.3	0.5-3.3	0.9	0.3-2.8	1.8	0.4-8.7

4.6.5 Combination risk factors associated with upper quadrant musculoskeletal pain

Learners were classified as having a poor posture when two or more angles were extreme angles as discussed in section 4.2.5. There was no association found between poor posture and upper quadrant musculoskeletal pain. However learners with the combination of an extreme cervical and an extreme thoracic angle, meaning angles either greater than the 75% quartile or lesser than the 25% quartile for the particular angles, have a 2.19 greater chance to develop upper quadrant musculoskeletal pain (95% CI: 1.0–5.6) and was statistically significant. The combination of an extreme cervical and an extreme thoracic angle also showed a tendency to reach significance but only for the boys (OR 2.56; 95% CI: 0.7–8.9) and not for the girls. The results are illustrated in Table 4.20.

Table 4.20 The association of upper quadrant musculoskeletal pain and poor posture

	Group OR	**Group** CI	**Boys** OR	**Boys** CI	**Girls** OR	**Girls** CI
Poor posture	1.39	0.5–4.0	1.91	0.4-8.3	0.9	0.2-4.2
Extreme cervical and thoracic angles	**2.19****	**1.0–5.6**	**2.56***	**0.7–8.9**	1.5	0.3–7.2

The OR in bold print marked with a (**) shows significance at the 95% confidence interval. The OR in bold print marked with a (*) shows a tendency to reach significance at the 95% confidence interval.

4.7 **Height, Weight, BMI, Anxiety and Depression related to Poor Posture**

The study further investigated the influence of height, weight, BMI and psychosocial factors (anxiety and depression) on poor posture (two or more 'extreme angles') and found the following results presented in Table 4.21. Weight greater than the median value of 54.15kg, was found to be a significantly associated with having two or more extreme angles and therefore having a poor posture (OR 3.1; 95% CI: 1.0-9.7). A depression score greater than 11 was significantly associated with poor posture (OR 1.02; 95% CI: 1.0-1.1) and an anxiety score greater than 51.5 only showed a tendency to be associated with poor posture (OR 1.65; 95% CI: 0.7-4.2). The effect of gender on poor posture were also considered but revealed no significance.

Table 4.21 The association of poor posture and height, weight, BMI and psychosocial factors

		Group OR	Group CI
Height (m)	>1.63m	1.1	0.5–2.8
Weight (kg)	>54.15kg	**3.1****	**1.0–9.7**
BMI	>20.37	1.7	0.6–4.9
Anxiety	>51.5	**1.65***	**0.7–4.2**
Depression	>11	**1.02****	**1.0–1.1**

The OR in bold print marked with a (**) shows significance at the 95% confidence interval. The OR in bold print marked with a (*) shows a tendency to reach significance at the 95% confidence interval.

4.8 Results Summary

- Extreme cervical angles and the combination of extreme cervical and thoracic angles are risk factors for upper quadrant musculoskeletal pain
- Boys are at a greater risk for developing upper quadrant musculoskeletal pain than girls
- Weight greater than the median value and high levels of depression are significantly associated with poor posture
- The cervical and thoracic angles show the least variability compared to the other angles measured
- Depression is detected among 37% of the learners
- Boys reported more computer use than girls for daily, 134 minutes (99), and weekly, 8.8 hours (6.2), use

CHAPTER 5

DISCUSSION

5.1 **Introduction**

An observational analytical study was conducted to determine whether exposure to certain postural angles during sitting, and to psychosocial factors such as anxiety and depression, have an effect on the outcome of upper quadrant musculoskeletal pain among high school learners who use desktop computers. A sample of 104 asymptomatic learners was followed for six months to see if they developed upper quadrant musculoskeletal pain after being exposed to the risk factors mentioned previously. The prospective study design enabled the researcher to measure the exposure accurately before any signs or symptoms of the disorder were present.

Out of the 104 asymptomatic learners, 27 learners developed upper quadrant musculoskeletal pain over the six-month period, and one-third of these complained of musculoskeletal pain symptoms both at three and six months. There is no published literature that can report the pain incidence or incidence rate of computer-related upper quadrant musculoskeletal pain among high school learners because of a lack of appropriate research. However, similar pain incidence rates for neck/shoulder and low back pain that is not related to computer use have been found in other studies (Feldman *et al.* 2002; Grimmer *et al*. 2006; Sjolie 2004)

Since childhood and adolescent reports of musculoskeletal pain are associated with pain in early adulthood, emphasis should be placed on the efficient management of musculoskeletal pain symptoms from a young age (Brattberg 2004; Stahl *et al*. 2004). The efficient management of the symptoms of musculoskeletal pain can only be accomplished if sound insight is available into the aetiology of the problem. Due to the number of hours spent attending classes on a daily basis, attending school can be acknowledged as a learner's occupation (Straker & Pollock 2005). Therefore occupational musculoskeletal injuries sustained by high school learners could be the result of exposure to certain risk factors at school or at home. Occupational musculoskeletal injuries are biomechanical in nature but can be influenced by the subject's genetics, morphological characteristics, psychosocial profile and occupational biomechanics (Kumar 2001). This study investigated sitting posture during computer use because prolonged sitting posture has been identified as a biomechanical risk factor for adults with sedentary occupations (Ariens, Bongers, Douwes, Miedema, Hoogendoorn, Van der Wal, Bouter & Van Mechelen 2001). Anxiety and depression was investigated because previous studies have shown that these two psychosocial factors are highly associated with the experience of upper quadrant musculoskeletal pain among adolescent high school learners (Chapter 2).

5.2 Computer Usage and Exposure

The Khanya Project of the Western Cape Education Department enhances the availability and accessibility of computers to high school learners. This project creates a unique setting for research to be performed on learners who use computers. The exposure to computers can be evaluated because very few of the nearly one million learners in the region had ever seen or touched a computer before the project was established in April 2001. With the rapid implementation of the Khanya Project, more learners are interacting with advanced technology on a daily basis and the ramifications of computer use among adolescent high school learners can be assessed. A cross-sectional study was conducted among selected Western Cape high schools enrolled in the Khanya project. The study found that 69.9% of the learners who used computers reported musculoskeletal pain symptoms (Smith *et al*. 2007). Previous research that investigated the associations between computer usage and upper quadrant musculoskeletal pain among adolescents showed no consistency in their findings. A cross-sectional study by Diepenmaat *et al*. (2006) showed that there was no association between computer use and musculoskeletal pain. However Harris & Straker (2000) and Ramos *et al.* (2005) found in their cross-sectional studies that 60% and 58.2% learners respectively complained of musculoskeletal pain while using laptop computers, and that upper quadrant musculoskeletal pain was significantly associated with computer use at school and at home.

This study has shown that the exposure to computer use per session and per day is on par with other developed countries, but most of the 15 to 17 year olds had limited years of exposure to computers. The group experiencing pain and the group with no pain had similar years of exposure to computers, with the former including 70% of the learners and the latter 85% of learners with less than three years experience working on computers. Both groups contained more than 40% of learners with less than one year's exposure to computers at school. Research has shown that, as the years of computer use increases, the prevalence of musculoskeletal discomfort among adolescents also increases (Harris & Straker 2000; Ramos *et al*. 2005). It could be that no association between computer usage and upper quadrant musculoskeletal pain was found in this study because the learners in this study reported limited years of exposure to computers.

The mean daily usage and the time per session sitting in front of a computer corresponded with other developed countries (Ho & Lee 2001; Jacobs &Baker 2002; Ramos *et al.* 2005). Ramos *et al.* 2005 and Jacobs & Baker 2002 both found that learners sit on average between 30 and 60 minutes per session which is similar to the 45 minutes found in this study. Ho & Lee (2001) found that adolescents spend about 137 minutes per day working on the computer which corresponds with the 119 minutes found in this study. However, Harris & Straker (2000) and Diepenmaat *et al*. (2006) reported a daily computer usage by adolescents that exceeded three hours and only Harris & Straker (2000) could find an association between computer use and musculoskeletal pain. Skeletal maturity, as defined by the age when the epiphyses of the hand and wrist fuse, occurs during adolescence. However, skeletal growth continues beyond this age of skeletal maturity and there is a significantly greater increase in sitting height compared to standing height from two years before and two years after skeletal maturity (Howell, Mahood & Dickson 1992). This implies that more growth takes place in the vertebral column during adolescence (Howell *et al.* 1992). Prolonged sitting due to computer use therefore occurs during a critical period of skeletal growth in the vertebral column and damage to the neuromusculoskeletal system could have a lasting effect if it occurs during this period (Harris & Straker 2000; Ramos *et al*. 2005)

Most of the computer-related musculoskeletal disorder research is centred on the adult population. Computer-related musculoskeletal pain among adults supports a relationship between postural alignment, abnormal muscle recruitment patterns and upper quadrant musculoskeletal pain. A prospective study by Gerr, Marcus, Ensor, Kleinbaum, Cohen, Edwards, Gentry, Ortiz & Monteilh (2002) reported an annual incidence of 58 cases/100 person-years of musculoskeletal symptoms and 35 cases/100 person-years of musculoskeletal disorders among computing adults. Szeto, Straker & O'Sullivan 2005a & 2005b found that a difference of 8° neck flexion between a symptomatic group and an asymptomatic group of computing office workers lead to an altered muscle activation pattern. It is evident from the literature that computer use can be a potential threat to a healthy neuromusculoskeletal system in adults. However, to date there is no published literature that has assessed musculoskeletal pain or discomfort that occurs after introducing computer use in an adolescent population of high school learners.

5.3 **Exposure to Sitting Postural Alignment**

5.3.1 <u>Postural angles</u>

This study found that extreme cervical angles, referring to angles less than the 25% quartile (<34.75°) or greater than the 75% quartile (>43.95°), was a significant risk factor for the development of upper quadrant musculoskeletal pain among the group (OR 2.6; CI: 1.0-6.7). These angles were measured using the horizontal line going through the C7 spinous process, as described in section 3.7.2. Therefore, as the angles increase, the cervical spine is in a position of less flexion. Figure 5.1 shows a cervical angle greater than the 75% quartile (a) and a cervical angle less than the 25% quartile (b)

(a) (b)

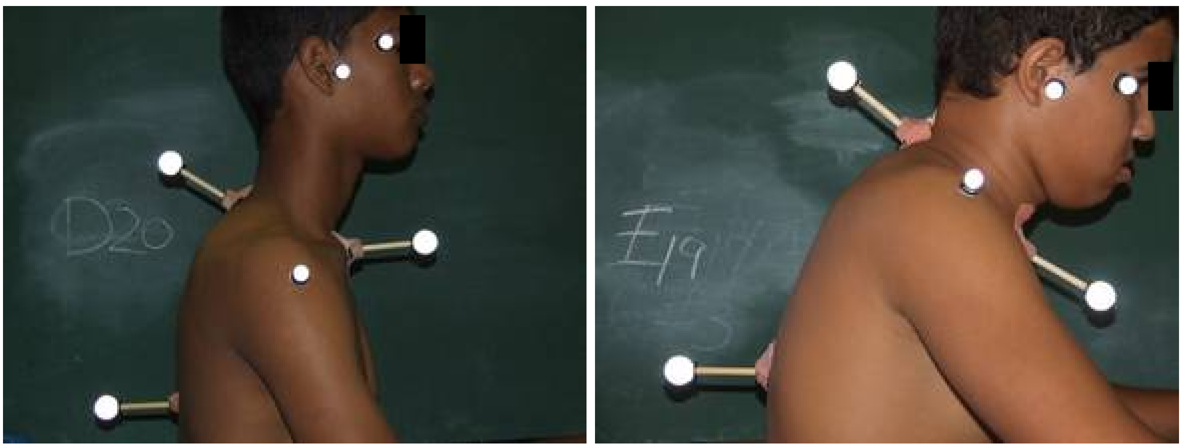


Figure 5.1 Photographs showing the different postures with extreme cervical angles

As the cervical angle decreases, as seen when lower visual display units are used (Figure 5.1 b), the extensor moment around C7 increases and more isometric muscle activity is needed from the superficial paraspinal extensors to counterbalance the gravitational moment (Briggs *et al.* 2004). Joosab, Torode & Prasada Rao (1994) and

Harrison, Harrison, Janik, Jones, Cailliet & Normand (2001) suggest that an increase in lower cervical flexion (forward head position, as seen in Figure 5.1b) causes a different loading pattern to the cervical spine. Straker, Jones & Miller (1997) concluded that a small difference of 6° in cervical angle can result in a 9% change in the extensor torque around C7 and have an effect on the neck extensor moment. This could potentially lead to musculoskeletal pain or discomfort (Briggs *et al*. 2004; Grieg *et al.* 2005). However if the cervical angle decreases to the maximum angle, as seen when reading a book, then the isometric muscle activity is reduced because the majority of the load is taken by the non-contractile tissues (Briggs *et al.* 2004). When the cervical angle increases (Figure 5.1a), the extensor moment is shortened, but muscle activity is still needed to stabilise the cervical spine in order to maintain an erect posture. With a greater cervical angle (less neck flexion), the length-tension relationship of the deep suboccipital muscles is not optimal and reduces the force-generating capability of the smaller suboccipital muscles as well as of the larger semispinalis capitis muscles. This places more stress on the upper cervical zygapophyseal and intervertebral joints and can lead to musculoskeletal pain or discomfort (Briggs *et al*. 2004; Burgess-Limerick, Mon-Williams & Coppard 2000). It appears that with either too much cervical flexion (less cervical angle) or too little cervical flexion (greater cervical angle), neuromusculoskeletal tissues can become symptomatic when exposed to factors that place repetitive or prolonged mechanical stress on the structures (Kumar 2001).

The extreme thoracic angles, referring to angles smaller than the 25% quartile (<63.1°) or greater than the 75% quartile (>71.1°), also indicates a tendency to be a risk factor (OR 1.86; 95% CI: 0.8-4.7) for upper quadrant musculoskeletal pain. However after testing various combinations of extreme angles, the researcher found that learners with an extreme cervical and extreme thoracic angle combined were at risk of developing upper quadrant musculoskeletal pain (OR 2.19; CI: 1.0-5.6).

The learners who complained of only neck pain had extreme cervical and thoracic angles, while the learners who complained of only upper back pain had extreme head tilt and cervical angles (section 4.5.6). However, the learners who complained of pain only around the head area had no extreme angles, even though this area was indicated the most by the pain group. It appears that the area of complaint is only an indication of the possible postural angles at inappropriate positions when the pain relates to the neck or upper back region and not to any other areas in particular. The number of pain areas indicated by the learners also showed no relation with the postural angles at fault (see section 4.5.6).

It is difficult to compare the postural angles of the head-neck complex of previous studies conducted among adolescents due to the inconsistency in the body landmarks used for defining the angles. The results of the measured angles from this study could be compared with studies conducted by Straker, Briggs & Grieg (2002) and Briggs *et al.* (2004), because these studies were consistent in the definition for head tilt and cervical angle and similar to the definition used in this study for the same age group. The mean values for head tilt (13.8°) and cervical angle (39.3°) of this study were similar to mean values found in the studies by Straker *et al*. (2002) and Briggs *et al.* (2004). No other study measured the shoulder protraction/retraction angle or the thoracic angle as measured in this study, and therefore no comparison could be made for these two angles. Similar results were found among the adult population for cervical angle (neck flexion). Szeto *et al.* (2002) reported a mean neck flexion angle of 30.9° for the symptomatic group and 37.5° for the control group. The head tilt angle was not any different for the asymptomatic and symptomatic workers. In this study, the researcher also found no difference in the head tilt angles between the group of high school learners experiencing pain and those experiencing no pain.

Murphy *et al*. (2004) measured the angles of static sitting posture without computer use and upper quadrant musculoskeletal pain simultaneously among children, and found that relatively less trunk flexion movement, between 20º and 45º, was significantly associated with self-reported upper back and neck pain. Other published studies Briggs *et al*. (2004) & Grieg *et al.* (2005) measured the postural angles of high school learners or adolescents while they worked on computers unfortunately did not measure musculoskeletal pain.

5.4 Exposure to Psychosocial Factors such as Anxiety and Depression

5.4.1 Depression

The researcher could not find any causal relationship between anxiety or depression and the development of upper quadrant musculoskeletal pain among high school learners who work on computers. However, 38 learners (37%) scored 16 and above on the Beck Depression Inventory. A score of 16 and above has 100% sensitivity to detect depression among adolescents (Barrera & Garrison-Jones 1988). Eight of the 38 learners who met the cut-off point for depression developed upper quadrant musculoskeletal pain. The mean depression score for the group with no pain was greater than for the group experiencing pain. This contradicts the findings of the systematic review discussed in Chapter 2, where depression is highly associated with upper quadrant musculoskeletal pain among adolescents. Diepenmaat *et al.* (2006) found a positive association between neck pain and high levels of depression (OR 1.9; 95% CI: 1.5-2.5). A study conducted among grade ten learners in the Western Cape of South Africa found that adolescents reported on average 3.5 childhood traumatic events and, as a result, 26.5% had difficulty expressing their emotion compared to learners from developed countries (Suliman, Kuminer, Seedat & Stein 2005). The researcher postulates that high levels of depression affected the South African learners differently than the adolescents from other developed countries and consequently more depressed feelings might have suppressed the learner’s expression of pain symptoms. Harma *et al.* (2002) found that recurrent pain symptoms were significantly associated with high levels of depression for both girls and boys (OR 1.4; 95% CI: 1.1-1.8 and OR 1.6; 95% CI: 1.2-2.2 respectively), which means that chronic pain symptoms might be the cause and not the outcome of high levels of depression among high school learners.

The mean depression scores for the girls were consistently higher than those for the boys across the different ages, and the mean scores for depression for both sexes became greater as age increased. The scores for depression were similar to those in other studies regarding the effect of gender and age (Niemi *et al.* 1997).

5.4.2 Anxiety

The mean score for anxiety was greater for the group experiencing pain than for the group experiencing no pain. Four of the 104 learners met the cut-off point of 70 for detecting anxiety among adolescents (March 1997). Three of the four learners developed upper quadrant musculoskeletal pain, although, the sample size was too small to assess the impact of anxiety on upper quadrant musculoskeletal pain. The mean anxiety score did not follow a similar trend as for depression. The mean anxiety scores for the girls were higher than for the boys except for the 15-year olds. The mean anxiety score for the 15-year old boys was greater than for the 16-and 17-year old boys. The anxiety scores of this study reflects what has been documented in other studies regarding the differences between groups experiencing pain and those experiencing no pain, but not for age or gender differences (Niemi *et al*. 1997). Diepenmaat *et al.* (2006) found a positive association between neck pain and high levels of anxiety (OR 2.0; CI: 1.5-2.7).

Even though the group experiencing pain was more anxious than depressed, the sample size of the anxious learners may have been too small to determine whether anxiety, resulting in very wide CI, has any influence on the development of upper quadrant musculoskeletal pain. This study was therefore unable to find any causal association between depression or anxiety and the experience of upper quadrant musculoskeletal pain.

This study also investigated any associations between poor posture and the other measured variables. Poor posture is related to having two or more extreme angles which in turn refers to angles smaller than the 25% or greater than the 75% quartiles (section 4.6.5). This study showed that depression was significantly associated with poor posture (OR 1.02; 95% CI: 1.0-1.1). There also was a tendency for anxiety to also be associated with poor posture, but it was not significant (OR 1.65; 95% CI: 0.7-4.2). It appears that psychosocial factors are associated with extreme postural angles, but not with upper quadrant musculoskeletal pain, although extreme postural angles, especially cervical angles, were a significant risk factor for upper quadrant musculoskeletal pain among the high school learners in this study. The researcher postulates that psychosocial factors might lead to poor posture and indirectly to upper quadrant musculoskeletal pain among South African high school learners.

One published study that measured upper quadrant musculoskeletal pain prospectively also measured mental health as a potential risk factor for neck and shoulder pain (Feldman *et al.* 2002). However the study measured mental health simultaneously with neck and shoulder pain at the follow-up sessions. Therefore neck and shoulder pain are only associated with poor mental health (OR 1.64; 95% CI: 1.29-2.10), rather than a risk factor for pain (Feldman *et al.* 2002). In this instance pain could be the cause of poor mental health or the outcome.

5.5 Exposure to Gender, Age, Height, Weight and BMI

5.5.1 Gender

In this study, twice as many boys (n=18) than girls (n=9) reported pain, and the boys had a 1.94 greater risk to develop upper quadrant musculoskeletal pain (95% CI: 0.9-4.9), even though there was almost an equal distribution of girls (n=49) and boys (n=55) at inception of the study. This contradicts the findings of Diepenmaat *et al*. (2006), Grimmer *et al*. (2006) and Stahl *et al*. (2004), who assessed neck/shoulder pain and lower back pain in developed countries and found that adolescent girls have a significantly greater risk for either neck/shoulder or low back pain.

The greater risk for boys to develop pain might be because of the significant risk that extreme cervical angle or a combination of extreme cervical and thoracic angles hold for the development of upper quadrant musculoskeletal pain for the group. Both these risk factors revealed a tendency to reach significance only for the boys (sections 4.6.2 and 4.6.5). The boys also demonstrated more daily and weekly computer use than their female counterparts, and this could explain the risk for boys to develop upper quadrant musculoskeletal pain rather than girls. A study by Auvinen, Tammelin, Taimela, Zitting & Karppinen (2007) reported that a larger proportion of boys worked on computers for more than two hours and that prolonged sitting due to computer work is associated with neck and occipital pain only for boys (OR 1.3; 95% CI: 1.0-1.7).

5.5.2 Age

The study found that the 17-year olds reported less pain (19.2%) than the 15-year olds (24%). More than half of the group experiencing pain were 16-year olds (59%). This could be because twice as many 16-year olds were included in the sample at inception.

These findings do not correspond with results from other studies, which emphasise the increase in pain prevalence and pain incidence as age increases (Siivola *et al.* 2004; Stahl *et al.* 2004; Sunblad, Saartok & Engström 2007; Wedderkopp *et al.* 2001). It could be that the subgroups for the different ages were too small to evaluate the effect of age on the experience of upper quadrant musculoskeletal pain. The 15-year olds also had the highest BMI values compared to the 16 and 17 year olds and consequently extreme BMI, referring to a BMI of <18.42 or >23.33 for the group showed a tendency to be a risk factor for upper quadrant musculoskeletal pain (OR 2.28; 95% CI: 0.8-5.92).

5.5.3 Height, weight and BMI

There are controversial findings from previous literature regarding the association between height, weight, BMI and musculoskeletal pain (Trevelyan & Legg 2006). However, this study found that only extreme BMI values, of <18.42 or >23.33, revealed a tendency to be a risk factor for upper quadrant musculoskeletal pain (OR 2.28; 95% CI: 0.8-5.92).

Weight measurements greater than the median value (54.15kg) revealed a significant association with poor posture (OR 3.1; 955 CI: 1.0-9.7). It seems that more attention should be paid to the weight than to the height of learners using desktop computers.

5.6 Clinical Implication

Postural rehabilitation is an important component of physiotherapy treatment in preventing and managing upper quadrant musculoskeletal pain. Steele, Dawson & Hiller (2006) recommended in their review of school-based spinal interventions that future interventions should be evidence based to ensure that children and adolescents benefit from these interventions.

The findings of this study imply that attention should be paid to the ergonomics of the school learners. The dimensions of the school furniture used in the computer room should be adjustable in order to accommodate the anthropometric parameters of each learner so that they are not exposed to the extreme cervical and thoracic angles reported in this study. For learners to assume good sitting posture, time should be made available during classes to implement pause exercises that can aid in maintaining good posture and preventing prolonged static sitting in front of the computer. The current knowledge available on adults using computers and the effect of this on musculoskeletal systems cannot simply be applied to adolescents because of the adolescent's different physical dimensions and usage of computers (Harris & Straker 2000; Straker & Pollock 2005). However, existing ergonomic principles, guidelines and treatment regimes form the basis from which treatment is directed.

The management of upper quadrant musculoskeletal pain comprises a multidisciplinary rehabilitation approach, especially where psychosocial factors are the more prominent risk factors, because they fall outside the management scope of physiotherapy and need to be addressed by the appropriate health professional (Sen & Christie 2006).

Even though there was no relationship between psychosocial factors and upper quadrant musculoskeletal pain, there still were learners that met the cut-off score for depression and anxiety. Attention must be given to the learners that fit this psychosocial profile in order to provide them with efficient management and prevention programmes.

5.7 Limitations of the Study

The size of the study sample was limited by time constraints to conduct the baseline measurements at each school. The postural measurements were time consuming because only two learners could be measured simultaneously. The sample size for cohort studies needs to be substantial so that the exposed group has sufficient numbers to obtain meaningful outcomes, meaning that there must be enough learners who develop upper quadrant musculoskeletal pain (Portney & Watkins 2000). A calculation of sample size was not made because only a certain number of learners could be accommodated. Nevertheless the sample size for this study consisted of more learners (n = 104) in comparison to other studies that have described the posture of high school learners via biomechanical measurements. Straker et al. (2002) and Murphy et al. (2004) had sample sizes of 32 and 66 respectively.

The passage of time (six months) that was allowed for upper quadrant musculoskeletal pain to run its course among computing high school learners could have been too short to fully encompass the effects of posture and psychosocial factors on musculoskeletal pain. The researcher had only six months for the study because of the time in which the study had to be completed. Gerr *et al*. (2002) and Ariens, Bongers, Douwes *et al.* (2001) conducted three-year follow-up studies to determine the risk factors for upper quadrant musculoskeletal pain among an adult population.

The Portable Posture Analysis Method (PPAM) had only been applied in a laboratory setting without learners using a desktop computer. For this study, the PPAM was utilised in a real-life classroom setting with learners actively using desktop computers for curriculum delivery. The two-dimensional photographs did not incorporate any rotation of the upper body. This influenced the pixel length of the wooden stems, though this problem was rectified by calculating the pixel length of each wooden stem and using the mean value to calculate the angles of each photograph separately. The X and Y coordinates would also be affected by the rotation of the upper body and can result in minimal differences in the angles obtained. However, the head tilt angle and the cervical angle did not differ from the values found in the literature, but there is no record of shoulder protraction/retraction angle or the thoracic angle with the same angle definition used in this study.

CHAPTER 6

RECOMMENDATIONS for FURTHER STUDIES and CONCLUSION

6.1 **Recommendations for further studies**

This study is the first study to measure sitting postural alignment, anxiety and depression prospectively in order to determine if these factors are risk factors for upper quadrant musculoskeletal pain among adolescent high school learners using desktop computers. Epidemiological studies determine the exposure or causal factors that increase or decrease the risk of developing certain disorders or influence the outcome of a disorder (Portney & Watkins 2000). The prospective studies that measured upper quadrant musculoskeletal pain such as neck and shoulder pain were conducted mostly on children and adults, and those of adolescents mainly measured low back pain symptoms. A recent systematic review (Chapter 2) revealed that only one study measured upper quadrant musculoskeletal pain among adolescents prospectively (Feldman *et al*. 2002). Future prospective longitudinal research should be conducted among adolescents or high school learners, measuring the sitting postural alignment and psychosocial factors, in order to determine their impact on upper quadrant musculoskeletal pain.

Prospective studies need to obtain larger study samples to make statistical analysis easier and to ensure that there are ample numbers in the group that do develop the disorder.

Future studies should only conform to utilising well-validated and reliable measurement tools for assessing posture. Several studies have evaluated sitting posture using a variety of postural measurement tools, from administering self-report questionnaires to measuring postural angles three-dimensionally via video analysis systems (Murphy *et al*. 2002; Vieira & Kumar 2004). The quantitative biomechanical measures were found to be more precise and reliable than the self-report questionnaires (Vieira & Kumar 2004). Posture should be described three-dimensionally to ensure more accurate X and Y coordinates. Learners should also be allowed to type for longer than 10 minutes to make sure that they assume their most comfortable position before the photographs are taken. This will ensure that the measured angles resemble the postural alignment that the learner maintains most of the time during computer classes. Prospective studies should also use well-validated and reliable measurement tools for assessing psychosocial factors (Sen & Christie 2006).

6.2 Conclusion

This study investigated whether there is an association between postural alignment, psychosocial factors and upper quadrant musculoskeletal pain. The study concludes that poor posture, referring to the cervical and thoracic angles, is a risk factor for the development of upper quadrant musculoskeletal pain among high school learners working on desktop computers. A cervical angle of <34.75° or >43.95° and a thoracic angle of <63.1° or >71.1° were risk factors for upper quadrant musculoskeletal pain developing within six months. There were also gender differences, with South African boys at greater risk of developing upper quadrant musculoskeletal pain than girls.

The study found no causal relationship between depression, anxiety and upper quadrant musculoskeletal pain, although there was a positive association between depression and anxiety and poor posture (having two or more extreme angles as described in section 4.7) among high school learners working on desktop computers.

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Appendix A:

Search strategies for systematic review

Databases		keywords / MESH	hits	limits	excluded by title	excluded duplicates	excluded by abstract	excluded by article	remaining articles	duplicated in other databases
Science Direct	1	sitting posture and neck or shoulder pain and (adolescents or children)	981		972	0	4	3	2	
	2	sitting posture and upper limb pain and (adolescents or children)	455		452	3			0	
	3	sitting posture and musculoskeletal pain and (adolescents or children)	200		196	4			0	
	4	psychosocial factors and musculoskeletal pain and (adolescents or children)	697		691	2	1	3	0	
	5	psychosocial factors and upper limb pain and (adolescents or children)	445		442	1	1	1	0	
	6	psychosocial factors and upper extremity pain and (adolescents or children)	474		472	1	1	0	0	
CINAHL	1	posture	286	English	280	2	2	2	0	
	2	posture and pain	59	adolescence	56	3	0	0	0	
	3	posture and (neck or shoulder pain)	123	6-12 years	111	0	2	6	3	1
	4	psychosocial factors and musculoskeletal pain	10		9	1	0	0	0	
	5	psychosocial factors and (neck or shoulder pain)	127		117	9	0	1	0	
PsycInfo	1	posture	321	English	314	2	0	5	0	
	2	posture and pain	10	human	7	1	0	2	0	
	3	posture and (neck or shoulder pain)	24	adolescence	18	3	0	2	1	
	4	psychosocial factors and pain	82	6-12 years	73	5	2	2	0	
	5	psychosocial factors and musculoskeletal pain	38		37	1	0	0	0	
	6	psychosocial factors and (neck or shoulder pain)	177		172	5	0	0	0	
Proquest	1	posture and pain	226		225	1	0	0	0	
	2	posture and (adolescents or children) and pain	27		26	0	0	1	0	

Databases		keywords / MESH	hits	limits	excluded by title	excluded duplicates	excluded by abstract	excluded by article	remaining articles	duplicated in other databases
Pubmed	1	sitting posture and MESH pain	35	adolescence	31	0	2	0	0	2
	2	sitting posture and [MESH neck or MESH shoulder pain]	3	child	1	2	0	0	0	
	3	sitting posture and musculoskeletal pain	4	human	3	1	0	0	0	
	4	MESH posture and [MESH neck or MESH shoulder pain]	150	English	141	2	2	1	2	2
	5	MESH posture and musculoskeletal pain	30		27	3	0	0	0	
	6	MESH posture and MESH student and MESH pain	7		5	2	0	0	0	
	7	psychosocial factors and MESH pain	291		287	0	1	1	0	2
	8	psychosocial factors and [MESH neck or MESH shoulder pain]	9		8	1	0	0	0	
	9	psychosocial factors and upper limb pain	6		5	1	0	0	0	
	10	psychosocial factors and upper extremity pain	6		5	1	0	0	0	
	11	psychosocial factors and MESH student and MESH pain	9		8	1	0	0	0	
BioMed	1	sitting posture	56		55	0	0	1	0	
Central	2	posture and pain	142		141	1	0	0	0	
	3	posture and musculoskeletal pain	78		77	1	0	0	0	
	4	posture and (neck or shoulder pain)	62		61	1	0	0	0	

Appendix B:

Critical Appraisal Form - Quantitative Studies

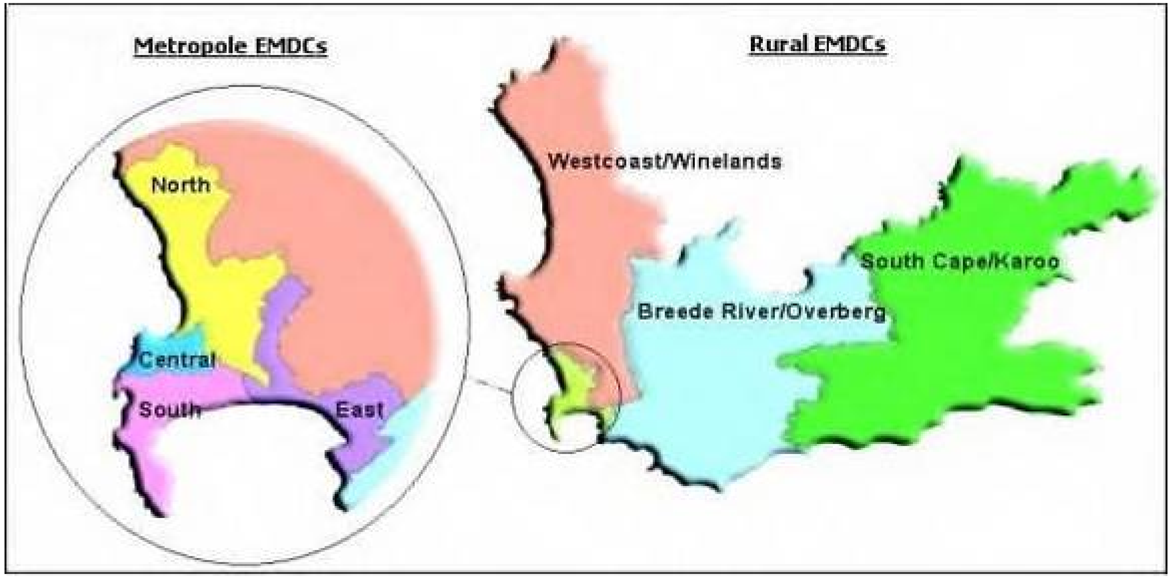
Critical Appraisal Form - Quantitative Studies

		YES	NO
Study purpose			
1	Was the purpose of the study clearly stated?		
Design			
2	Was the study design appropriate?		
Biases			
3	Were there sample biases detected in the study?		
4	Were there measurement biases detected in the study?		
Sample			
5	Was the sample size stated?		
6	Was the sample described in detail?		
7	Was the sample size justified?		
Outcomes			
8	Were the outcomes clearly stated and relevant to the study?		
9	Was the method of outcome measurement described sufficiently?		
10	Were the outcome measures reliable?		
11	Were the outcome measures valid?		
Results			
12	Were the results reported in terms of statistical significance?		
13	Were the analysis methods appropriate?		
14	Was clinical importance reported?		
Dropouts			
15	Were dropouts reported?		
Conclusion and clinical implication			
16	Were the conclusions relevant and appropriate given the methods and results of the study?		

Appendix C:

Educational Development Centers of the Western Cape Metropole (EMDC's)

EDUCATIONAL DEVELOPMENT CENTERS OF THE WESTERN CAPE (EMDC's)



Appendix D:

Consent letter from the Western Cape Education Department

Appendix E:

Computer Usage Questionnaire for school learners (January 2007) / Rekenaargebruikvraelys vir skoolleerders (Januarie 2007)

COMPUTER USAGE QUESTIONNAIRE for

SCHOOL LEARNERS

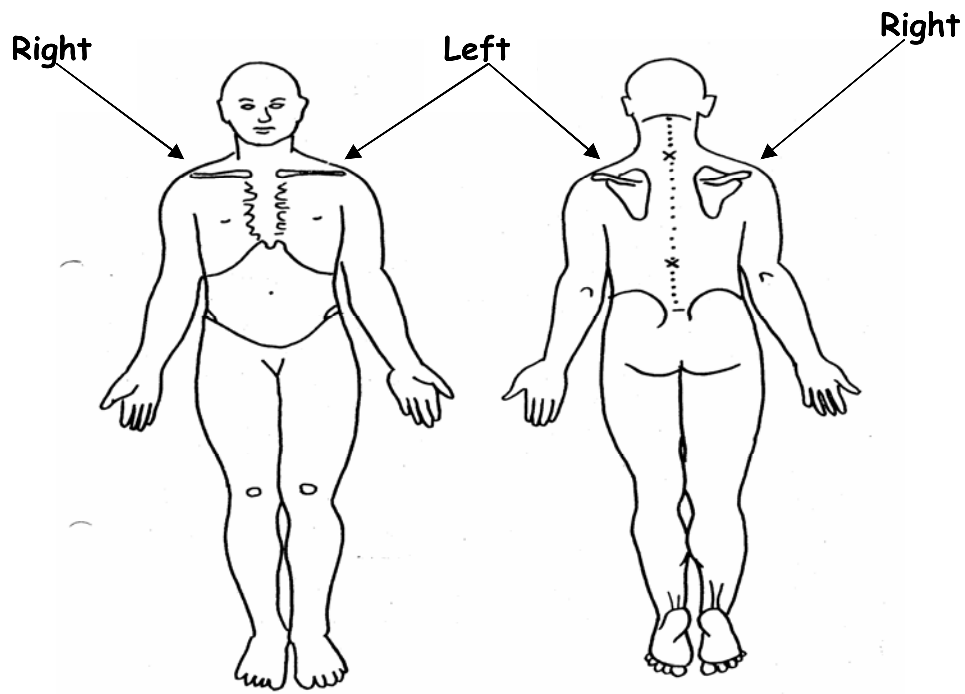
(Screening - January 2007)

TELL US ABOUT YOUR ACHES and PAINS…

*Mark your answer with a **cross (X)**.*

1. Have you experienced any **headaches, discomfort, stiffness, pain,** or **tingling** in your **muscles** or **joints** in the **last month?**
   ☐ Yes ☐ No

2. If **"Yes"**, in which **areas of the body** did you experience these feelings in the last month? Mark the **areas** where you **felt** your **symptoms** with a "**X**"



Please turn the page…..

3. Tell us **how bad** these feelings of **discomfort, stiffness, pain** or **tingling** has been in the **last month**

If you had **SLIGHT discomfort, stiffness, pain,** or **tingling**, mark (**X**): .

If you had **A LOT** of **discomfort, stiffness, pain,** or **tingling,** mark (**X**):

This is an example of how you should do it…

Neck	X	

Body Area	Slight Discomfort, Pain, etc	A lot of discomfort, pain, etc
Head		
Neck		
Upper Back		
Mid-Back		
Lower Back		
Right Shoulder		
Left Shoulder		
Right Elbow		
Left Elbow		
Right Wrist and Hand		
Left Wrist and Hand		

4. **When** did you feel the **headaches**, **discomfort, stiffness, pain** or **tingling** of your **muscles and joints**? Mark as many as you want.

- ☐ Sitting in front of your school desk
- ☐ During or after sports.
- ☐ Working on the computer at school.
- ☐ Writing in a book at school desk
- ☐ Working on the computer elsewhere.
- ☐ Other (please list):____

Please turn the page…..

5. In the **last month**, have you seen a **Doctor** or any other **medical professional** for any of your muscle and joint **complaints** mentioned above?
   ☐ Yes   ☐ No

TELL US ABOUT YOURSELF…. 

1. What is your **school's** name?______________________________________

2. What is **your name**?____

3. What is your **date of birth** (day, month, year)?___________________________

4. In which **grade** are you?_____________________

5. Are you: ☐ A **boy**   ☐ *A girl*

6. Are you: ☐ **Mainly right handed**   ☐ **Mainly left handed**

7. Do you wear: ☐ **Spectacles**   ☐ **Contact Lenses**   ☐ **None**

8. Do you suffer from any **medical condition/s**, e.g. Epilepsy, Diabetes, Asthma?
   ☐ Yes   ☐ No   **If "No", go to question 10**

9. If **"Yes"**, do you use any **medication** for this condition?
   ☐ Yes   ☐ No

10. Have you ever been involved in an **accident or sporting injury** where you injured your **back** or **neck**?
   ☐ Yes   ☐ No

Please turn the page……

11. Have you had any **surgery** involving your **muscles** or **joints** done?

☐ Yes ☐ No

If **"Yes"**, please list the **type of surgery** and when it was done.

Year: _____ Surgery: ______________________________

Year: _____ Surgery: ______________________________

Year: _____ Surgery: ______________________________

THANK YOU FOR COMPLETING THIS QUESTIONNAIRE!!!

The End.

REKENAARGEBRUIKVRAELYS vir

SKOOLLEERDERS

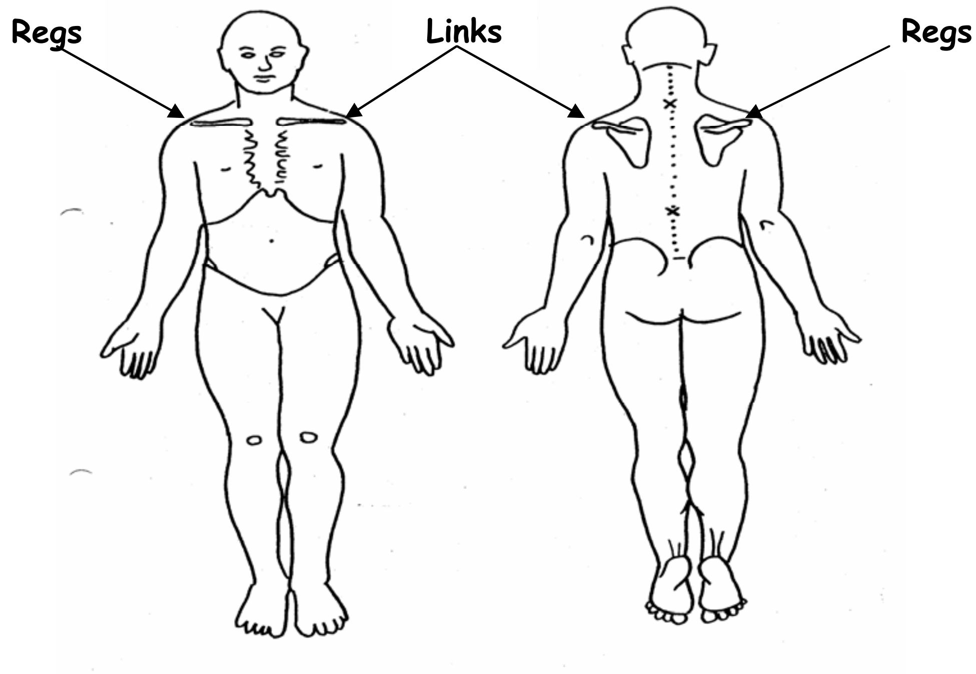
(Siftingsproses - Januarie 2007)

VERTEL ONS VAN JOU PYNE EN SKETE…

Dui jou antwoord met 'n ***kruisie (X)*** *aan.*

1. Het jy in die **afgelope maand** enige **hoofpyn, ongemak, styfheid, pyn** of 'n **tintelende** gevoel in jou spiere of gewrigte ervaar?
   ☐ Ja ☐ Nee

2. Indien wel, in watter **liggaamsdele** het jy hierdie pyn/gevoel ervaar? Merk (**X**) slegs die **dele** waar jy jou **simptome gevoel** het.



Blaai asb om.....

3. Vertel vir ons hoe **"erg"** hierdie **ongemak, styfheid, pyn of tinteling** in jou spiere en /of gewrigte was in die **afgelope maand**.
   Inien jy slegs **GERINGE ongemak, styfheid, pyn** of **tinteling** ervaar het, merk (**X**)
   Indien jy **BAIE ongemak, styfheid, pyn** of **tinteling** ervaar het, merk (**X**)

   Hier is 'n voorbeeld van hoe jy dit moet doen…

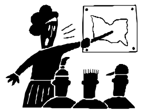
Nek	X	

Liggaamsdeel	Geringe ongemak, pyn, ens	Baie ongemak, pyn,ens
Hoofpyn		
Nek		
Bo-Rug		
Middel Rug		
Lae Rug		
Regter Skouer		
Linker Skouer		
Regter Elmboog		
Linker Elmboog		
Regter Pols en Hand		
Linker Pols en Hand		

4. **Wanneer** het jy die **hoofpyn, ongemak, styfheid, pyn** of **tinteling** in jou **spiere** en **gewrigte** gevoel? Merk soveel opsies as wat op jou van toepassing is.
   - ☐ Wanneer jy voor jou skoollessenaar sit
   - ☐ Tydens of na sportdeelname
   - ☐ Wanneer jy op die skoolrekenaar werk
   - ☐ Wanneer jy by jou skoollessenaar in 'n boek skryf
   - ☐ Wanneer jy elders op 'n rekenaar werk
   - ☐ Ander (noem asseblief):____

Blaai asb om…..

5. Het jy in die **afgelope maand** 'n **dokter** of enige ander **mediese praktisyn** oor die **spier- en gewrigprobleme** wat jy hierbo noem, gaan spreek?
   ☐ Ja ☐ Nee



VERTEL ONS VAN JOUSELF…

1. Wat is jou **skool** se naam? ______________________________

2. Wat is **jou naam**? ____________________________________

3. Wat is jou **geboorte datum** (dag, maand, jaar)? ______________________

4. In watter **graad** is jy? _________________

5. Is jy: ☐ 'n Seun ☐ 'n Meisie

6. Is jy: ☐ Hoofsaaklik **regshandig** ☐ Hoofsaaklik **linkshandig**

7. Dra jy: ☐ 'n bril ☐ kontaklense ☐ **niks van die genoemde nie**

8. Ly jy aan enige **mediese toestand(e)**, byvoorbeeld epilepsie, diabetes, asma?
   ☐ Ja ☐ Nee

9. Indien "**Ja**" by vraag 8, gebruik jy enige **medikasie** vir hierdie toestand(e)?
   ☐ Ja ☐ Nee

10. Was jy al ooit in 'n **ongeluk of sportbesering** betrokke waar jou rug of nek seergekry het?
   ☐ Ja ☐ Nee

Blaai asb om....

11. Het jy al enige **operasies** aan jou spiere of gewrigte gehad?

☐ Ja ☐ Nee

Indien **"Ja"** by vraag 11, noem asseblief die **tipe operasie** en ook **wanneer** dit gedoen is.

Jaar: _____ Operasie: ______________________________

Jaar: _____ Operasie: ______________________________

Jaar: _____ Operasie: ______________________________

DANKIE DAT JY DIE VRAELYS VOLTOOI HET!!!

Die einde.

Appendix F:

Participant Information leaflet and consent form for use by parents/legal guardians / Deelnemerinligtingsblad en Toestemmingsvorm vir gebruik deur ouers/wettige voogde / Incwadana yolwazi elungiselwe umthathi-nxaxheba kunye nephepha-mvume yomzali okanye umgcini womntwana ngokusemthethweni

PARTICIPANT INFORMATION LEAFLET AND CONSENT FORM FOR USE BY PARENTS/LEGAL GUARDIANS

TITLE OF THE RESEARCH PROJECT: Would postural alignment and psychosocial factors be risk factors for developing upper quadrant musculoskeletal pain in high school learners who use desktop computers?

REFERENCE NUMBER: ______________________________________

PRINCIPAL INVESTIGATOR: Yolandi Prins

CONTACT NUMBER: 021 5511494

ADDRESS: Stellenbosch University

Tygerberg Campus

Parow

Your child *(or ward, if applicable*) is being invited to take part in a research project. Please take some time to read the information presented here, which will explain the details of this project. Please ask the study investigator any questions about any part of this project that you do not fully understand. It is very important that you are fully satisfied that you clearly understand what this research entails and how your child could be involved. Also, your child's participation is **entirely voluntary** and you are free to decline to participate. If you say no, this will not affect you or your child negatively in any way whatsoever. You are also free to withdraw him/her from the study at any point, even if you do initially agree to let him/her take part.

This study has been approved by the **Committee for Human Research at Stellenbosch University** and will be conducted according to the ethical guidelines and principles of the international Declaration of Helsinki, South African Guidelines for Good Clinical Practice and the Medical Research Council (MRC) Ethical Guidelines for Research.

What is the research project about?

The purpose of this project is to determine if a child's sitting posture in front of a computer might be the cause of neck and/or shoulder pain. This project will also look at psychosocial aspects that might contribute to neck and/or shoulder pain. The results of this project will enable the medical profession to appropriately intervene in order to prevent children from developing computer-related neck and/or shoulder pain.

In January 2007 the grade ten learners from all the participating schools will be asked to complete a questionnaire about muscle pain or discomfort related to computer activities. As a result of this questionnaire a sample of children will be chosen to participate in the research project.

In February 2007 the selected children will be asked to complete a computer typing task while two researchers take measurements of their sitting posture. The typing will take place in the school's computer room within school hours. The measurements will be taken by means of photographs. The children girls will wear specially designed sports-tops and the boys will wear no tops. This is necessary for markers to be placed on certain landmarks. The landmarks will include the eye, ear, neck vertebra, upper point of the breastbone and upper back vertebra. After completing the 15 minute typing task, the children will be ask to complete a questionnaire asking questions about their feelings and how they relate to others.

Three months later, May 2007, the researcher will come back to the schools and hand out questionnaires to the same children asking about any symptoms of pain and in August 2007 the children will complete the same questionnaire during school hours.

Why has your child been invited to participate?

The schools that are selected all have computer studies as an optional subject for grade ten learners. Your child has chosen this subject as part of his/her curriculum. Only children that do take computer studies at school level can participate in this research project.

Will your child benefit from this project?

Because this is not an invasive study your child will not benefit directly from participating in this project, however by participating in this project your child makes it possible for the researcher to study the possible contributing factors for muscle pain and can therefore in future treat other learners that do suffer from computer-related pain.

Are there any risks involved in your child taking part in this project?

There are no risks for your child participating in this project. The project will be conducted at the school where your child attends and the task that they are required to do is something that they do ever day for computer studies.

Who will have access to your child's questionnaire answers and postural measurements?

All the answers from the different questionnaires are confidential and only the researcher has access to the information. At completion of the questionnaires your child will be allocated a number so that the child remains anonymous. If any of the results are published in a thesis, the child will still remain anonymous.

Will you or your child be paid to take part in this project and are there any costs involved?

You or your child will not be paid to take part in this project and there will be no costs involved for you if your child participates.

Any additional information that you would like to know?

You can contact the Committee for Human Research at 021 9389207 if you have any concerns or complaints that have not been adequately addressed by the study investigator. You will receive a copy of this information and consent form for your own records.

Assent of minor

I (*name of child*)…………………………………… have been invited to take part in the above research project.

- The study investigator and my parents have explained the details of the study to me and I understand what they have said to me.
- They have also explained that this study will involve: typing for 15 minutes on my school computer while the study researchers take measurements of my sitting

position. I will also complete questionnaires asking about my feelings and any muscle pain or discomfort.

- I also know that I am free to withdraw from the study at any time if I am unhappy.
- By writing my name below, I voluntary agree to take part in this research project.

I confirm that I have not been forced either by my parents or study investigator to take part.

....

Name of child **Independent witness**

(To be written by the child if possible)

Declaration by parent/legal guardian

By signing below, I *(name of parent/legal guardian)* …………………………………….. agree to allow my child (*name of child*) …………………………… who is ………. years old, to take part in a research study entitled: Would postural alignment and psychosocial factors be risk factors for developing upper quadrant musculoskeletal pain in high school learners who use desktop computers?

I declare that:

- I have read or had read to me this information and consent form and that it is written in a language with which I am fluent and comfortable.
- My child is older then 7 years, therefore he/she must agree to take part in the study and his/her ASSENT must be recorded on this form.
- I have had a chance to ask questions and all my questions have been adequately answered.

- I understand that taking part in this study is **voluntary** and I have not been pressurised to let my child take part.

- I may choose to withdraw my child from the study at any time and my child will not be penalised or prejudiced in any way.

Signed at (*place*) ....……........…………….... on (*date*) …………...……….. 2005.

....

Signature of parent/legal guardian **Signature of witness**

Declaration by investigator

I *(name)* ……………………………………………..……… declare that:

- I explained the information in this document to ……………………………….

- I encouraged him/her to contact me and ask questions and took adequate time to answer them.

- I am satisfied that he/she adequately understand all aspects of the research, as discussed above

- I did/did not use a translator.

Signed at (*place*) ....……........………….. on (*date*) …………...……….. 2005.

....

Signature of investigator **Signature of witness**

Declaration by translator

I *(name)* …………………………………………..……… declare that:

- I assisted the investigator (*name*) ……….……………………………. to explain the information in this document to (*name of parent/legal guardian*) ……..………………………... using the language medium of Afrikaans/Xhosa.
- We encouraged him/her to ask questions and took adequate time to answer them.
- I conveyed a factually correct version of what was related to me.
- I am satisfied that the parent/legal guardian fully understands the content of this informed consent document and has had all his/her questions satisfactorily answered.

Signed at (*place*) ....…........………….. on (*date*) …………..……….. 2005.

....	....
Signature of parent/legal guardian	**Signature of witness**

DEELNEMERINLIGTINGSBLAD EN TOESTEMMINGSVORM VIR GEBRUIK DEUR OUERS/WETTIGE VOOGDE

TITEL VAN DIE NAVORSINGSPROJEK: Sou posturale belyning en psigososiale faktore, risiko faktore vir die ontwikkelling van boonste kwadrant muskuloskeletale pyn van hoërskool leerders wees wat rekenaars gebruik?

VERWYSINGSNOMMER:	______________________________
HOOFNAVORSER:	Yolandi Prins
KONTAKNOMMER:	021 5511494
ADRES:	Stellenbosch Universiteit Tygerberg Kampus Parow

U kind *(of pleegkind, indien van toepassing*) word genooi om deel te neem aan 'n navorsingsprojek. Lees asseblief hierdie inligtingsblad op u tyd deur aangesien die detail van die projek hierin verduidelik word. Indien daar enige deel van die projek is wat u nie ten volle verstaan nie, is u welkom om die navorser daaroor uit te vra. Dit is baie belangrik dat u ten volle moet verstaan wat die navorsing behels en hoe u kind daarby betrokke gaan wees. U kind se deelname is ook **volkome vrywillig** en dit staan u vry om deelname te weier. U kind sal op geen wyse hoegenaamd negatief beïnvloed word indien u sou weier om hom/haar te laat deelneem nie. U mag u kind ook te eniger tyd aan die projek onttrek, selfs al het u ingestem om hom/haar te laat deelneem.

Hierdie studie is deur die **Komitee vir Mensnavorsing van die Universiteit Stellenbosch** goedgekeur en sal uitgevoer word volgens die etiese riglyne en beginsels van die Internasionale Verklaring van Helsinki en die Etiese Riglyne vir Navorsing van die Mediese Navorsingsraad (MNR).

<u>Wat behels die navorsingsprojek?</u>

Die doel van die projek is om te bepaal of 'n kind se sitpostuur voor 'n rekenaar moontlik die oorsaak van nek en/of skouer pyn kan wees. Die projek gaan ook psigososiale faktore ondersoek wat moonlik 'n bydraende rol kan speel tot die onwikkeling van nek en/of skouer pyn. Die resultate van hierdie projek sal dit vir die mediese professie moontlik maak om kinders met rekenaarverwante nek en/of skouer pyn meer toepaslik te hanteer.

In Januarie 2007 gaan die graag tien leerders van al die deelnemende hoërskole gevra word om 'n vraelys te voltooi. Hierdie vraelys gaan vrae stel in verband met pyn of ongemak tydens rekenaargebruik. Volgens hierdie vraelys gaan sekere kinders gekies word om deel te neem aan die projek.

In Februarie 2007 gaan die gekose leerders gevra word om 15 minute op 'n rekenaar te tik terwyl metings van hul sitpostuur deur twee navorsers geneem word. Hierdie metings sal geneem word in die skool se rekenaarlokaal tydens skoolure. Die metings word gedoen deur middel van foto's. Die leerders sal 'n spesiaal 'n ontwerpte sports-top dra. Dit is nodig sodat merkers op sekere areas geplaas kan word. Hierdie areas sluit in die oog, oor, nekwerwels, boonste deel van die borsbeen en rugwerwels. Na afloop van die postuurmetings gaan die leerders 'n vraelys invul wat vrae stel oor hul gevoelens en hoe hul met ander leerders oor die weg kom.

Drie maande later, Mei 2007, sal die navorser teruggaan na al die skole en dieselfde leerders vra om ‘n vraelys, in verband met enige pyn of ongemak, in te vul. In Agustus 2007 gaan die leerders dieselfde vraelys gedurende skoolure invul.

Waarom is u kind genooi om deel te neem?

Die skole wat genader word om deel te neem bied almal rekenaarstudie as vak aan. Slegs leerders wat rekenaarstudie of rekenaartik as vak het, mag deelneem aan hierdie navorsingsprojek.

Sal u kind voordeel trek deur deel te neem aan hierdie projek?

U kind sal nie direk voordeel trek by hierdie projek nie, maar deur deel te neem sal dit vir die navorser moontlik maak om faktore, wat bydra tot die ontwikkeling van pyn, te kan bestudeer en in die toekoms ander leerders met rekenaarverwante pyn te hanteer.

Is daar enige risiko’s verbonde aan u kind se deelname aan die projek?

Daar is geen risiko’s verbonde aan u kind se deelname nie. Hierdie projek word by die skool waar u kind skoolgaan uitgevoeren wat van u kind verwag word om te doen word reeds daagliks gedoen.

Wie sal toegang hê tot u kind se vraelys antwoorde en postuurmetings?

Al die antwoorde van die verskillende vraelyste is vertroulik en slegs die navorser het toegang daartoe. Na voltooiing van die vraelys sal u kind ‘n nommer gegee word sodat u kind anoniem bly. As enige van die resultate van die projek gepubliseer word in ‘n tesis, sal u kind steeds anoniem bly.

Sal u of u kind betaal word vir deelname aan die projek en is daar enige koste verbonde aan deelname?

Nee, u of u kind sal nie betaal word vir deelname aan die projek nie. Deelname aan die projek sal u niks kos nie.

Enige addisionele inligting wat u wil weet?

U kan die Komitee vir Mensnavorsing kontak by 021 9389207 indien u enige bekommernis of klagte het wat nie bevredigend deur die navorser hanteer is nie. U sal ’n afskrif van hierdie inligtings- en toestemmingsvorm ontvang vir u eie rekords.

Instemming van minderjarige

Ek (*naam van minderjarige*) …………………………….................. is genooi om deel te neem aan bogenoemde navorsingsprojek.

- Die navorser en my ouers het die besonderhede van bogenoemde navorsingsprojek aan my verduidelik en ek verstaan wat hulle aan my gesê het.

- Hulle het ook aan my verduidelik dat die projek die volgende insluit: 15 minute tik op my skoolrekenaar terwyl die navorsers metings van my sitpostuur neem. Ek sal ook vraelyste volooi wat vrae stel oor my gevoelens en hoe ek met ander oor die weg kom en enige nek/skouer pyn of ongemak.

- Ek weet ook dat ek te eniger tyd aan die navorsingsprojek kan onttrek indien ek ongelukkig is.

- Deur my naam hieronder in te vul, onderneem ek om **vrywillig** aan die navorsingsprojek deel te neem. Ek bevestig ook dat ek nie deur my ouers of die navorser gedwing is om deel te neem nie.

....

Naam van kind **Onafhanklike getuie**

(*Deur kind geskryf indien moontlik*)

Verklaring deur ouer/wettige voog

Met die ondertekening van hierdie dokument onderneem ek, (*naam van ouer/wettige voog*) ………......................................., om my kind *(naam van kind)* ………..., wat .... jaar oud is, te laat deelneem aan 'n navorsingsprojek getiteld: Would postural alignment and psychosocial factors be risk factors for developing upper quadrant musculoskeletal pain in high school learners who use desktop computers?

Ek verklaar dat:

- Ek hierdie inligtings- en toestemmingsvorm gelees het of aan my laat voorlees het en dat dit in 'n taal geskryf is waarin ek vaardig en gemaklik mee is.

- My kind moet instem om aan die navorsingsprojek deel te neem omdat hy/sy ouer as 7 jaar is, en dat sy/haar INSTEMMING op hierdie vorm aangeteken sal word.

- Ek geleentheid gehad het om vrae te stel en dat al my vrae bevredigend beantwoord is.

- Ek verstaan dat deelname aan hierdie projek **vrywillig** is en dat daar geen druk op my geplaas is om my kind te laat deelneem nie.

- My kind te eniger tyd aan die projek mag onttrek en dat hy/sy nie op enige wyse daardeur benadeel sal word nie.

Geteken te (*plek*) ....………….. op (*datum*) …………...……….. 2005.

....

Handtekening van ouer/wettige voog **Handtekening van getuie**

Verklaring deur navorser

Ek (*naam*) ……………………………………….... verklaar dat:

- Ek die inligting in hierdie dokument verduidelik het aan ………………...…………..

- Ek hom/haar aangemoedig het om vrae te vra en voldoende tyd gebruik het om dit te beantwoord.

- Ek tevrede is dat hy/sy al die aspekte van die navorsingsprojek soos hierbo bespreek, voldoende verstaan.

- Ek ’n tolk gebruik het/nie ’n tolk gebruik het nie.

Geteken te (*plek*) ....………….. op (*datum*) …………...……….. 2005.

....

Handtekening van navorser **Handtekening van getuie**

Verklaring deur tolk

Ek (*naam*) ………………………………………………… verklaar dat:

- Ek die navorser (*naam*) ……...............................…..…………… bygestaan het om die inligting in hierdie dokument in Engels/Xhosa aan (*naam van ouer/wettige voog)* ……..............………………….. te verduidelik.
- Ons hom/haar aangemoedig het om vrae te vra en voldoende tyd gebruik het om dit te beantwoord.
- Ek 'n feitelik korrekte weergawe oorgedra het van wat aan my vertel is.
- Ek tevrede is dat die ouer/wettige voog die inhoud van hierdie dokument ten volle verstaan en dat al sy/haar vrae bevredigend beantwoord is.

Geteken te (*plek*) ....…………..... op (*datum*) …………...……….. 2005

....	....
Handtekening van tolk	**Handtekening van getuie**

INCWADANA YOLWAZI ELUNGISELWE UMTHATHI-NXAXHEBA KUNYE NEPHEPHA-MVUME YOMZALI OKANYE UMGCINI WOMNTWANA NGOKUSEMTHETHWENI

ISIHLOKO SEPROJEKTHI YOPHANDO: Ingaba uhlobo ahlala ngalo umfundi phambi kwekhompyutha, imeko yengqondo nobudlelwane nabanye zingambeka emngciphekweni wokufumana iingqaqambo zamathambo nezihlunu kumzimba ongentla?

INOMBOLO SALATHISO: ____

UMPHANDI OYINTLOKO: Yolandi Prins

INOMBOLO YOMNXEBA: 021 551 1494

IDILESI: I-Yunivesithi yaseStellenbosch
Tygerberg Campus
Parow

Umntwana wakho (*okanye umntwana ophantsi kwegunya lomnye umntu ongengomzali wakhe ngokomthetho kaRhulumente, ukuba kuyenzeka)* uyacelwa ukuba athabathe inxaxheba kuphando olwenziwayo noluyiprojekthi. Nceda uzinike ithuba lokuba ufunde ulwazi olubhalwe apha, lona luza kunika iinkcukacha ngale projekthi. Nceda ubuze umphandi oyintloko nayiphi na imibuzo ongaba akuyiqondi ngokupheleleyo ngale projekthi. Kubalulekile ukuba uthi kanti waneliseke ngokupheleleyo ekuqondeni ukuba olu phando luphathelene nantoni na nokuba umntwana wakho angabandakanyeka njani. Kananjalo, ukubandakanyeka komntwana wakho **kusekuthandeni kwakhe** kwaye uvumelekile ukuba ungamrhoxisa kolu phando. Ukuba wena uyala ukuba athabathe inxaxheba, eso sigqibo asisayi kumchaphazela ngendlela egwenxa umntwana wakho. Uvumelekile ukuba ungayirhoxisa inxaxheba yakhe kolu phando nangaliphi na ixesha, nangona ubusele uyinikile imvume yokwenza njalo ngaphambili.

Olu phando lunikwe imvume **yiKomiti yoPhando ngentlalo yoMntu kwiYunivesithi yseStellenbosch** kwaye luza kuqhutywa ngokwesiKhokelo seMikhwa eseSikweni noMthetho-siseko wesiBhengezo saseHelsinki, isiKhokelo senKqubo yoNyango esikuMgangatho oPhezulu saseMzantsi Afrika kunye nesiKhokelo seMikhwa eseSikweni seBhunga loPhando ngamaChiza (BLC).

<u>Olu phando luyiprojekthi lungantoni?</u>

Injongo yale projekthi kukufumana impendulo kumbuzo ofuna ukuqonda ukuba ngaba indlela ahlala ngayo umntwana phambi kwekhompyutha ingabangela iingqaqambo ezivakala entanyeni nase gxalabeni okanye egxalabeni. Kananjalo le projekthi iza kujonga imeko yengqondo nobudlelwane bomntwana nabanye abafundi njengezinto ezinokubangela iingqaqambo ezivakala entanyeni nasegxalabeni okanye egxalabeni. Iziphumo zale projekthi ziza kubangela ukuba abecandelo lezonyango bakwazi ukungenenelela ngendlela echanekileyo ukuze kuthinteleke abantwana kwiingqaqambo ezivakala entanyeni nasegxalabeni okanye egxalabeni.

NgoFebruwari wama-2007 abafundi begreyidi yeshumi nabavela kuzo zonke izikolo ezithabatha inxaxheba baza kucelwa ukuba baphendule uxwebhu lwemibuzo ngeengqaqambo zezihlunu okanye ukuxakiswa zizinto eziphathelene nomsebenzi wekhompyutha. Olu xwebhu lwemibuzo luza kufunisa ukuba kubekho isampulu yabantwana abaza kukhethelwa ukuthabatha inxaxheba kwiprojekthi eluphando.

NgoFebruwari wama-2007 abantwana abakhethelwe ukuthabatha inxaxheba kolu phando baza kucelwa ukuba benze umsebenzi wokuchwetheza ngekhompyutha ngeli xesha abaphandi bathatha umlinganiselo wendlela yokuhlala kwabo phambi kwekhompyutha. Ukuchwetheza ngekhompyutha kuza kwenzelwa kwigumbi leekhompyutha ngexesha lesikolo. Imilinganiselo iza kuthatyathwa ngokufota. Abantwana abangamantombazana baza kunxiba imintla eyimpahla esetyenziswa kwezemidlalo eyenziwe ngendlela eyodwa ze amakhwenkwe wona angayinxibi le mintla. Ezi nzame zenzelwa ukuba kubelula ukubeka izalathisi kwiindawo ezikhangelwayo ngabaphandi. Kwiindawo ezikhangelwayo kuza kubandakanywa iliso, indlebe, ithambo lomqolo elenza intamo, incum, kunye nethambo lomqolo ongasentla. Emva kokugqiba imizuzu eli-15 besenza umsebenzi wokuchwetheza, abantwana baza kucelwa ukuba baphendule uxwebhu lwemimbuzo malunga nendlela abaye baziva ngayo emoyeni nasemzimbeni nendlela abaye banxulumana ngayo nabanye abafundi.

Kwiinyanga ezintathu ezilandelayo, ngoMeyi wama-2007, umphandi uza kubuyela kwezi zikolo anike abantwana abayebathabatha inxaxheba kolu phando amaxwebhu ukuze baphendule imbuzo ngayo nayiphi into eyingqaqambo emzimbeni ukuze kwakhona ngoAgasti abafundi abathabathe inxaxheba baphendule kwa olu xwebhu lunye lwemibuzo ngexesha lesikolo.

Yintoni isizathu sokuba umntwana wakho acelwe ukuba athabathe inxaxheba?

Zonke izikolo ezikhethelwe olu phando zinezifundo zekhompyutha ezingesiso isinyanzelo nathi umfundi wegreyidi yeshumi azithathe ukuba uthandile. Umntwana wakho ukhethe ezi zifundo njengenxalenye yekhondo lemfundo yakhe.

Ngabantwana abenza izifundo zekhompyutha nabasekwinqanaba lesikolo kuphela abanokuthabatha inxaxheba kule projekthi yophando.

Ngaba umntwana wakho uza kuxhamla kule projekthi?

Kuba ingelulo uphando oluphazamisana nesidima sakhe, umntwana wakho akazi kuxhamla ngqo ngokuzibandakanya kwakhe nale projekthi, kungenjalo ngokuzibandakanya kwakhe kule projekthi wenzela lula umphandi ukuba afunde ukuba ziziphi izinto ezingunobangela wezihlunu ezibuhlungu ukuze kwixesha elizayo akwazi ukunyanga abanye abafundi abangcugcuthekiswa ziingqaqambo ezibangwa yindlela yokuhlala ngexesha achwetheza umsebenzi kwikhompyutha.

Ngaba kukho ingozi enokumvelela umntwana wakho ngokuzibandakanya nolu pha ndo?

Akukho ngozi inokuvelela untwana wakho nokuzibandakanya nolu phando. Le projekthi iza kuqhutyelwa esikolweni apho umntwana wakho afunda khona kwaye nomsebenzi abaza kucelwa ukuba bawenze ngumsebenzi abawenza mihla le kwizifundo zabo zekhompyutha.

Ngubani oza kubanolwazi ngeempendulo ezinikwe ngumntwana wakho kuxwebhu lwemibuzo kunye noqikelelo lwendlela ahlala ngayo?

Zonke iimpendulo ezinikwe kuxwebhu lwemibuzo ziyimfihlelo yaye ngumphandi yedwa onokubanolwazi ngazo. Wakuba ugqityiwe umsebenzi wokugcwalisa amaxwebhu umntwana wakho uza kunikwa inani, lilo eliza kwaziwa hayi ubuqu bakhe. Ukuba ezinye iziphumo zophando ziza kupapapashwa kwithisisi, nangelo xesha kuza kwaziwa inani ubuqu bomntwana mntwana buza kuhlala bungaziwa mntu.

<u>Ingaba umntwana wakho uza kuhlawulwa ngokuthabatha kwakhe inxaxheba kolu phando, yaye ingaba zikho na iindleko?</u>

Wena nomntwana wakho anizi kuhlawulwa ngokuzibandakanya kwenu kule projekthi kwaye akukho ntlawulo uza kuyifumana ukuba umntwana wakho uthabatha inxaxheba.

<u>Olunye ulwazi olongezelekileyo onokuthanda ukubanalo?</u>

Ungaqhagamshelana neKomiti yoPhando ngentlalo yoLuntu kule nombolo 021 938 9207 ukuba kukho into ekuxhalabisayo okanye izikhalazo ezingakhange zabe umphandi oyintloko uziphendule kakuhle. Uza kufumana ikopi eza kunika ulwazi ngolu phando nephepha-mvume oza kuzigcina njengeziqinisekiso.

Imvume yomntwana

Mna (igama lomntwana) …………………………………… ndiceliwe ukuba ndithabathe inxaxheba kuphando oluyiprojekthi nolungentla apha.

- Umphandi oyintloko kunye nabazali bam bandicacisele ngeenkcukacha zolu phando kwaye ndiyayiqonda yonke into abayithethileyo kum.

- Baye bandicacisela ukuba olu phando luza kuquka: ukuchwetheza kwikhompyutha yesikolo imizuzu elishumi elinesihlanu ngeli xesha abenzi bophando ngezi zifundo bathabatha umlinganiselo wendlela esihlala ngayo phambi kwekhompyutha. Ndiza kuphendula amaxwebhu emibuzo ngendlela endivakalelwa ngayo kwanokuba andinazingqaqambo zezihlunu ndinazo okanye ukudidekiswa ngokwasemzimbeni.

- Ndiyazi ukuba ndinalo ilungelo lokurhoxa kwezi zifundo nagaliphi na ixesha ukuba ndiziva ndingonwabanga.

- Ngokubhala igama lam ngezantsi, ndiyavuma ukuthabatha inxaxheba ngokuzikhethela kwam. Ndiyangqina ukuba abazali bam okanye umphandi oyintloko akhange andinyanzele ukuba ndithabathe inxaxheba.

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Igama lomntwana **Ingqina elizimeleyo**

(Kufuneka libhalwe ngumntwana ukuba kuyenzeka)

Isibhengezo esenziwa ngumzali okanye umgcini womntwana ngokusemthethweni

Ngokusayina ngezantsi, Mna *(igama lomzali okanye umgcini womntwana ngokusemthethweni)* ………………………………….. ndiyavuma ukuba ndikhulule umntwana (igama lomntwana) …………………………… oneminyaka e- ………. ubudala, ukuba athabathe inxaxheba kuphando olusihloko sithi: Ngaba indlela ahlala ngayo umfundi wesikolo semfundo ephakamileyo phambi kwekhompyutha, imeko yengqondo kunye nobudlelewane nabanye abafundi zingambeka emngciphekweni wokufumana iingqaqambo zezihlunu namathambo kumzimba ongentla?

Ndibhengezisa ukuba:

- Ndilufundile okanye ndalufunda ulwazi ngolu phando kunye nephepha-mvume kwaye zibhalwe ngolwimi endilwazi ngendlela etyibilikayo.

- Umntwana wam ungaphezulu kwiminyaka esixhenxe, ngoko ke kufuneka enze imvume ngokwakhe malunga nokuthabatha inxaxheba kwaye imvume yakhe kufuneka ishicilelwe kweli phepha.

- Ndaye ndalifumana ithuba lokuphosa imibuzo kwaye yonke imibuzo yam yaphenduleka ngendlela eyanelisayo.

- Ndiyayiqonda into yokuba ukuthabatha inxaxheba kolu phando **kusentandweni yomntu** kwaye andikhange ndinyanzelwe ukuba ndikhululele umntwana wam ukuba azibandakanye nolu phando.

- Ndingamrhoxisa umntwana wam kolu phando nangaliphi na ixesha kwaye akasayi kufumana sohlwayo okanye adlelwe indlala nangaluphi na uhlobo.

Isayinwe e- (*indawo*) ....…........…………..... ngomhla (usuku) …………....……….. 2005.

....	....
Isandla somzali okanye umgcini womntwana ngokusemthethweni	**Isandla sengqina**

Isibhengezo somphandi oyintloko

Mna (*igama)* …………………………………………..……… ndibhengezisa ukuba:

- Ndiyenzile ingcaciso ngolwazi olu kolu xwebhu ku……………………………….

- Ndimkhuthazile ukuba aqhagamshelane nam, abuze imibuzo kwaye ndizinike ithuba elaneleyo ndiyiphendula.

- Ndanelisekile kukuba wazi ngokwaneyo ngayo yonke imiba yophando, njengokuba kuchaziwe ngentla apha.

- Ndilusebenzisile okanye andikhange ndilusebenzise uncedo lomguquli wolwimi.

Isayinwe (indawo) ....….......…………..ngomhla (usuku) …………...……….. 2005.

....

Isandla somphandi **Isandla sengqina**

Isibhengezo somguquli wolwimi

Mna *(igama)* ……………………………………………...……… ndibhengezisa ukuba:

- Ndimncedisile umphandi (*igama*) ……….……………………………. ekucaciseleni (*igama lomzali okanye ummeli womntwana ngokusemthethweni*)……………………………… ngolwazi olukweli xwebhu ndisebenzisa intetho elulwimi lwesiBhulu okanye isiXhosa.
- Simkhuthazile ukuba abuze imibuzo kwaye sithabathe ixesha elaneleyo ukuyiphendula.
- Ndayenza inguqulelo ethe ngqo malunga nolwazi endandilunikiwe.
- Ndikholisekile ukuba umzali okanye ummeli womntwana ngokusemthethweni uyawuqonda umongo weli phepha-mvume kwaye uphenduleke ngendlela eyanelisayo kuyo yonke imibuzo athe wanayo.

Isayinwe (*indawo*) ....….......………….. ngomhla (usuku) …………...……….. 2005.

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Isandla somzali okanye umgcini womntwana **Isandla sengqina ngokusemthethweni**

Appendix G:

Beck Depression Inventory / Beck Depressie Inventaris

BECK DEPRESSION INVENTORY

Name: ______________________________

Date: ______________________________

School: ______________________________

On this questionnaire are groups of statements. Please read each group of statements carefully. Then pick out the one statement in each group, which best describes the way you have been feeling the PAST WEEK, INCLUDING TODAY. Circle the number beside the statement you picked. If several statements in the group seem to apply equally well, circle each one. Be sure to read all the statements in each group before making your choice.

1.	I do not feel sad.	0		6.	I don't feel I am being punished.	0
	I feel sad.	1			I feel I may be punished.	1
	I am sad all the time and I can't snap out of it.	2			I expect to be punished.	2
	I am so sad or unhappy that I can't stand it.	3			I feel I am being punished.	3
2.	I am not particularly discouraged about the future.	0		7.	I don't feel disappointed in myself.	0
	I feel discouraged about the future.	1			I am disappointed in myself.	1
	I feel I have nothing to look forward to.	2			I am disgusted with myself.	2
	I feel that the future is hopeless and that things cannot improve.	3			I hate myself.	3
3.	I do not feel like a failure.	0		8.	I don't feel I am any worse than anybody else.	0
	I feel I have failed more than the average person.	1			I am critical of myself for my weaknesses or mistakes.	1
	As I look back on my life, all I can see is a lot of failures.	2			I blame myself all the time for my faults.	2
	I feel I am a complete failure as a person	3			I blame myself for everything bad that happens.	3
4.	I get as much satisfaction out of things as I used to.	0		9.	I don't have any thoughts of killing myself.	0
	I don't enjoy things the way I used to.	1			I have thoughts of killing myself, but I would not carry them out.	1
	I don't get really satisfaction out of anything anymore.	2			I would like to kill myself.	2
	I am dissatisfied or bored with everything.	3			I would kill myself if I had the chance.	3
5.	I don't feel particularly guilty.	0		10.	I don't cry any more than usual.	0
	I feel guilty a good part of the time.	1			I cry more now than I used to.	1
	I feel quite guilty most of the time.	2			I cry all the time now.	2
	I feel guilty all of the time.	3			I used to be able to cry, but now I can't cry even though I want to.	3

11.	I am no more irritated now than I ever am.	0		17.	I don't get more tired than usual.	0
	I get annoyed or irritated more easily than I used to.	1			I get tired more easily than I used to.	1
	I feel irritated all the time now.	2			I get tired from doing almost anything.	2
	I don't get irritated at all by the things that used to irritate me.	3			I am too tired to do anything.	3
12.	I have not lost interest in other people.	0		18.	My appetite is no worse than usual.	0
	I am less interested in other people than I used to be.	1			My appetite is not as good as it used to be.	1
	I have lost most of my interest in other people.	2			My appetite is much worse now.	2
	I have lost all of my interest in other people.	3			I have no appetite at all anymore.	3
13.	I make decisions about as well as I ever could.	0		19.	I haven't lost much weight, if any, lately.	0
	I put off making decisions more than I used to.	1			I have lost more than 2.5 kilograms.	1
	I have greater difficulty in making decisions than before.	2			I have lost more than 4.5 kilograms.	2
	I can't make decisions at all anymore.	3			I have lost more than 7 kilograms.	3
					I am purposely trying to lose weight by eating less.	
					Yes / No	
14.	I don't feel I look any worse than I used to.	0		20.	I am no more worried about my health than usual.	0
	I am worried that I am looking old or unattractive.	1			I am worried about physical problems such as aches and pains or upset stomach or constipation.	1
	I feel that there are permanent changes in my appearance that make me look unattractive.	2			I am very worried about physical problems and it's hard to think of much else.	2
	I believe that I look ugly.	3			I am so worried about my physical problems that I cannot think about anything else.	3
15.	I can work about as well as before.	0		21.	I have not noticed any recent change in my interest in sex.	0
	It takes me an extra effort to get started at doing something.	1			I am less interested in sex than I used to be.	1
	I have to push myself very hard to do anything.	2			I am much less interested in sex now.	2
	I can't do any work at all.	3			I have lost interest in sex completely.	3
16.	I can sleep as well as usual.	0				
	I don't sleep as well as I used to.	1				
	I wake up 1-2 hours earlier than usual and find it hard to get back to sleep.	2				
	I wake up several hours earlier than I used to and cannot get back to sleep.	3				

Beck Depressie-Inventaris

Naam: ________________________

Datum: ________________________

Skool: ________________________

In hierdie vraelys is daar groepe stellings. Lees asseblief elke groep stellings aandagtig deur. Kies dan een stelling uit elke groep wat die beste beskryf hoe jy die AFGELOPE WEEK, OOK VANDAG, gevoel het. Trek 'n kringetjie om die nommer langs die stelling wat jy gekies het. As dit lyk asof verskeie stellings in die groep almal ewe van toepassing is, trek 'n kringetjie om elkeen. Maak seker jy lees al die stellings in elke groep voor jy kies.

1.	Ek voel nie hartseer nie.	0		6.	Dit voel nie vir my asof ek gestraf word nie.	0
	Ek voel hartseer.	1			Ek voel ek word dalk gestraf.	1
	Ek is gedurig hartseer en ek kan my net nie regruk nie.	2			Ek verwag om gestraf te word.	2
	Ek is so hartseer of ongelukkig dat ek dit nie kan uithou nie.	3			Ek voel ek word gestraf.	3
2.	Ek is nie besonder mismoedig oor die toekoms nie.	0		7.	Ek voel nie in myself teleurgestel nie.	0
	Ek voel mismoedig oor die toekoms.	1			Ek is teleurgesteld in myself.	1
	Ek voel ek het niks om na uit te sien nie.	2			Ek is vies vir myself.	2
	Ek voel die toekoms is hopeloos en dat dinge nie kan verbeter nie.	3			Ek haat myself.	3
3.	Ek voel nie soos 'n mislukking nie.	0		8.	Ek dink nie ek is enigsins slegter as enigiemand anders nie.	0
	Ek voel ek het al meer misluk as die gemiddelde mens.	1			Ek is krities teenoor myself ten opsigte van my swakhede of foute.	1
	As ek oor my lewe terugkyk, is 'n klomp mislukkings al wat ek kan sien.	2			Ek blameer myself gedurig vir my foute.	2
	Ek voel ek is 'n volslae mislukking as 'n persoon	3			Ek blameer myself vir alle slegte dinge wat gebeur.	3
4.	Ek kry net soveel bevrediging uit dinge as vantevore.	0		9.	Ek dink glad nie daaraan om myself dood te maak nie.	0
	Ek geniet dinge nie meer soos vantevore nie.	1			Ek het al daaraan gedink om myself dood te maak, maar ek sal nie my planne uitvoer nie.	1
	Ek kry nie werklik meer bevrediging uit enigiets nie.	2			Ek sou myself graag doodmaak.	2
	Ek is ontevrede of verveeld met alles.	3			Ek sou myself doodmaak as ek die kans sou kry.	3
5.	Ek voel nie juis skuldig nie.	0		10.	Ek huil nie meer as gewoonlik nie.	0
	Ek voel dikwels skuldig.	1			Ek huil nou meer as voorheen.	1
	Ek voel die meeste van die tyd taamlik skuldig.	2			Ek huil nou gedurig.	2
	Ek voel die hele tyd skuldig.	3			Ek kon vroeër huil, maar nou kan ek nie, selfs al wil ek.	3

11.	Ek is nie nou meer geïrriteerd as wat ek gewoonlik is nie.	0		17.	Ek raak nie moeër as vantevore nie.	0
	Ek raak nou makliker vererg of geïrriteerd as vantevore.	1			Ek raak makliker moeg as vantevore.	1
	Ek voel nou gedurig geïrriteerd.	2			Ek raak moeg selfs as ek so te sê niks doen nie.	2
	Ek word glad nie geïrriteer deur die dinge wat my vantevore geïrriteer het nie.	3			Ek is te moeg om enigiets te doen.	3
12.	Ek het nie belangstelling in ander mense verloor nie.	0		18.	My eetlus is nie slegter as normaalweg nie.	0
	Ek is stel minder in ander mense belang as vantevore.	1			My eetlus is nie so goed soos vantevore nie.	1
	Ek het die meeste van my belangstelling in ander mense verloor.	2			My eetlus is nou baie slegter.	2
	Ek het al my belangstelling in ander mense verloor.	3			Ek het hoegenaamd geen eetlus meer nie.	3
13.	Ek neem besluite ongeveer so goed as wat ek vantevore kon.	0		19.	Ek het die afgelope tyd nie juis gewig verloor nie.	0
	Ek stel meer uit om besluite te neem as vantevore.	1			Ek het meer as 2,5 kilogram verloor.	1
	Ek sukkel meer om besluite te neem as vantevore.	2			Ek het meer as 4,5 kilogram verloor.	2
	Ek kan glad nie meer besluite neem nie.	3			Ek het meer as 7 kilogram verloor.	3
					Ek probeer doelbewus gewig verloor deur minder te eet.	
					Ja / Nee	
14.	Ek dink nie ek lyk enigsins slegter as vantevore nie.	0		20.	Ek is nie meer bekommerd oor my gesondheid as gewoonlik nie.	0
	Ek is bekommerd daaroor dat ek oud of onaantreklik lyk.	1			Ek is bekommerd oor liggaamlike probleme soos pyne en kwale of ’n omgekrapte maag of hardlywigheid.	1
	Ek dink daar is permanente veranderinge in my voorkoms wat my onaantreklik laat lyk.	2			Ek is baie bekommerd oor liggaamlike probleme en dit is vir my moeilik om aan enigiets anders te dink.	2
	Ek dink ek lyk lelik.	3			Ek is so bekommerd oor my liggaamlike probleme dat ek aan niks anders kan dink nie.	3
15.	Ek werk ongeveer so goed soos vantevore.	0		21.	Ek het geen onlangse verandering in my belangstelling in seks opgemerk nie.	0
	Dit is vir my ekstra moeite om aan die gang te kom as ek iets moet doen.	1			Ek stel minder in seks belang as vantevore.	1
	Ek moet myself baie hard dryf om enigiets te doen.	2			Ek stel nou baie minder in seks belang.	2
	Ek kan glad nie enige werk doen nie.	3			Ek het alle belangstelling in seks verloor.	3
16.	Ek slaap nog net so goed soos altyd.	0				
	Ek slaap nie so goed soos vantevore nie.	1				
	Ek word 1 tot 2 uur vroeër as gewoonlik wakker en sukkel dan om weer aan die slaap te raak.	2				
	Ek word etlike ure vroeër wakker as waaraan ek gewoond is en kan dan nie weer aan die slaap raak nie.	3				

Appendix H:

Multidimensional Anxiety Scale for Children /

Multidimensionale Angsskaal vir kinders

THE MULTIDIMENSIONAL ANXIETY SCALE FOR CHILDREN (MASC)

Name: ______________________________

Date: ______________________________

School: ______________________________

This questionnaire asks how you have been thinking, feeling, or acting recently. For each item, please circle the number that shows how often the statement is true for you. If a sentence is true about you a lot of the time, circle 3. If it is true about you some of the time, circle 2. If it is true about you once in a while, circle 1. If a sentence is hardly ever true about you, circle 0. Remember, there is no right or wrong answers, just answer how you have been feeling recently.

Here are two examples to show you how to complete the questionnaire, In Example A, if you were hardly ever scared of dogs, you would circle 1, meaning that the statement is rarely true about you. Example B, if thunderstorms sometimes upset you, you would circle 2, meaning the statement is sometimes true about you.

	Never true about me	Rarely true about me	Sometimes true about me	Often true about me
Example A: I'm scared of dogs.	0	1	2	3
Example B: Thunderstorms upset me.	0	1	2	3

		Never true about me	Rarely true about me	Sometimes true about me	Often true about me
1	I feel tense or uptight	0	1	2	3
2	I usually ask permission	0	1	2	3
3	I worry about other people laughing at me	0	1	2	3
4	I get scared when my parents go away	0	1	2	3
5	I have trouble getting my breath	0	1	2	3
6	I keep my eyes open for danger	0	1	2	3
7	The idea of going to camp scares me	0	1	2	3
8	I get shaky or jittery	0	1	2	3
9	I try hard to obey my parents and teachers	0	1	2	3
10	I'm afraid the other kids will make fun of me	0	1	2	3
11	I try to stay near mom or dad	0	1	2	3
12	I get dizzy or faint feelings	0	1	2	3
13	I check things out first	0	1	2	3
14	I worry about getting on in class	0	1	2	3
15	I'm jumpy	0	1	2	3

		Never true about me	Rarely true about me	Sometimes true about me	Often true about me
16	I'm afraid other people will thing I'm stupid	0	1	2	3
17	I keep the light on at night	0	1	2	3
18	I have pains in my chest	0	1	2	3
19	I avoid going to places without my family	0	1	2	3
20	I feel strange, weird, or unreal	0	1	2	3
21	I try to do things other people will like	0	1	2	3
22	I worry about what other people think of me	0	1	2	3
23	I avoid watching scary movies and TV shows	0	1	2	3
24	My heart races or skips beats	0	1	2	3
25	I stay away from things that upset me	0	1	2	3
26	I sleep next to someone of my family	0	1	2	3
27	I feel restless and on edge	0	1	2	3
28	I try to do everything exactly right	0	1	2	3
29	I worry about doing something stupid or embarrassing	0	1	2	3
30	I get scared riding in the car or on the bus	0	1	2	3
31	I feel sick to my stomach	0	1	2	3
32	If I get upset or scared, I let someone know straight away	0	1	2	3
33	I get nervous if I have to perform in public	0	1	2	3
34	Bad weather, the dark, heights, animals, or bugs scare me	0	1	2	3
35	My hands shake	0	1	2	3
36	I check to make sure things are save	0	1	2	3
37	I have trouble asking other kids to play with me	0	1	2	3
38	My hands feel sweaty or cold	0	1	2	3
39	I feel shy	0	1	2	3

MULTIDIMENSIONELE ANGSSKAAL VIR KINDERS (MASK)

Naam: ____________________________

Datum: ____________________________

Skool: ____________________________

Hierdie vraelys gaan vasstel hoe jy die afgelope tyd gedink, gevoel of opgetree het. Trek asseblief by elke item ’n kringetjie om die nommer wat aantoon hoe dikwels die stelling in jou geval waar is. Indien ’n sin vir ’n groot deel van die tyd waar is van jou, trek ’n kringetjie om 3. Indien dit partymaal waar is van jou, trek ’n kringetjie om 2. Indien dit slegs af en toe waar is van jou, trek ’n kringetjie om 1. Indien ’n sin byna nooit waar is van jou nie, trek ’n kringetjie om 0. Onthou, daar is geen regte of verkeerde antwoorde nie; antwoord net hoe jy die afgelope tyd gevoel het.

Here is twee voorbeelde om jou te wys hoe om die vraelys in te vul. In voorbeeld A sou jy ’n kringetjie om 1 trek as jy byna nooit bang was vir honde nie, wat beteken dat die stelling selde waar is van jou. In voorbeeld B sou jy ’n kringetjie om 2 trek as donderstorms jou soms ontstel, wat beteken dat die stelling partymaal waar is van jou.

	Nooit waar van my nie	Selde waar van my	Partymaal waar van my	Dikwels waar van my
Voorbeeld A: Ek is bang vir honde	0	1	2	3
Voorbeeld B: Donderstorms ontstel my	0	1	2	3

		Nooit waar van my nie	Selde waar van my	Partymaal waar van my	Dikwels waar van my
1.	Ek voel gespanne of senuweeagtig	0	1	2	3
2.	Ek vra gewoonlik toestemming	0	1	2	3
3.	Ek is bekommerd daaroor dat mense vir my lag	0	1	2	3
4.	Ek is bang wanneer my ouers weggaan	0	1	2	3
5.	Ek haal moeilik asem	0	1	2	3
6.	Ek is op die uitkyk vir gevaar	0	1	2	3
7.	Die gedagte daaraan dat ek op ’n kamp moet gaan, maak my bang	0	1	2	3
8.	Ek raak bewerig of senuweeagtig	0	1	2	3
9.	Ek doen my bes om my ouers en onderwysers te gehoorsaam	0	1	2	3
10.	Ek is bang die ander kinders spot my	0	1	2	3
11.	Ek probeer naby my ma of pa bly	0	1	2	3
12.	Ek raak duiselig of voel ek gaan flou raak	0	1	2	3
13.	Ek kyk dinge eers goed uit	0	1	2	3

		Nooit waar van my nie	Selde waar van my	Partymaal waar van my	Dikwels waar van my
14.	Ek is bekommerd oor my vordering in die klas	0	1	2	3
15.	Ek is skrikkerig	0	1	2	3
16.	Ek is bang ander mense gaan dink ek is dom	0	1	2	3
17.	Ek laat die lig snags brand				
18.	Ek het pyn in my bors				
19.	Ek gaan nie sonder my gesin êrens heen nie				
20.	Ek voel vreemd, eienaardig, of onwerklik				
21.	Ek probeer dinge doen waarvan ander mense sal hou				
22.	Ek is bekommerd oor wat ander mense van my dink				
23.	Ek vermy dit om na flieks en TV-programme wat my bang maak, te kyk				
24.	My hart klop vinnig of mis 'n slag				
25.	Ek bly weg van dinge wat my ontstel				
26.	Ek slaap langs iemand in my gesin				
27.	Ek voel rusteloos en op my senuwees				
28.	Ek probeer om alles presies reg te doen				
29.	Ek is bekommerd daaroor dat ek iets sal doen wat dom is of wat my in die verleentheid sal stel				
30.	Ek raak bang daarvoor om in die kar of met die bus te ry				
31.	Ek voel asof ek wil opgooi				
32.	As ek ontsteld of bang raak, sê ek dadelik vir iemand				
33.	Ek raak senuweeagtig as ek in die openbaar moet optree				
34.	Slegte weer, die donker, hoogtes, diere of goggas maak my bang				
35.	My hande bewe				
36.	Ek maak seker dinge is veilig				
37.	Dit is vir my moeilik om ander kinders te vra om met my te speel				
38.	My hande voel sweterig of koud				
39.	Ek voel skaam				

Appendix I:

Computer Usage Questionnaire for school learners (February 2007) / Rekenaargebruikvraelys vir skoolleerders (Februarie 2007)

COMPUTER USAGE QUESTIONNAIRE for

SCHOOL LEARNERS

(Baseline - February 2007)

COMPUTER USE AT SCHOOL.....

*Mark your answer with a **cross (X)**.*

1. How long have you been using a computer during **lessons at school**?
   ☐ Less than 1 year ☐ 2 years ☐ 3 years ☐ 4 years or more

2. Do you **use the computer** for any of the following **subjects**? Mark as many as you want.
   ☐ Mathematics ☐ Computer Studies ☐ Languages ☐ Compu-Typing
   ☐ Others, please list: ___________________________

3. What do you **use** the **computer** for at **school**? Mark as many as you want.
   ☐ Typing ☐ View lessons ☐ Experiments ☐ Internet and e-mail
   ☐ Use educational programmes ☐ Other, please list: ____

4. How many **times per week** do you use the **computer at school**?
   ☐ Once or less per week ☐ Twice per week ☐ Three times per week ☐ Four times per week
   ☐ Five times or more per week

5. During **one session** at school, **how long** do you spend using the computer?
   ☐ Less than 30 minutes ☐ About 45 minutes ☐ 1 Hour ☐ 1 ½ Hours ☐ 2 Hours or more

6. How many **hours per week** do you spend working on the **school computer**?
   ☐ About 2 Hours per week ☐ About 4 Hours per week ☐ About 6 Hours per week ☐ 8 Hours or more per week

7. Did you receive any **instruction** on **how to sit** in front of the **computer**?
   ☐ Yes ☐ No

   If **"Yes"**, who **instructed** you? ____

Please turn the page

8. Do you take a **short break** of a few minutes at least **once an hour**, when using the **computer**? (A short computer break, means to stop using your hands at the keyboard/ mouse, e.g. to stand up, stretch out, use the bathroom, etc.)
   ☐ Yes ☐ No

9. Have you received any information on **stretches/ exercises** you can do during the above-mentioned short breaks?
   ☐ Yes ☐ No

   If " **Yes",** who provided the information?______________________________
   Please describe the type of **stretches** or **exercises** that you do?

____

COMPUTER USE ELSEWHERE….

Complete this section if you use a computer ***outside school.*** *Mark your answer with a* ***cross (X).***

1. **Where** do you use a computer **outside school**? Mark as many as you want.
   ☐ At your home ☐ Internet Café ☐ Relative/ friend's home ☐ Library
   ☐ Elsewhere (state where)_________________________________

2. Roughly, **how long** have you been using the computer **outside school**?
   ☐ Less than a year ☐ 2-3 Years ☐ 4 Years ☐ 5 years or more

3. On average, how many **times per week** do you use the computer?
   ☐ Less than once a week ☐ 2 times per week ☐ 3 times per week ☐ 4 times per week
   ☐ Five times or more per week

4. On average, how many **hours per day** do you spend working on the computer **outside of school?**
   ☐ Less than 30 minutes ☐ 1 Hour ☐ 2-3 Hours ☐ 4 Hours or more

Please turn the page

5. What **type of computer** do you use most of the time?
☐ Desktop computer ☐ Laptop computer ☐ Both

6. Where is the computer **positioned** when you are using it? Mark as many as you want.
☐ On a desk/ table ☐ On your lap ☐ On the floor ☐ On a chair
☐ Other, please list____

7. Do you participate in any **other activity** whilst simultaneously working on the computer? Mark as many as you want.
☐ Talk to a friend ☐ Listen to music ☐ Talk on the phone ☐ Writing on a page
☐ Other, please list____

TELL US ABOUT YOURSELF….

1. What is your **school's** name?____

2. What is **your name**?____

3. Do you wear: ☐ **Spectacles** ☐ **Contact Lenses** ☐ **None**

4. Do you suffer from any **medical condition/s**, e.g. Epilepsy, Diabetes, Asthma?
☐ Yes ☐ No **If "No", go to question 6**

5. If **"Yes"**, do you use any **medication** for this condition?
☐ Yes ☐ No

6. Have you ever been involved in an **accident or sporting injury** where you injured your **back** or **neck**?
☐ Yes ☐ No

Please turn the page

7. Have you had any **surgery** involving your **muscles** or **joints** done?

☐ Yes ☐ No

If **"Yes"**, please list the **type of surgery** and when it was done.

Year: _____ Surgery: ____________________________

Year: _____ Surgery: ____________________________

Year: _____ Surgery: ____________________________



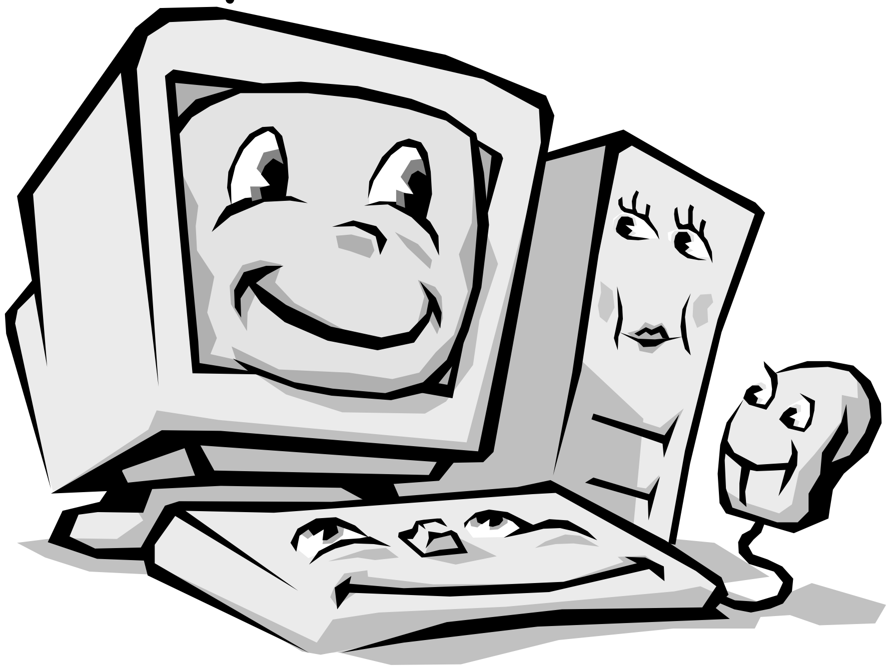
THANK YOU FOR COMPLETING THIS QUESTIONNAIRE!!!

The End.

REKENAARGEBRUIKVRAELYS vir

SKOOLLEERDERS

(Basislyn - Februarie 2007)



REKENAARGEBRUIK BY DIE SKOOL…

*Dui jou antwoord met 'n **kruisie (X)** aan.*

1. Hoe lank gebruik jy al 'n rekenaar gedurende **klastyd**?
   ☐ Minder as 'n jaar ☐ 2 jaar ☐ 3 jaar ☐ 4 jaar of langer

2. **Gebruik jy die rekenaar** vir enige van die volgende **vakke**? Merk soveel opsies as wat op jou van toepassing is.
   ☐ Wiskunde ☐ Rekenaarstudie ☐ Afrikaans/ Engels ☐ Rekenaartik
   ☐ Ander, noem asseblief:____

3. Waarvoor **gebruik** jy die **skoolrekenaar**? Merk soveel opsies as wat op jou van toepassing is.
   ☐ Tikwerk ☐ Bestudeer lesse ☐ Eksperimente ☐ Internet en e-pos
   ☐ Gebruik opvoedkundige programme ☐ Ander, noem asseblief:____

4. Hoeveel **keer per week** gebruik jy die **skoolrekenaar**?
   ☐ Een keer per week, of minder ☐ Twee keer per week ☐ Drie keer per week
   ☐ Vier keer per week ☐ Vyf keer per week, of meer

5. **Hoe lank** duur **een rekenaargebruiksessie** by die skool?
   ☐ Minder as 30 minute ☐ Omtrent 45 minute ☐ 1 uur ☐ $1\frac{1}{2}$ uur
   ☐ 2 uur of langer

6. Hoeveel **uur per week** gebruik jy die **skoolrekenaar**?
   ☐ Ongeveer 2 uur per week ☐ Ongeveer 4 uur per week ☐ Ongeveer 6 uur per week
   ☐ 8 uur per week, of meer

Blaai asb om.....

7. Neem jy ten minste **elke uur** 'n **kort ruskans** van 'n paar minute wanneer jy die **rekenaar** gebruik? ('n Kort **rekenaarruskans** beteken om op te hou om die sleutelbord/muis te gebruik, en byvoorbeeld op te staan, te strek, badkamer toe te gaan, ensovoorts.)
☐ Ja ☐ Nee

8. Het jy enige inligting oor **strek- of ander oefeninge** ontvang, wat jy gedurende bogenoemde kort ruskanse kan doen?
☐ Ja ☐ Nee

8.1 Indien wel, **wie** het die **inligting** verskaf? ______________________________

8.2 Beskryf asseblief die tipe **strek- of ander oefeninge** wat jy doen?____

REKENAARGEBRUIK ELDERS…

*Voltooi hierdie seksie indien jy 'n rekenaar buite die skool gebruik. Dui jou antwoord met 'n **kruisie (X)** aan.*

1. **Waar anders as by die skool** gebruik jy ook 'n rekenaar? Merk soveel opsies as wat op jou van toepassing is.
☐ By die huis ☐ Internetkafee ☐ By 'n familielid/vriend se huis ☐ Biblioteek
☐ Elders (noem waar) _________________________________

2. Ongeveer **hoe lank** gebruik jy al 'n rekenaar **buiten die een by die skool**?
☐ Minder as 'n jaar ☐ 2-3 jaar ☐ 4 jaar ☐ 5 jaar of meer

3. Ongeveer hoeveel **keer per week** gebruik jy dié rekenaar?
☐ Minder as een keer per week ☐ 2 keer per week ☐ 3 keer per week
☐ 4 keer per week ☐ Vyf keer per week, of meer

4. Gemiddeld hoeveel **uur per dag** werk jy op dié rekenaar**?**
☐ Minder as 30 minute ☐ 1 uur ☐ 2 uur ☐ 3 uur ☐ 4 uur of meer

Blaai asb om....

5. Watter **tipe rekenaar** gebruik jy meestal?
☐ Tafelrekenaar ☐ Skootrekenaar ☐ Beide

6. Waar **staan** die rekenaar wanneer jy dit gebruik? Merk soveel opsies as wat op jou van toepassing is.
☐ Op 'n lessenaar/tafel ☐ Op jou skoot ☐ Op die vloer ☐ Op 'n stoel
☐ Ander, noem asseblief: ______________________________________

7. Verrig jy enige **ander** gelyktydige **aktiwiteit** terwyl jy op die rekenaar werk? Merk soveel opsies as wat op jou van toepassing is.
☐ Gesels met 'n vriend ☐ Luister na musiek ☐ Praat oor die telefoon ☐ Skryf
☐ Ander, noem asseblief: ______________________________________

VERTEL ONS VAN JOUSELF…

1. Wat is jou **skool** se naam? ______________________________________

2. Wat is **jou naam**? ______________________________________

3. Dra jy: ☐ 'n bril ☐ kontaklense ☐ **niks van die genoemde nie**

4. Ly jy aan enige **mediese toestand(e)**, byvoorbeeld epilepsie, diabetes, asma?
☐ Ja ☐ Nee

5. Indien "**Ja**" by vraag 4, gebruik jy enige **medikasie** vir hierdie toestand(e)?
☐ Ja ☐ Nee

6. Was jy al ooit in 'n **ongeluk of sportbesering** betrokke waar jou rug of nek seergekry het?
☐ Ja ☐ Nee

Blaai asb om....

7. Het jy al enige **operasies** aan jou spiere of gewrigte gehad?
   ☐ Ja ☐ Nee

8. Indien **"Ja"** by vraag 7, noem asseblief die **tipe operasie** en ook **wanneer** dit gedoen is.

   Jaar: _____ Operasie: ______________________________
   Jaar: _____ Operasie: ______________________________
   Jaar: _____ Operasie: ______________________________



DANKIE DAT JY DIE VRAELYS VOLTOOI HET!!!

Die einde.

Appendix J:

Computer Usage Questionnaire for school learners (May/August 2007) / Rekenaargebruikvraelys vir skoolleerders (Mei/Augustus 2007)

COMPUTER USAGE QUESTIONNAIRE for

SCHOOL LEARNERS

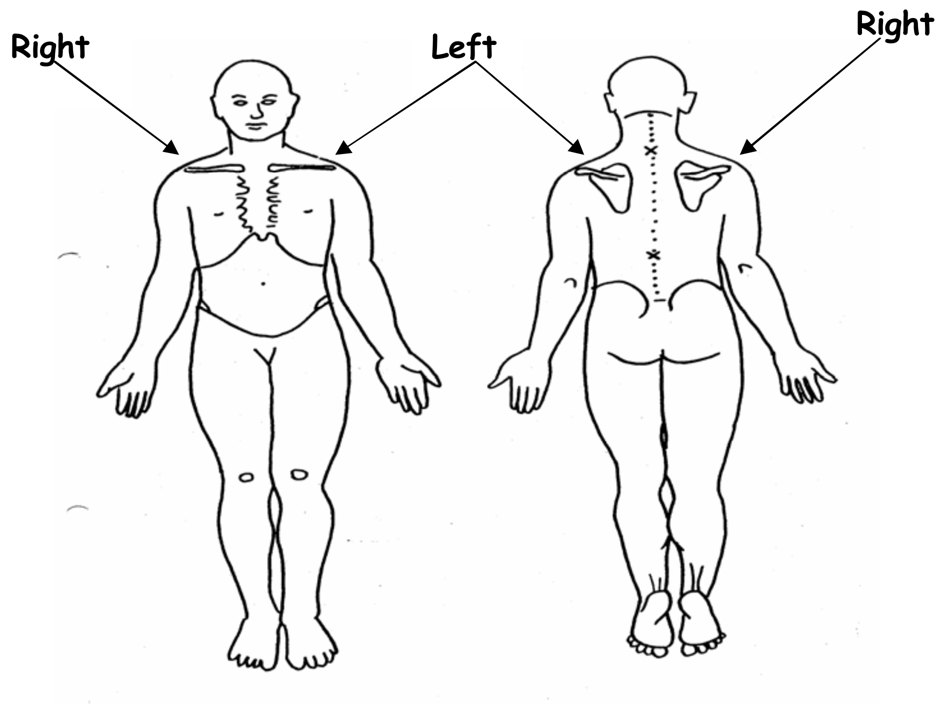
(Post baseline – May/Aug 2007)

TELL US ABOUT YOUR ACHES and PAINS…

*Mark your answer with a **cross (X)**.*

1. Have you experienced any **headaches**, **discomfort**, **stiffness**, **pain**, or **tingling** in your **muscles** or **joints** in the **last month?**
   ☐ Yes ☐ No

2. If **"Yes"**, in which **areas of the body** did you experience these feelings in the last month? Mark the **areas** where you **felt** your **symptoms** with a "**X**"



Please turn the page.....

3. Tell us **how bad** these feelings of **discomfort, stiffness, pain** or **tingling** has been in the **last month**

If you had **SLIGHT discomfort, stiffness, pain,** or **tingling**, mark (**X**): .

If you had **A LOT** of **discomfort, stiffness, pain,** or **tingling,** mark (**X**):

This is an example of how you should do it…

Neck	**X**	

Body Area	Slight Discomfort, Pain, etc	A lot of discomfort, pain, etc
Head		
Neck		
Upper Back		
Mid-Back		
Lower Back		
Right Shoulder		
Left Shoulder		
Right Elbow		
Left Elbow		
Right Wrist and Hand		
Left Wrist and Hand		

4. **When** did you feel the **headaches**, **discomfort, stiffness, pain** or **tingling** of your **muscles and joints**? Mark as many as you want.

- ☐ Sitting in front of your school desk
- ☐ During or after sports.
- ☐ Working on the computer at school.
- ☐ Writing in a book at school desk
- ☐ Working on the computer elsewhere.
- ☐ Other (please list):____

Please turn the page.....

5. Have you ever felt like not using the computer because of **headaches, discomfort, stiffness, pain,** or **tingling** of your **muscles** and **joints**?
   ☐ Yes ☐ No

6. Have you **stopped** any of the following **activities** because of the **headaches, discomfort, stiffness, pain**, or **tingling** of your **muscles** and **joints** in the **last month**? Mark as many as you want.
   ☐ Playing sports ☐ Working on the computer ☐ Writing in a book ☐ Playing a musical instrument
   ☐ List any other____

7. In the **last month**, have you seen a **Doctor** or any other **medical professional** for any of your muscle and joint **complaints** mentioned above?
   ☐ Yes ☐ No

TELL US ABOUT YOURSELF…. 

1. What is your **school's** name?______________________________

2. What is **your name**?______________________________

3. Do you wear: ☐ **Spectacles** ☐ **Contact Lenses** ☐ **None**

4. Do you suffer from any **medical condition/s**, e.g. Epilepsy, Diabetes, Asthma?
   ☐ Yes ☐ No **If "No", go to question 6**

5. If **"Yes"**, do you use any **medication** for this condition?
   ☐ Yes ☐ No

6. Have you ever been involved in an **accident or sporting injury** where you injured your **back** or **neck**?
   ☐ Yes ☐ No

Please turn the page…..

7. Have you had any **surgery** involving your **muscles** or **joints** done?

☐ Yes ☐ No

If **"Yes"**, please list the **type of surgery** and when it was done.

Year: _____ Surgery: ______________________________
Year: _____ Surgery: ______________________________
Year: _____ Surgery: ______________________________

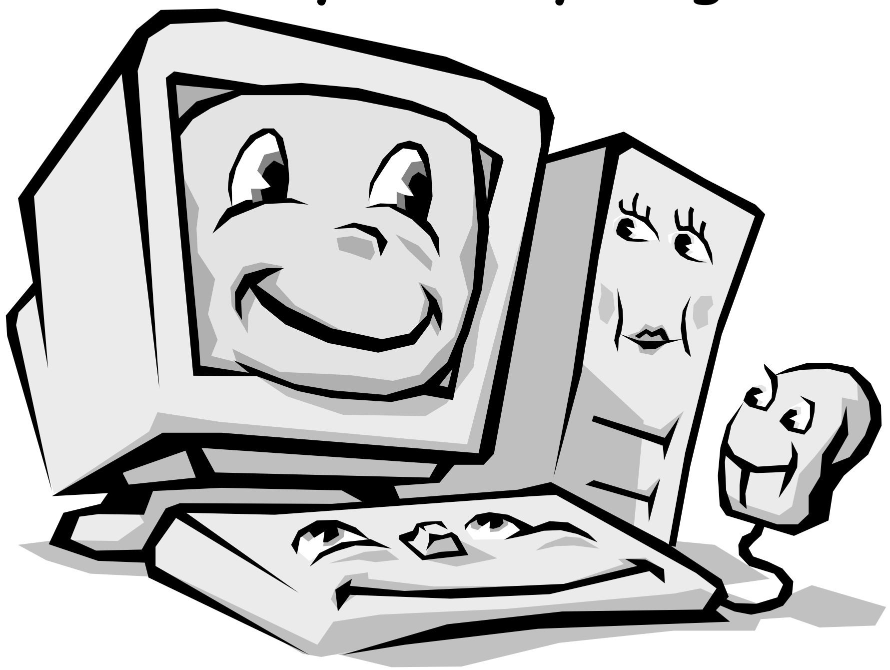


THANK YOU FOR COMPLETING THIS QUESTIONNAIRE!!!

REKENAARGEBRUIKVRAELYS vir

SKOOLLEERDERS

(Post basislyn – May/Aug 2007)

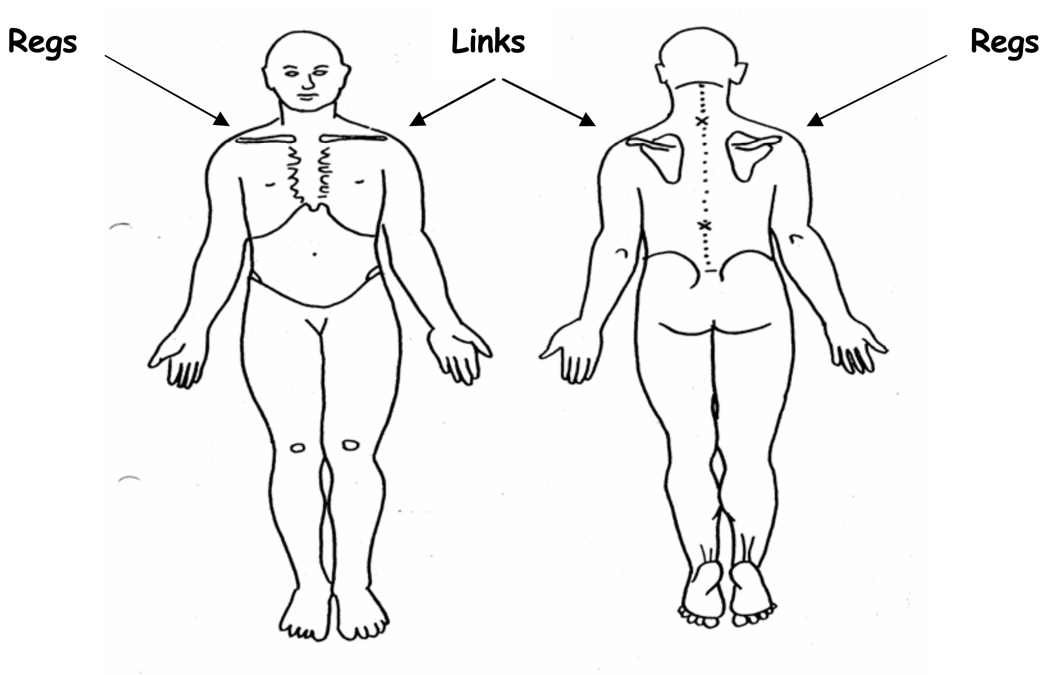


VERTEL ONS VAN JOU PYNE EN SKETE...

Dui jou antwoord met 'n ***kruisie (X)*** *aan.*

1. Het jy in die **afgelope maand** enige **hoofpyn, ongemak, styfheid, pyn** of 'n **tintelende** gevoel in jou spiere of gewrigte ervaar?
   ☐ Ja ☐ Nee

2. Indien wel, in watter **liggaamsdele** het jy hierdie pyn/gevoel ervaar? Merk (**X**) slegs die **dele** waar jy jou **simptome gevoel** het.



Blaai asb om.....

3. Vertel vir ons hoe **"erg"** hierdie **ongemak, styfheid, pyn of tinteling** in jou spiere en /of gewrigte was in die **afgelope maand**.

Inien jy slegs **GERINGE ongemak, styfheid, pyn** of **tinteling** ervaar het, merk (**X**)

Indien jy **BAIE ongemak, styfheid, pyn** of **tinteling** ervaar het, merk (**X**)

Hier is 'n voorbeeld van hoe jy dit moet doen…

Nek	X	

Liggaamsdeel	Geringe ongemak, pyn, ens	Baie ongemak, pyn,ens
Hoofpyn		
Nek		
Bo-Rug		
Middel Rug		
Lae Rug		
Regter Skouer		
Linker Skouer		
Regter Elmboog		
Linker Elmboog		
Regter Pols en Hand		
Linker Pols en Hand		

4. **Wanneer** het jy die **hoofpyn, ongemak, styfheid, pyn** of **tinteling** in jou **spiere** en **gewrigte** gevoel? Merk soveel opsies as wat op jou van toepassing is.

☐ Wanneer jy voor jou skoollessenaar sit ☐ Tydens of na sportdeelname ☐ Wanneer jy op die skoolrekenaar werk

☐ Wanneer jy by jou skoollessenaar in 'n boek skryf ☐ Wanneer jy elders op 'n rekenaar werk

☐ Ander (noem asseblief):____

Blaai asb om…..

5. Het jy in die **afgelope maand** gevoel om nie op die **rekenaar** te werk nie a.g.v. die bogenoemde **ongemak, styfheid, pyn,** of **tinteling** in jou **spiere** en **gewrigte**?
   ☐ Ja ☐ Nee

6. Het jy in die afgelope **maand** enige van die volgende **aktiwiteite gestop** a.g.v die **ongemak, styfheid, pyn** of **tinteling** in jou **spiere** en **gewrigte**? Merk soveel opsies as wat op jou van toepassing is.
   ☐ Speel van 'n sport ☐ Werk op 'n rekenaar ☐ Skryf in 'n boek ☐ Speel van 'n musiek instrument
   ☐ Lys enige ander aktiwiteite____

7. Het jy in die **afgelope maand** 'n **dokter** of enige ander **mediese praktisyn** oor die **spier- en gewrigprobleme** wat jy hierbo noem, gaan spreek?
   ☐ Ja ☐ Nee

VERTEL ONS VAN JOUSELF…

1. Wat is jou **skool** se naam? ______________________________________

2. Wat is **jou naam**? ____

3. Dra jy: ☐ 'n bril ☐ kontaklense ☐ **niks van die genoemde nie**

4. Ly jy aan enige **mediese toestand(e)**, byvoorbeeld epilepsie, diabetes, asma?
   ☐ Ja ☐ Nee

5. .Indien "**Ja**" by vraag 8, gebruik jy enige **medikasie** vir hierdie toestand(e)?
   ☐ Ja ☐ Nee

6. .Was jy al ooit in 'n **ongeluk of sportbesering** betrokke waar jou rug of nek seergekry het?
   ☐ Ja ☐ Nee

Blaai asb om…..

7. Het jy al enige **operasies** aan jou spiere of gewrigte gehad?

☐ Ja ☐ Nee

Indien **"Ja"** by vraag 11, noem asseblief die **tipe operasie** en ook **wanneer** dit gedoen is.

Jaar: _____ Operasie: ______________________________

Jaar: _____ Operasie: ______________________________

Jaar: _____ Operasie: ______________________________

DANKIE DAT JY DIE VRAELYS VOLTOOI HET!!!

Die einde.

Appendix K:

Letter of approval from the Committee for Human Research at the Stellenbosch University

Appendix L:

Formulas for calculating postural angles

Formulas for calculating the postural angles

Given:

The positions (X,Y) of the markers are given as well as the length of the stems, where applicable.

Declaration of Symbols

$C7'_x$	X coordinate of C7 marker
$C7'_y$	Y coordinate of C7 marker
$T8'_x$	X coordinate of T8 marker
$T8'_y$	Y coordinate of T8 marker
M'_x	X coordinate of Manubrium marker
M'_y	Y coordinate of Manubrium marker
θ_{C7}	Smallest angle between horizontal and C7 marker stem
θ_{T8}	Smallest angle between horizontal and T8 marker stem
θ_M	Smallest angle between horizontal and Manubrium marker stem
L_{C7}	Length of C7 stem
L_{T8}	Length of T8 stem
L_M	Length of Manubrium stem
T_x	X coordinate of Tragus marker
T_y	Y coordinate of Tragus marker
C_x	X coordinate of Canthus marker
C_y	Y coordinate of Canthus marker
H_x	X coordinate of Humerus
H_y	Y coordinate of Humerus

The first step is to calculate of the actual position of C7, T8 and the manubrium. The positions are as follows:

$C7_x = C7'_x + L_{C7}\cos(\theta_{C7})$

$C7_y = C7'_y - L_{C7}\sin(\theta_{C7})$

$T8_x = T8'_x + L_{T8}\cos(\theta_{T8})$

$T8_y = T8'_y - L_{T8}\sin(\theta_{T8})$

$M_x = M'_x - L_m\cos(\theta_{C7})$

$M_y = M'_y - L_m\sin(\theta_{C7})$

Now the angles can be calculated. We denote vectors in bold. The dot product is denoted with " · ". The vector norm is denoted with "|| ||".

Thoracic Angle

Let **T1** be the vector from the manubrium to C7:

$\mathbf{T1} = \{C7_x - M_x; C7_y - M_y\}$

Let T2 be the vector from the manubrium to T8:

$\mathbf{T8} = \{T8_x - M_x; T8_y - M_y\}$

Then the thoracic angle is: $\mathrm{acos}(\mathbf{T1} \cdot \mathbf{T2}/(||\mathbf{T1}|| \times ||\mathbf{T2}||))$

Gaze angle

The angle is: $\mathrm{atan}((T_y - C_y)/(T_x - C_x))$

Shoulder protraction/retraction angle

The angle is: $\mathrm{atan}((C7_y - H_y)/(C7_x - H_x))$

Cervical angle

The angle is: $\mathrm{atan}((T_y - C7_y)/(T_x - C7_x))$

8 June 2006

Ms Y Prins
Discipline of Physiotherapy
Dept Interdisciplinary Health Sciences

Dear Ms Prins

RESEARCH PROJECT : "THE ETIOLOGY OF UPPER QUADRANT MUSCULOSKELETAL PAIN IN HIGH SCHOOL LEARNERS USING DESK TOP COMPUTERS: A PROSPECTIVE STUDY"
PROJECT NUMBER : N06/05/093

It is my pleasure to inform you that the abovementioned project has been provisionally approved on 7 June 2006 **for a period of one year from this date**. You may start with the project, but this approval will however be submitted at the next meeting of the Committee for Human Research for ratification, after which we will contact you again.

Notwithstanding this approval, the Committee can request that work on this project be halted temporarily in anticipation of more information that they might deem necessary to make their final decision.

Please note that a progress report (obtainable on the website of our Division) should be submitted to the Committee before the year has expired. The Committee will then consider the continuation of the project for a further year (if necessary).

In future correspondence, kindly refer to the above project number.

I wish to remind you that patients participating in a research project at Tygerberg Hospital will not receive their treatment free, as the PGWC does not support research financially.

The nursing staff of Tygerberg Hospital can also not provide extensive nursing aid for research projects, due to the heavy workload that is already being placed upon them. In such instances a researcher might be expected to make use of private nurses instead.

Yours faithfully

CJ VAN TONDER
RESEARCH DEVELOPMENT AND SUPPORT (TYGERBERG)
Tel: +27 21 938 9207 / E-mail: cjvt@sun.ac.za

CJVT/cjvt

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Wes-Kaap Onderwysdepartement

Western Cape Education Department

ISebe leMfundo leNtshona Koloni

Verwysing
Reference **20061012-0038**
ISalathiso

Miss Yolandi Prins
P.O. Box 5135
BELLVILLE
7535

Dear Miss Y. Prins

RESEARCH PROPOSAL: THE ETIOLOGY OF UPPER QUADRANT MUSCULOSKELETAL PAIN IN HIGH SCHOOL LEARNERS USING DESK TOP COMPUTERS: A PROSPECTIVE STUDY.

Your application to conduct the above-mentioned research in schools in the Western Cape has been approved subject to the following conditions:

1. Principals, educators and learners are under no obligation to assist you in your investigation.
2. Principals, educators, learners and schools should not be identifiable in any way from the results of the investigation.
3. You make all the arrangements concerning your investigation.
4. Educators' programmes are not to be interrupted.
5. The Study is to be conducted from **5th February 2007 to 21st September 2007**.
6. No research can be conducted during the fourth term as schools are preparing and finalizing syllabi for examinations (October to December 2007).
7. Should you wish to extend the period of your survey, please contact Dr R. Cornelissen at the contact numbers above quoting the reference number.
8. A photocopy of this letter is submitted to the Principal where the intended research is to be conducted.
9. Your research will be limited to the following schools: **Settlers High, Macassar Secondary, Ikamvalethu Secondary, Crestway Secondary, and GarlandaleSecondary**.
10. A brief summary of the content, findings and recommendations is provided to the Director: Education Research.
11. The Department receives a copy of the completed report/dissertation/thesis addressed to:

    The Director: Education Research
    Western Cape Education Department
    Private Bag X9114
    CAPE TOWN
    8000

We wish you success in your research.

Kind regards.

Signed: Ronald S. Cornelissen
for: **HEAD: EDUCATION**
DATE: 16th November 2006