



Prevalence and Individual Risk Factors Associated with Non-specific Low Back Pain
Among Secondary School Adolescents in Harare, Zimbabwe.

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Abstract

Background: Traditionally, non-specific low back pain (NSLBP) has been described as an important public health issue among adults but a rare phenomenon in the young. However, recent epidemiological studies have provided evidence that NSLBP affects all age groups. In adolescents, the literature has shown that the prevalence has increased tremendously during the past two decades. The reasons for this remain unclear. In addition, there is substantial evidence to suggest some adolescents will experience severe episodes of recurrent NSLBP associated with adverse consequences such as long-term chronicity into adulthood, reduced health-related quality of life, and school absenteeism. In spite of such evidence, no studies have been conducted in Zimbabwe to investigate the subjective presence of NSLBP symptoms among school-aged adolescents and to screen adolescents in schools affected by the condition in an attempt to identify the associated risk factors.

Purpose: The aim of the study was to estimate the prevalence (lifetime and point) and the one-year prevalence of recurrent NSLBP. In addition, the study aimed at identifying the individual risk factors associated with the report of recurrent NSLBP. A further aim was to compare the health-related quality of life between adolescents with recurrent NSLBP and those without.

Methods: The study was conducted in two continuous phases. The first phase of the study was cross-sectional survey based on a reliable and validated self-administered questionnaire. A cluster sample of school-children (age 13-19 years, N= 532) derived from three randomly-selected government-administered secondary schools in Harare, Zimbabwe participated in the study. Subsequently, based on a specific eligibility criteria, a small subset of adolescents with recurrent NSLBP were matched for age, gender, school type and class with adolescents without a previous history of low back pain in a 1:1 case-control study of Phase 2. The case-control study, conducted on 64 school-children (32 symptomatic cases vs. 32 asymptomatic controls), was designed to evaluate the influence of objectively-measured risk factors such as body mass index, relative school-bag weight and hamstring muscles flexibility with regard to recurrent NSLBP.

Results: The average lifetime prevalence was 42.9% [95% confidence interval, CI= 41.4-43.3]. There was no significant difference between males (42.7%) and females (43.0%) in the lifetime prevalence [$\chi^2 (1) = 0.006$, $p = 0.94$]. Significantly, NSLBP peaked earlier in females [Mean=13.9 years, SD= 1.91] than in males [Mean=15.0 years, SD= 1.75 years] as indicated by the t -test [$t (226) = 4.21$, $p < 0.001$]. On average, 10% of the school-children had

point NSLBP (5.3% in males and 14.0% in females) [$\chi^2 (1) = 11.2, p < 0.001$]. Almost a third (28.8%) of the school-children reported having experienced recurrent NSLBP in the 12 months prior to the study, with the majority experiencing more than three episodes. Most cases of recurrent NSLBP were mild [Mean= 4.8 on the Visual Analogue Scale, SD= 1.9], lasted a short duration and did not lead to medical treatment. In addition, the influence of recurrent NSLBP on health-related quality of life was not significant. However, adolescents reporting recurrent NSLBP indicated feeling sad or worried ($p = 0.004$, Fisher exact test). Nonetheless, on univariate analysis, recurrent NSLBP was significantly associated with increasing age [χ^2 for linear trend = 90.9, $p < 0.001$], perceptions of a heavy school-bag [$\chi^2 (1) = 85.9, p < 0.001$], duration of carrying a school-bag [$\chi^2 (4) = 58.3, p < 0.001$] and parental history of NSLBP [$\chi^2 (1) = 4.33, p = 0.04$]. In addition, recurrent NSLBP was higher in adolescents who did not practice sport [$\chi^2 (1) = 5.85, p = 0.02$], who sat four to six hours daily on entertainment activities [$\chi^2 (1) = 77.1, p < 0.001$] and who had tight hamstrings based on the chair-sit and reach test [$\chi^2 (1) = 7.57, p = 0.006$].

Conclusions: NSLBP is a common occurrence among Zimbabwean adolescents in secondary schools; it increases with age and is recurrent in the minority of adolescents. Although much of the symptomatology may be considered benign with little impact on health-related quality of life, school-children with recurrent NSLBP may be prone to psychological problems. Therefore, school psychological services may need to be established in secondary schools with the aim of identifying and mitigating psychological problems. The positive relationship between tight hamstrings and recurrent NSLBP validates the need for specific exercise therapy programmes to be implemented promptly in schools and justifies the need to resurrect defunct physical educational programmes. In addition, this study provides cross-sectional evidence to recommend sport activity for at least four hours per week in schools to reduce the prevalence of recurrent NSLBP. Moreover, concerted effort is needed from parents and teachers to restrict prolonged sitting in school or home on entertainment activities. Schools can schedule exercise programmes throughout the school day creating opportunities for students to be active between classes. At home, parents may be encouraged to create a platform for exercises as a family habit and make an active commitment to dissuade school-children from prolonged sitting on entertainment activities. Lastly, schools should empower school-children on the possible dangers of carrying heavy school-bags and, if possible, introduce appropriate measures that restrict prolonged carrying of school-bags such as the use of lockers.

Declaration

I,, hereby declare that the work on which this thesis is based is my original work and that neither the whole work nor any part of it has been, is being, or is to be submitted for another degree in this or any other university.

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Dedication

To my lovely wife, Precious Chizanga, for her fortitude during times when I was not around. Thank you for your understanding and patience. I also dedicate this project to my two lovely twin daughters, Nokutenda Nicole Chiwaridzo and Nokuvimba Nicky Chiwaridzo who were born while I was away in Cape Town.

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List of Abbreviations

ADL	Activities of Daily Living.
AKET	Active Knee Extension Test.
BMI	Body Mass Index.
CI	Confidence Interval.
CSR	Chair-Sit and Reach.
EQ-5D	EuroQol 5 Dimensions.
EQ-5D-Y	EuroQol 5 Dimensions for Youth.
HIV/AIDS	Human Immunodeficiency Virus/ Acquired Immune Deficiency Syndrome.
HREC	Human Resources Ethics Committee.
HRQoL	Health Related Quality of Life.
ICC	Intra-class correlation coefficient.
ICF	International Classification of Functioning, Disability and Health.
IQR	Interquartile range.
K	Kappa coefficient.
LBP	Low Back Pain.
M	Mean.
MOHCW	Ministry of Health and Child Welfare.
MRCZ	Medical Research Council of Zimbabwe.
MRI	Magnetic Resonance Imaging.
NSLBP	Non-specific low back pain.
OR	Odds Ratio.
PEDro	Physiotherapy Evidence Database.
PedsQL	Paediatric Quality of Life Inventory.
QoL	Quality of Life.
RCTs	Randomised Controlled Trials.
RR	Relative Risk.
SA	South Africa.
SD	Standard Deviation.
SF-36	Medical Outcomes Study Short Forms.
SLR	Straight Leg Raise.
SPSS	Statistical Package for Social Sciences.
SR	Sit and Reach.
TV	Television.
UCT	University of Cape Town.
UK	United Kingdom.

USA	United States of America.
US	United States.
UZ-CHS	University of Zimbabwe-College of Health Sciences
VAS	Visual Analogue Scale.
WHO	World Health Organisation.
ZimStat	Zimbabwe National Statistical Agency.

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Glossary

Adolescents	Males or females between the ages of 10 and 19 years.
Lifetime Prevalence	Proportion of the population that had experienced an episode of low back pain at some point in their lifetime.
Low Back Pain	Pain and/or discomfort, localised between the costal margin and above the inferior gluteal folds, with or without radiating leg pain.
Non-specific low back pain	Low back pain not attributable to a recognisable, known or specific pathology such as tumours, infections or inflammation. The acronym LBP was used interchangeably to denote NSLBP in most instances.
Recurrent non-specific low back pain	Low back pain that has occurred at least twice over the past year with each episode lasting at least 24 hours, with pain intensity of greater than two on Visual Analogue Scale with at least a 30-day pain free period between the episodes.
Point Prevalence	Proportion of the population experiencing low back pain at the time of completing the questionnaire.
Secondary schools	Refers to government-administrated schools for high school students located in the urban areas of Harare.
S₁ schools	Represents group “A” schools located in the low density areas where people of high socio-economic status live (Bandason and Rusakaniko, 2010).
S₂ schools	Represents group “B” schools located in the high density areas, where people of low socio-economic status live.

CHAPTER ONE: INTRODUCTION

1.1 Introduction

This chapter describes the background to the study of non-specific low back pain (NSLBP) in a sample of school-going adolescents in Harare, Zimbabwe. The general aim and specific objectives for the study will also be explained. In addition, this chapter provides detail on the justification for the study.

1.2 Background to the study

NSLBP has been described as pain or discomfort localised below the costal margin and above the inferior gluteal folds, with or without leg pain, but not attributable to a known or specific pathology (Burton, Balagué, Cardon, Eriksen, Henrotin, Lahad, Leclerc, Müller & Van der Beek, 2006). Globally, it has been identified as an important public health problem among adults (Walker, 2000; Louw, Morris & Grimmer-Somers, 2007; Hoy, Bain, Williams, March, Brooks, Blyth, Woolf, Vos & Buchbinder, 2012) with an estimated lifetime prevalence of over 60% (Louw et al, 2007; Walker, 2000). Traditionally, it was considered a common symptom in adults only (Limon, Valinsky & Ben-shalom, 2004) and was mainly associated with occupational or work-related risk factors (Latza, Karmaus, Stürmer, Steiner, Neth & Rehder, 2000; (Yun, Sheng, Hua, Shan Shan, Lei, Shan Fa, Li Ping, Jian Xian & Yan Di, 2012). However, recent evidence emerging has begun to portray a different perspective on the age of onset of NSLBP.

For decades, it was suggested that NSLBP among children and adolescents was a rare phenomenon (Balagué, Mannion, Pellisé & Cedraschi, 2012). However, a review of the literature indicates that the prevalence of NSLBP in the young has increased dramatically during the past two decades (Watson, Papageorgiou, Jones, Taylor, Symmons, Silman, Macfarlane, 2002; Jeffries, Milanese & Grimmer-Somers, 2007). There is evidence that the first episodes of NSLBP could be experienced as early as nine years of age (Gunzburg, Balagué, Nordin, Szpalski, Duyck, Bull & Mélot, 1999; Kjaer, Wedderkopp, Korsholm & Leboeuf-yde, 2011) especially in females (Jones and Macfarlane, 2005) and the occurrence increases with age (Shehab, AL-Jarallah, Al-Ghareeb; Sanaseeri, Al-Fadhli & Habeeb, 2004; Ayanniyi, Mbada & Muolokwu, 2011). In addition, evidence from prospective cohort studies have revealed that NSLBP experienced during adolescence may persist into adulthood (Brattberg, 2004; Poussa, Heliovaara, Seitsamo, Kononen, Hurmerinta & Nissinen, 2005; Hestbaek, Leboeuf-yde & Kyvik, 2006a). In light of this, primary prevention efforts commenced early in adolescence may contribute to the prevention of NSLBP in adulthood.

Prevalence estimates for adolescent NSLBP have been shown to vary between studies (Hill & Keating, 2009; Jeffries et al, 2007) because of methodological or definitional issues (Bejia, Abid, Ben-Salem, Letaief, Younes, Touzi & Bergaoui, 2005). In high-income countries, the lifetime prevalence has been reported to be 61% in Spain (Kovacs, Mufraggi, Gil del Real, Lopez & Gestoso, 2003), 62% in Norway (Sjolie, 2004a), 40% in the UK (Jones, Stratton, Reilly & Unnithan, 2004) and 34.5% in the USA (Chiang, Jacobs & Orsmond, 2006). In low-income countries, the lifetime prevalence has been similarly reported: 58% among SA adolescents (Jordaan, Kruger, Stewart & Becker, 2005), 57.8% in Kuwait (Shehab et al, 2004) and 25% among Nigerian adolescents (Ayanniyi et al, 2011). In addition, 12% of adolescents are reported to have NSLBP at any specific time (Louw et al, 2007).

Unfortunately, in spite of international and regional evidence of NSLBP in adolescents, there is dearth of literature on the condition among Zimbabwean adolescents in schools. In Switzerland, NSLBP has been recognised as a public health problem among children and adolescents necessitating referral to physicians (Gierlach, 2002). In Italy, Masiero, Carraro, Celia, Sarto and Ermani (2008) reported that adolescents with NSLBP frequently consult a health care provider. In low-income countries such as Nigeria and Mozambique, the prevalence rates for adolescent NSLBP have been reported to fall within the range reported for the high-income countries (Prista, Balagué, Nordin & Skovron, 2004; Ayanniyi et al, 2011). Against this background, it would be important to establish the prevalence of NSLBP in a stable Zimbabwean adolescent population and assess how it compares with other countries.

NSLBP has been reported to be recurrent in a subset of adolescents (Jones et al, 2004; Sjolie, 2004b). In the literature, it is estimated that 13%-36% of children and adolescents experience recurrent NSLBP (Vikat, Rimpelä, Salminen, Rimpelä, Savolainen & Virtanen, 2000; Jones et al, 2004; Shehab et al, 2004). Some reports have acknowledged the grave consequences that recurrent NSLBP poses during adolescence such as long-term chronicity into adulthood (Hestbaek, Leboeuf-yde & Kyvik, 2006b), frequent visits to health practitioners (Masiero et al, 2008) and reduced HRQoL (O'Sullivan, Beales, Smith & Straker, 2012). It becomes essential to identify Zimbabwean adolescents in schools experiencing recurrent NSLBP and to test different individual factors potentially associated with the condition. Most of the epidemiological studies on adolescent NSLBP have sampled adolescents in structured environments such as schools (Jeffries et al, 2007). This followed, as reported in Jones et al (2004), the recognition of schools as an effective setting for influencing and promoting children's health by the World Health Organisation (WHO).

NSLBP is reported to be the most common musculoskeletal condition and an important cause for adult disability in high-income countries (Woolf & Pfleger, 2003). But, a report released by the WHO of the burden on the musculoskeletal conditions indicated a greater increase in the occurrence of NSLBP among low-income countries for the 2010-2020 decade (WHO, 2003). The factors contributing to such an increase are unclear and may need to be examined. One of the possible factors could be the reported increase in the prevalence of NSLBP among adolescents and the potential tracking into adulthood. This creates a need to evaluate the presence of NSLBP among adolescents and to investigate the associated risk factors to recurrent episodes. However, a number of factors have been linked to the report of adolescent NSLBP in the literature. An understanding of the risk factors associated with the report of NSLBP is important in developing well-targeted preventative actions with the aim of reducing back pain (Trevelyan & Legg, 2011). In Australia, Haselgrove, Straker, Smith, Sullivan, Perry and Sloan (2008) found that school-bag related factors such as load and duration of carrying were associated with back pain among adolescents. It is also believed that the method of carrying may predispose school-children to musculoskeletal complaints (Negrini & Carabalona, 2002). Globally, such evidence has alerted teachers, parents and health professionals on the possible effect of school-bags on adolescent spinal health (Puckree, Silal, Lin, 2004; Moore, White & Moore, 2007; Lindstrom-Hazel, 2009; Shamsoddini, Hollisaz & Hafezi, 2010). Lack of literature on this subject in Zimbabwe could indicate that no importance has been attached to the issue of school-bags and the potential effect on adolescent spinal health. A casual observation of the Zimbabwean scholars has shown that school-bags are frequently used to carry items that include textbooks, lunchboxes, sports and electrical gadgets (laptops). These items may represent a substantial load if carried every day. It also seems that size and weight of the school-bags have increased over the years possibly due to increased educational demands.

The period of adolescence has been described as a critical stage of spinal development characterised by rapid growth until early adulthood (Grimmer & Williams, 2000; Dockrell, Kane & Keeffe, 2006). During this period of rapid growth, the adolescent spine is thought to be vulnerable to stresses that are common (Grimmer & Williams, 2000). In light of this, it is possible to hypothesize that the factors that contribute to increased load on the lumbar spine or diminished blood supply to the area may contribute to NSLBP among adolescents. Therefore, individual risk factors such as a high BMI, smoking, decreased muscle flexibility, prolonged sitting and intense sports activity may be important in the report of NSLBP in adolescents.

In the literature, however, the influence of the above factors in the pathogenesis of adolescent LBP is still a matter of debate (Cardon & Balague, 2004). Nevertheless, this hypothesis is interesting from a primary prevention perspective. Exercise therapy programmes in schools may reduce high BMI; educational interventions may curb smoking and physical education classes may enhance muscle flexibility and promote general body fitness. So far, research on the possible influence of these factors in the report of NSLBP among Zimbabwean adolescents is lacking. In Japan, Sato, Ito, Hirano, Kikuchi, Endo and Tanabe (2011) found that sports participation was strongly related to adolescent NSLBP. In Canada, Feldman, Shrier, Rossignol and Abenhaim (2001) found that adolescent LBP was associated strongly with smoking of cigarettes and the presence of tight hamstrings muscles. In the USA, Sheir-neiss, Kruse, Rahman, Jacobson and Pelli (2003) found that NSLBP was related to time spent sedentary watching television in adolescents.

1.3 Justification for the study

While the epidemiology and risk factors of NSLBP have been studied extensively in adults, studies evaluating the prevalence of NSLBP and the associated risk factors at a young age are still emerging. In Zimbabwe, there is no documented evidence of the existence of NSLBP symptoms among adolescents. However, a study conducted by Jelsma, Mielke, Powell, De Weerd and De Cock (2002) to establish the health conditions primarily responsible for disability and morbidity gave the researcher insight into the possible existence of musculoskeletal symptoms among the younger age groups. The study involved 10 839 residents from one high-density residential area in Harare, Zimbabwe between the ages of 0 and 61 years. The authors found that NSLBP constituted the third most common condition responsible for disability and morbidity. However, according to the authors, the sample was characterised by a higher number of “scholars” as compared to employed persons. This attracts attention for a possible high occurrence of musculoskeletal conditions such as NSLBP among “scholars” in Harare and justifies the need to explore NSLBP symptoms among school-going adolescents. Nevertheless, there is no clear evidence of the existence of the problem in Zimbabwe upon which health professionals can base health promotion activities. Therefore, there is a need for school-based screening for NSLBP especially recurrent NSLBP in adolescents and to identify associated risk factors. This information has important implications for the Ministry of Health and Child Welfare, health-care professionals involved in the management of NSLBP, and for the Ministry of Education, Sports, Arts and Culture in Zimbabwe.

1.4 Problem Statement

There is some evidence of a high prevalence rate of musculoskeletal conditions such as NSLBP amongst “scholars” in Harare (Jelsma et al, 2002). However, to the author’s

knowledge, there is no documented evidence indicating the occurrence of NSLBP in the Zimbabwean adolescents against a background of reported high prevalence rates worldwide.

Therefore, the research questions are:

1. What proportion of adolescents in secondary schools has a lifetime history of NSLBP?
2. At what age are the first episodes of NSLBP being experienced by adolescents?
3. What proportion of adolescents in secondary schools has “current” NSLBP identified as point prevalence?
4. What proportion of adolescents in secondary schools reports recurrent NSLBP in the last 12 months prior to the study?
5. Is there any association between recurrent NSLBP and risk factors such as age, gender, body mass index, smoking, hamstring flexibility, sports, time spent sedentary, and relative school-bag weight?

1.5 General Aim

The main aim of the study was to estimate the prevalence (lifetime and point) and the one-year prevalence of recurrent NSLBP among a sample of secondary school students in Harare, Zimbabwe. In addition, the study sought to evaluate the possible association between pre-determined individual risk factors and non-specific recurrent NSLBP in the specific population.

1.6 Specific Objectives

The specific objectives are divided into separate phases: Phase1 objectives and Phase 2 objectives.

1.6.1 Phase 1 Objectives

Phase 1 objectives were to determine in secondary school adolescents in Harare, Zimbabwe:

1. If there is a significant difference in the lifetime prevalence of NSLBP between males and females.
2. If there is a significant difference in the mean age of onset for NSLBP between males and females.
3. If there is a significant difference in the point prevalence of NSLBP between the males and females.
4. The prevalence of recurrent NSLBP experienced 12 months prior to the study.
5. Individual risk factors associated with subjective morbidity of recurrent NSLBP.

1.6.2 Phase 2 Objectives

Phase 2 objectives were to determine in adolescents:

1. If recurrent NSLBP is associated with Body Mass Index (BMI) calculated using the Quetelet's index [weight (kg)/ height (m²)].
2. If recurrent NSLBP is associated with the Relative Schoolbag Weight [(Schoolbag weight/student weight) ×100].
3. If there is a significant difference in the mean value for the Chair Sit and Reach (CSR) test for Hamstring Flexibility between adolescents with recurrent NSLBP and those without.
4. If there is a significant difference in the mean score of the Visual Analogue Scale (VAS) on the Health Related Quality of Life Questionnaire, EQ-5D-Y, between adolescents with recurrent NSLBP and those without.

CHAPTER 2: LITERATURE REVIEW

2.1 Introduction

This chapter reviews literature on NSLBP in adolescents in an attempt to draw conclusions regarding the prevalence and the individual risk factors associated with recurrent NSLBP among adolescents in both high and low-income countries. In addition, this chapter explores the historical background and the evolvement of NSLBP as a potentially serious public health disorder in adolescents.

The articles reviewed in this chapter were obtained from various medical databases: Academic Search Premier via EBSCOhost, PubMed, BioMed Central, Physiotherapy Evidence Database (PEDro) and ScienceDirect. The literature search was performed using the following key terms: NSLBP, recurrent NSLBP, prevalence, risk factors, individual risk factors, cross-sectional studies, systematic reviews, longitudinal studies, epidemiological studies, adolescents and school-children. This literature review included articles published in the last twenty years because NSLBP among adolescents has increased significantly in the last two decades.

Although the literature covers a wide variety of conditions that cause adolescent LBP, this literature review focused mainly on NSLBP. Epidemiologists refer to NSLBP as LBP not attributable to a recognisable pathology such as infection or tumour but associated with or without radiating leg (Burton et al, 2006). Anatomically, the low back area has been recognised as between the twelve ribs to the area above the inferior gluteal folds (Woolf & Pfelger, 2003) represented by the area shaded black on the mannequin below (

Figure 1) adopted from Watson, Papageorgiou, Jones, Taylor, Symmons, Silman and Macfarlane (2003)

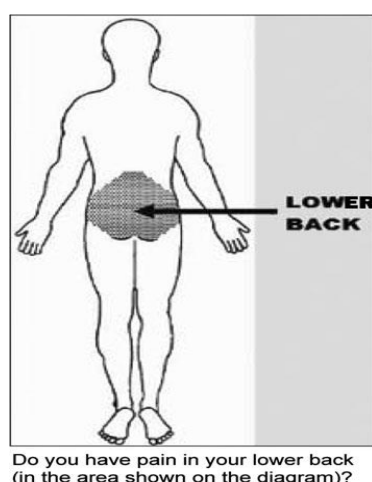


Figure 1: The anatomical low back pain region

This review focused on the five major themes which emerged continuously throughout the literature on adolescent NSLBP, before a review of the methodology. A conclusion of the literature review will summarise the key concepts in the epidemiology of adolescent NSLBP. The major themes discussed in this review include:

- Historical background of NSLBP in adolescents.
- Epidemiological studies on adolescent NSLBP.
- Definitions of outcome measures used to assess LBP.
- Prevalent rates of NSLBP.
- Characteristics and classification of LBP.
- Individual risk factors associated with recurrent NSLBP in adolescents.

2.2 Historical background

Medical science and health technology has improved tremendously over the years which has led to momentous changes in the burden of disease (Petersen, 2008). For adolescents, the WHO reports a shift from injuries and communicable diseases to non-communicable, lifestyle-related conditions such as mental health, smoking, drug abuse, nutrition, exercise, sexual and reproductive behaviours as prominent causes of disability adjusted-life years (WHO, 2006). Although this indicates a positive transition in health care, it also implies that adolescents are now much more vulnerable to conditions previously considered in adults such as obesity, lung cancer, LBP and HIV/AIDS. According to the WHO report on adolescent health, more than 33 percent of the disease burden among adults is associated with conditions or attitudes that occurred or began during the adolescence period (WHO, 2006).

Until recently, NSLBP was scarcely reported in adolescents (Jones & Macfarlane, 2005) because the disorder was considered a rare phenomenon (Shehab et al, 2004). In addition, the historical dominance of the biomedical model of illness hugely contributed to this lack of reporting. This model governed the practice of medicine for the past century (Wade and Halligan, 2004; Engel, 1977). Based on this model, any illness has a specific biological cause which must be treated (Wade and Halligan, 2004). Therefore, adolescents with LBP were thought to have a specific pathology such as an infection or tumour (Gunzburg et al, 1999). Historically, that was the standard clinical approach towards a child or adolescent with LBP.

Following an international congress about “the back of children and teenager and prevention of backache” which was held in France in 1999, entrenched thoughts on LBP began to change (Phélip, 1999). This congress was an immediate response to the emerging evidence of adolescent NSLBP from different population studies. Prospectively, Burton, Clarke,

McClune and Tillotson (1996) followed a cohort of 216 adolescents between the ages of 11 and 15 over a period of five years, and reported high figures of lifetime prevalence of NSLBP from 11.6% at 11 years to 50.4% at 15 years. This school-based study provided irrefutable evidence that NSLBP was a common symptom in the younger age-groups. In a retrospective study of 648 paediatric patients with spinal disorders conducted by Combs and Caskey (1997) reported in Gunzburg et al (1999), “back pain with no organic cause” was the primary diagnosis (57.4%). This study highlighted the prevalence of NSLBP in the young in a clinic setting. Since then, a number of epidemiological studies have continued to provide evidence of NSLBP among the younger population (Grimmer & Williams, 2000; Watson et al, 2002; Jones et al, 2004; Ayanniyi et al, 2011; Yao, Luo, Ai, Chen, 2012). Currently, it is understood that LBP is non-specific in the majority of the cases (Woolf & Pfelger, 2003; Ehrlich, 2003) and has the potential to affect individuals indiscriminately (Burton et al, 2006). However, Milanese and Grimmer-Somers (2010) classified the potential causes of adolescent LBP into three major categories, namely primary spinal disorders, systemic or non-spinal diseases, and non-specific causes. The primary spinal disorders were further classified into mechanical, inflammatory/infectious and neoplasms. However, it is beyond the scope of this literature review to expand on the specific causes of LBP among adolescents. Table 1 below summarises these potential causes of adolescent LBP.

Table 1: Potential causes of adolescent low back pain.

1. Primary spinal disorders
a) Mechanical
1. Disc lesions or herniation
2. Spondylolysis and spondylolisthesis
3. Scheuermanns disease
4. Traumatic injuries
5. Congenital disorders – scoliosis, spinal fusion, spinal stenosis
b) Inflammatory/Infectious
1. Discitis
2. Disc calcifications
3. Inflammatory rheumatic disorders
4. Infections of the bone/soft tissue
c) Neoplasms
1. Benign tumours – osteoid osteoma, osteochondroma, lipoma, giant cell tumour
2. Malignant tumours – Ewings sarcoma, osteogenic sarcoma, neuroblastoma
3. Radiation Therapy sequelae
2. Systemic or non-spinal diseases
1. Hematologic disorders – sickle cell, leukaemia, Hodgkin's,
2. Aortic dissection
3. Intra-abdominal diseases
4. Psychological
3. Nonspecific causes

2.3 Epidemiological studies on adolescent NSLBP

Although NSLBP has been correlated to occupational exposures in adults (Hoogenderon, Bangers; de Vet, Ariens, Van Mechelen & Bouter, 2002) it has been reported among adolescents before work life begins (Watson et al, 2002; Onofrio, Da Silva, Domingues, & Rombaldi, 2012). This invigorated a new focus into adolescent NSLBP by researchers. According to Cardon and Belague (2004), the quality of studies on adolescent NSLBP is improving from cross-sectional studies to prospective studies. With the evidence that adolescent NSLBP predicts adulthood NSLBP (Hestbaek et al, 2006a), observational studies

have been followed by RCTs to evaluate preventative strategies (Fanucchi, Stewart, Jordaan & Becker, 2009; Jones, Stratton, Reilly & Unnithan, 2007). However, epidemiological research into adolescent NSLBP is abounding with cross-sectional studies (Cardon and Belague, 2004) illustrating prevalence figures (Masiero et al, 2008; Ayanniyi et al, 2011), risk factors (Feldman et al, 2001; Watson et al, 2003; Trevelyan and Legg, 2011) and consequences of LBP (Jones et al, 2004; Pellise, Balague, Rajmil, Cedraschi, Aguirre, Fontecha & Ferrer, 2009). The majority of these investigations have targeted adolescents between the ages of 10 and 18 years in structured environments such as schools (Smith & Leggat, 2007). However, the epidemiological relevance of the data from these studies has been compromised by methodological differences (Hill & Keating, 2009; Masiero et al, 2008) involving the LBP definition (Watson et al, 2002) and recall period (Milanese and Grimmer-Somers, 2010).

2.4 Definitions of outcome measures used to assess LBP

2.4.1 Prevalence

It is well-established that NSLBP often resolves completely and recurs after some time (Burton et al, 2006). Because of that individuals can be counted as having prevalent cases if LBP recurs (Loney and Stratford, 1999). In their methodological review of literature on the prevalence of LBP in adults, Loney and Stratford (1999) adopted a definition of prevalence as the “number of people in a defined population who have a specified disease or condition at a point in time.” In LBP research, the outcome measures of prevalence have been specified as lifetime prevalence, point prevalence and period prevalence (Calvo-Muñoz, Gómez & Sanchez, 2013).

2.4.2 Lifetime prevalence

According to Hill and Keating (2009), lifetime prevalence is the most common outcome measure in the literature for adolescent NSLBP. Rarely, does the operational definition of lifetime prevalence of NSLBP differ between studies. In many studies, lifetime prevalence was determined by the following question “have you ever suffered from LBP?” (Jeffries et al, 2007). This homogeneity allows for an improved ability to compare results. Jones et al (2004) clearly defined the lifetime prevalence as the “proportion of the population that had experienced an episode at some point in their lifetime.” This definition captures the problem of LBP at a larger scale. However, its use and relevance in epidemiological studies have been reported to be susceptible to significant drawbacks. The major disadvantage was aptly described by Milanese and Grimmer-Somers (2010) as “memory decay”. The authors defined memory decay as the “gradual memory loses that occurs over time when recalling

significant events.” This implies that individuals are likely to forget previous LBP episodes resulting in imprecise lifetime prevalence rates.

In a two-year longitudinal study based on a validated questionnaire conducted on school-children aged between 9-12 years, Szpalski, Gunzburg, Balague, Nordin and Mélot (2002) reported that 18.4% (n=287) of school-children who had reported a lifetime history of LBP at the beginning of the study (at the age of 9 years) did not do so two years later (at the age of 11 years). Although this study used a relatively younger sample, the findings were consistent with those of Burton et al (1996). In a longitudinal survey involving 216 school-children aged between 12 and 16 years, Burton et al (1996) found that 60% of adolescents had forgotten about previously reported episodes of LBP. These findings suggest that children and adolescents forget about some previously experienced NSLBP episodes when they are asked to recall. However, there seems to be contrasting reports that describe that adolescents are “accurate historians” of pain episodes (Grimmer & Williams, 2000). This is corroborated by the high intra-rater agreement achieved in some studies. For example, a study by Bejia, Abid, BenSalem, Touzi and Bergaoui (2006) evaluated the reproducibility of a questionnaire using 72 adolescents, the authors reported high kappa coefficients for important items such as time for NSLBP onset ($k=0.83$) and NSLBP duration ($k=0.73$). These items required a good memory to recall.

2.4.3 Period and point prevalence

Another commonly reported recall prevalence of NSLBP is period prevalence, measured over a specified time period (1 week, 1 month, or 1 year). Although period prevalence has a shorter recall period, its use is disadvantaged by what has been described as “forward telescoping” (Milanese and Grimmer-Somers, 2010). The authors defined “forward telescoping” as “recollecting events such as NSLBP as occurring more recently than they actually did.” Because of that, “forward telescoping” has been thought to over-estimate prevalence rates (Loney and Stratford, 1999). However, according to Milanese and Grimmer-Somers (2010), the use of point prevalence negates the above-mentioned recall biases for lifetime prevalence and period prevalence, as it is not affected by memory decay and forward telescoping. Point prevalence of NSLBP is usually measured as the “number of people experiencing LBP at the time of completing the questionnaire” (Mohseni-Bandpei, Bagheri & Shayesteh, 2007). However, because of a short period of recall, point prevalence may limit the ability to collect data from sufficient subjects to develop an understanding of the risk factors associated with adolescent NSLBP. In addition, it may fail to accommodate an episode of LBP that is not hurting at the precise time of questioning.

2.5 Prevalent rates of low back pain

2.5.1 Lifetime prevalence rates

Four systematic reviews reported lifetime prevalence figures of NSLBP between 7% and 80% before the age of 20 years (Jones and Macfarlane, 2005; Jeffries et al, 2007; Louw et al, 2007; Hill and Keating, 2009). However, absolute prevalence figures appear to vary distinctively between studies because of methodological differences (Smith and Leggat, 2007). In addition, there seems to be no standard way in which NSLBP is defined or described (Jeffries et al, 2007). A cross-sectional study conducted in Kuwait among 400 school-children (age range, 10-18 years) reported a lifetime prevalence of 57.8% (Shehab et al, 2004). The authors adopted a commonly used definition of LBP as given by Burton et al (2006) (refer to page xviii, glossary). In contrast, a large cross-sectional study conducted among 43 630 Japanese school-children aged between 9 and 15 years, found a relatively lower lifetime prevalence of 32.1% (Sato et al, 2012). However, this study could be criticised on the grounds that the authors left the judgment of NSLBP to the respondents. This lack of specification on the low back region could have contributed to the lower prevalence rate.

Adolescent NSLBP has attracted considerable research attention across a wide range of countries. Generally, most of the research on adolescent NSLBP has come from high income countries compared to low income countries. The latter countries seem to be the consumers of research generated by the high-income countries (Rahman & Fukui, 2003). A global systematic review into the prevalence of NSLBP conducted by Walker (2000) identified only one study from Africa. In accordance, a systematic review specifically into adolescent LBP conducted by Jeffries et al (2007) identified only one article from Africa. The most recent systematic review of the global prevalence of LBP by Hoy et al (2012) did not include any article from Africa. Nevertheless, Hoy et al (2012) found that the mean prevalence of LBP in high-income countries was significantly higher than for countries with low-income economies ($t=3.03$, $p=0.003$).

The above findings have guided the belief that NSLBP is more prevalent in high-income countries than in low-income countries. In the literature, the reason for this finding is not clear. However, Walker (2000) attributed this to constrained health-care resources in low-income countries for NSLBP surveillance against urgent health threats such as HIV/AIDS. Louw et al (2007) argues that the problem of NSLBP may be a recent or emerging phenomenon in low-income countries in Africa as evidenced by recent publications from countries such as Nigeria (Ayanniyi et al, 2011), Mozambique (Prista et al, 2004), Egypt

(Ibrahim, 2012), Tunisia (Bejia et al, 2005; Bejia et al, 2006) and SA (Puckree et al, 2004; Jordaan et al, 2005; Fannuchi et al, 2009).

2.5.2 Lifetime prevalence and age

According to Trevelyan and Legg (2011), age is the most commonly considered factor in research undertaken to explore the risk factors for LBP among adolescents. A review of the literature showed that lifetime prevalence of non-specific LBP increases with chronological age (Watson et al, 2002; Kovacs et al, 2003; Poussa et al, 2005; Wedderkopp, Andersen, Froberg & Leboeuf-yde, 2005). A systematic review of 35 studies on the incidence and prevalence of LBP in children by Hill and Keating (2009) found an age-specific increase in lifetime prevalence from 1% at seven years to 53% at 15 years. This is in accordance with the conclusions of another systematic review on adolescent LBP conducted by Jeffries et al (2007). Cross-sectionally, Shehab et al (2004) found the lifetime prevalence of LBP to be 31.6% at the age of 10 years increasing to 74.0% at the age of 18 years among 400 school-children in Kuwait. In the UK, Jones et al (2004) reported similar findings of increasing prevalence with age among 500 school-children between the ages of 10 and 16 years. Although the causes for this age-specific increase in LBP are unclear in adolescents, Smith and Leggat (2007) reported that such an increase may reflect the increasing probability of physical injury among adolescents over time. According to the conclusions made by Grimmer and Williams (2000) on their study investigating age, gender and environmental correlates of adolescent LBP, age-specific increases in the prevalence of LBP related to the differences in the musculoskeletal maturity with each year.

2.5.3 Age of onset of low back pain

According to Jeffries et al (2007), the WHO recognises adolescents as people between the ages of 10 and 19 years. Adolescents constitute the second most common group studied by researchers with regard to NSLBP (Louw et al, 2007; Burton et al, 2006). However, the literature is inconclusive on the specific age of onset for NSLBP among adolescents. NSLBP has been reported among seven to nine year olds in the literature (Gunzburg et al, 1999; Wedderkopp et al, 2005; El-metwally, Mikkelsen, Macfarlane, Jones, Pulkkinen, Rose, Kaprio and Stahl, 2008), a finding that illustrates the indiscriminate nature of the condition. However, some studies have indicated that LBP starts in early adolescence and varies by gender (Watson et al, 2002; Shehab et al, 2004; Ayanniyi et al, 2011).

Shehab et al (2004) conducted a cross-sectional study on 400 school-children aged between 10 and 18 years in Kuwait and found that the median age of onset of LBP was 13 years in females and 14 years in males. In accordance, Salminen, Erkinntalo, Pentti, Oksanen and Kormanen (1999) reported that the first LBP episode often occurs between the ages of 13 and

14 years but earlier in females than in males. This has been attributed to earlier puberty and associated hormonal influences such as accelerated growth rate in females (Shehab et al, 2004; Grimmer & Williams, 2000). However, there is conflicting evidence on the link between LBP and pubertal related factors. In a study investigating whether LBP was related to puberty Wedderkopp, Andersen, Froberg and Leboeuf-yde (2005) compared the prevalence of LBP between 254 female children (aged between 8 and 10 years) and 165 female adolescents (aged between 14-16 years). The authors found that the reporting of LBP increased with increasing level of puberty. These findings indicated that adolescent LBP may be related to puberty in females. Besides acknowledging the possible link between LBP and menstruation, Pellise et al (2009) claimed that adolescent LBP strongly has social, environmental and behavioural connotations to it. In addition, there are studies that have reported an early onset in males. Jordaan et al (2005) reported peak onset of adolescent LBP at 13 years for males compared to 14 years for female participants. A possible reason, according to the authors, was the fact that males are generally inflexible compared to females. This is thought to lead to increased stresses on spinal soft tissue structures predisposing males to back injuries. Jordaan et al (2005) further attributed this to the higher concentration of testosterone in males resulting in larger vertebral bodies in males which might increase stress on innervated spinal structures leading to LBP.

2.5.4 Lifetime prevalence and gender

Gender has been equally considered as an important risk factor associated with reports of LBP in adolescents (Trevelyan and Legg, 2011). However, the literature is inconclusive on the gender most affected. One well-designed cross-sectional study by Watson et al (2002) in 1 446 school-children between the ages of 11 and 14 years reported a significant difference in the lifetime prevalence between females (28%) and males (19%) [$\chi^2=14.7$, $p< 0.001$]. In accordance, a literature review of the initial studies on adolescent LBP conducted by Jones and Macfarlane (2005) concluded that LBP was more prevalent among females. The causes for this are unknown (Haselgrove et al, 2008) but a number of plausible explanations have been given in the literature. Kovacs et al (2003) reported that females have a low tolerance for pain. Hence, they are more likely to perceive and report pain than males. Johnson, Mbada, Akosile and Agbeja (2009) related increased prevalence of LBP in females to physical attributes such as poor isometric trunk musculature strength compared to males. Ayanniyi et al (2011) speculated that males worry less about pain than females. In another study, Harreby, Nygaard, Jessen, Larsen, Storr-Paulsen, Lindahl, Fisker and Laegaard, (1999) highlighted the possibility of LBP being confused with pain emanating from menses in females.

However, the study by Jordaan et al (2005) conducted in SA in 1 123 school-children aged between 13 and 18 years found no association between LBP and female gender. Although the difference was not statistically significant, the authors found that males had a slightly higher lifetime prevalence than females (53.6% vs. 51.8%, $p=0.78$). These findings are in agreement with the findings on annual prevalence of LBP reported by Mohseni-Bandpei et al (2007) in 5 000 Iranian school-children aged 11-14 years. The authors found the prevalence of LBP significantly higher in males compared to females (20.5% vs. 14.5%, $p=0.000$) possibly due to the higher exposure to physical and sporting activities. To compound the relationship between gender and adolescent LBP, several other studies showed no significant difference in the reports of lifetime history of LBP between males and females (Jones et al, 2004; Murphy, Buckle & Stubbs, 2007). According to Ayanniyi et al (2011) no plausible explanation exists for the lack of significant difference. In conclusion, the lack of conclusive findings on gender and adolescent LBP in the literature reflects on the absence of concerted investigations on important issues such as hormonal influences in the development of adolescent LBP (Steele, Grimmer, Williams & Gill, 2001).

2.6 Point prevalence of non-specific low back pain

Epidemiological surveys among adolescents estimate point prevalence of NSLBP between 10% and 35% (Bejia et al, 2005; Jordaan et al, 2005; Louw et al, 2007; Ayanniyi et al, 2011; Shehab et al, 2004). In the literature, there are mixed definitions of “point” LBP between the studies. This partly explains the heterogeneity in the absolute figures of point prevalence. Jordan et al (2005), Ayanniyi et al (2011) and Mohseni-Bandpei et al (2007) in their studies considered point prevalence as “LBP on the day of survey.” However, Jones et al (2004) and Bejia et al (2005) referred to “LBP occurring during the course of the week” as point pain.

In a school-based survey by Jones et al (2004) conducted on 500 school-children aged between 10 and 16 years in the United Kingdom, the point prevalence within the week was reported to be 15.5%. In accordance, Bejia et al (2005) found a point prevalence of 13% amongst 622 Tunisian school-children aged between 11 and 19 years using the same recall period. However, other studies reported relatively higher point prevalence figures. Shehab et al (2004) found a point prevalence of 35% among 400 school-children aged between 10 and 18 years in Kuwait. In comparison with studies that evaluated the point prevalence on the day of the survey, Jordaan et al (2005) found a point prevalence of 14% among 1 123 adolescents aged 13 to 18 years. In Nigeria, Ayanniyi et al (2011) reported a point prevalence of 17% among 4 400 school-children aged between 10 and 19 years. Similarly, an Iranian study by Mohseni-Bandpei et al (2007) on 5000 school-children between the ages of 11 and 14 years reported a point prevalence of 15% on the day of questioning.

In spite of the recall period of point prevalence adopted, the figures are much lower than lifetime prevalence figures (Calvo-Munoz et al, 2013). Similarly to the lifetime prevalence, point prevalence has been shown to increase as age increased in many studies (Jones et al, 2004; Jordaan et al, 2005; Mohseni-Bandpei et al, 2007; Ayanniyi et al, 2011). Studies have reported different rates of LBP in relation to gender. Many reported that the prevalence was higher among females (Shehab et al 2004; Kovacs et al, 2003), while other studies reported almost equal frequency in both males and females (Jones et al, 2004; Jordaan et al, 2005).

2.7 Low back pain: Characteristics and Classification

According to Ehrlich (2003), LBP is neither a disease nor a diagnostic entity of any sort. The term represents a large group of conditions all causing pain in the lumbar body region. In many instances (85%), the causes of LBP are obscure and are described to be non-specific (Burton et al, 2006; Woolf and Pfelger, 2003). According to Burton et al (2006), LBP is commonly classified according to the duration of symptoms as acute (less than six weeks), sub-acute (between six and twelve weeks) and chronic LBP (longer than twelve weeks). However, this classification has been criticised for failing to capture the exact nature of LBP. Rather than being persistent, LBP is considered to be episodic or recurrent characterised by fluctuating episodes of various intensities and duration and symptom-free periods (De Vet, Heymans, Dunn, Pope, Van der Beek, Macfarlane, Bouter & Croft, 2002; Burton et al, 2006).

In adolescents, some studies have acknowledged the consequences of recurrent NSLBP (Harreby et al, 1999; Jones et al, 2004). There is evidence that adolescents with recurrent NSLBP may show early radiological signs of disc degeneration on a MRI (Salminen et al, 1999; Kjaer, Lebouef-Yde, Solgaard & Bendix, 2005) and may consult health professionals to alleviate pain symptoms (Jones et al, 2004). In addition, LBP has been linked to decreased HRQoL in adolescents (O'Sullivan et al, 2012). A well-designed longitudinal study conducted by Hestbaek et al (2006a) among 10 000 Danish twins demonstrated that adolescent recurrent NSLBP has high odds of becoming adult chronic LBP [OR = 3.5, 95% CI 2.8–4.5].

2.7.1 Recurrent low back pain: Prevalence

There are a few studies that have investigated the prevalence of recurrent NSLBP among adolescents. However, epidemiological surveys estimated the prevalence of recurrent NSLBP between 8% and 36% (Salminen et al, 1999; Harreby et al, 1999; Prista et al, 2004; Jones et al, 2004; Shehab et al, 2004; Sjolie, 2004b). The prevalence has been shown to increase with age, but there is no consensus regarding the influence of gender (Jones et al, 2004; Masiero et al, 2008).

One primary concern identified in most studies on recurrent NSLBP has been the lack of a standard definition of recurrent NSLBP (Stanton, Latimer, Maher & Hancock, 2010). There seems to be over-reliance on random or pragmatic definitions lacking scientific rationalisation (de Vet et al, 2002). Studies have differed tremendously on the definitional parameters of recurrent NSLBP with regard to the duration, intensity and frequency over which recurrence is considered. This partly explains a wide range of prevalence figures for recurrent NSLBP in adolescents and renders comparisons between studies difficult. In an attempt to standardise the terminology used in LBP, Stanton, Latimer, Maher and Hancock, (2011) provided a Delphi consensus definition of recurrent NSLBP as “pain which has occurred at least two times over the past year with each episode of lasting at least 24 hours, with pain intensity of greater than two on VAS with at least a 30-day pain free period between the episodes.” This definition captures the most important parameters that characterise recurrent NSLBP such as pain intensity, frequency and duration of an episode.

Jones et al (2004) evaluated the prevalence of recurrent NSLBP using a validated questionnaire among 500 school-children aged between 10 and 16 years and found a prevalence of 13.1%. Recurrent NSLBP cases were identified based on the following question “do you get back pain regularly?” referring to acute episodes experienced in one-year. This definition could be criticised on the basis of lacking clarity on the definition of “acute episode”. Although the term “acute” may describe pain intensity vaguely, the definition lacked specifications on the frequency and duration of “acute episodes” that represented recurrent NSLBP. Nevertheless, Jones et al (2004) findings are consistent with those of Prista et al (2004). In their study of 204 school-children between the ages of 11 and 16 years in Mozambique, Prista et al (2004) found that 13.5% had LBP “several times in the previous 12 months”. However, it can be argued that a comprehensive picture on the nature of recurrent NSLBP experienced by Mozambican adolescents may not be clear. Similarly to Jones et al (2004), the screening question lacked clarity on the frequency, intensity and duration of the “several” episodes experienced by the school-children. However, the study by Sjolie (2004b) conducted in Norway with 88 school-children found a relatively higher prevalence of recurrent NSLBP (32%). Probably, this may be explained by the contextual definition of recurrent NSLBP which was based on the duration of symptoms as “LBP for more than seven days in the last 12 months.” Although the definition clarified the duration of symptoms, there was no specification on the intensity and frequency of episodes.

2.7.2 Consequences of recurrent low back pain

LBP has been reported to be a common symptom among adolescents (Smith & Leggat, 2007). However, its impact has not been fully investigated compared to adult LBP. It is well-established that chronic LBP in adults is costly and impacts negatively on many aspects of

life (Walker, Muller & Grant, 2003). LBP is the second most common cause of disability in adults and a common reason for lost work days, with estimated cost between \$100 and \$200 billion annually in the US (Freburger, Holmes, Agans, Jackman, Darter, Wallace, Castel, Kalsbeek & Carey, 2009). In adolescence, recurrent NSLBP has been linked with seeking medical treatment (Watson et al, 2002; Masiero et al, 2008; Bejia et al, 2005), restrictions in ADL (Trevelyan and Legg, 2011; Watson et al, 2002; Jones and Macfarlane, 2005), school absenteeism (Jones et al, 2004), and reduced HRQoL (O'Sullivan et al, 2012).

2.7.2.1 Health-care seeking behaviour

Health-care seeking behaviour has been reported amongst adolescents with NSLBP (Watson et al, 2002; Jones et al, 2004) with the use of pain medications (Harreby et al, 1999; Ayanniyi et al, 2011), consulting orthopaedic specialists (Masiero et al, 2008) and having X-rays of the spine taken (Harreby et al, 1999). The prevalence of LBP necessitating medical consultation varies from 4% to 76% (Belague et al, 1999; Jones et al, 2004; Masiero et al 2008). This has been attributed largely to the socio-cultural reasons (Masiero et al, 2008) and economic reasons (Ayanniyi et al, 2011).

A literature review by Belague, Troussier and Salminen (1999) recognised a need for medical treatment in only 4% to 16% of children and adolescents with LBP. This indicates low numbers of consultations for LBP in young people. These findings are consistent with those of Jones et al (2004). In their study of 500 school-children, Jones et al (2004) found recurrent NSLBP deserving medical treatment in a minority of adolescents (23.1%). However, the authors did not report on the details of the actual medical treatment sought and on the factors prompting health-care seeking behaviour. In contrast, the study conducted in Italy with 7 542 school-children by Masiero et al (2008) showed that adolescents between the ages of 13 and 15 with LBP regularly sought medical care from various health professionals. Surprisingly, the majority of school-children with LBP (76.3%) had consulted at least one medical health professional. The authors attributed this to the operational definition of LBP that considered the “presence of pain that hindered performance of activities of everyday living and sports activities usually practiced by teenagers.” These findings may highlight the candid plight of Italian school-children in the face of LBP. However, in spite of the large sample used, the study could be criticised on the basis that the reliability of the LBP questionnaire was not reported.

Although the above-mentioned findings illustrate the usage of health-care services by adolescents with LBP, the factors motivating such behaviour are not clear. It seems that adolescent health-care seeking behaviour varies between individuals and on the severity of the LBP. A study conducted by Boćkowski, Sobaniec, Kułak, Sendrowski and Roszkowska

(2007) on 36 patients showed that LBP was a medical concern for adolescents between the ages of 10 and 18 years when reported in combination with sciatica. However, the study by Watson et al (2002) in 1 446 school-children found no association. In Nigeria, Ayanniyi et al (2011) showed interesting results on health care-seeking behaviour among school-children with LBP. Using 4 400 school-children between the ages of 10 and 19 years, the study showed that LBP was managed mainly by self-medication (27%) compared to seeking medical care from health professionals (12%). This was largely attributed to the unrestricted access to off-the-shelf analgesics. According to the authors, these findings indicated that LBP treatment was motivated by recurring and painful episodes. In contrast, Masiero et al (2008) found no significant differences in the mean intensity of LBP between those who consulted a health care provider (VAS 4.9 ± 2.5) compared to those who did not (VAS 4.9 ± 2.7); dismissing pain intensity as the sole factor leading to health seeking behaviour in adolescents. A retrospective study of 35 adolescents with LBP by Clifford and Fritz (2003) showed that the majority of adolescents (95%) referred for physiotherapy treatment were involved in regular athletic activity. Despite the small sample used in the study, the authors concluded that adolescents with LBP related to sport participation were motivated to seek out treatment in order to return to sport. In other words, the personal desire to recover quickly and return to sport informed health-seeking behaviour. In accordance, Weisel (2002) reports that health seeking behaviours often signaled poor coping strategies of individuals rather than the severity of LBP.

2.7.2.2 Functional limitations

Adolescents with recurrent NSLBP often have functional limitations due to LBP symptoms (Jones et al, 2004; Bejia et al, 2005). Some of the LBP disabling consequences reported in the literature include restrictions in leisure or competitive sports participation (Jones et al, 2004), school absenteeism (Harreby et al, 1999) and difficulties in ADL (Watson et al, 2002). There are contrasting findings on the prevalence on self-reported disability secondary to LBP in adolescents. The reported figures vary from 2% (Kristensen, Bø & Ommundsen, 2001) to 94% (Watson et al, 2002). In a large community study (n=1 446) by Watson et al (2002), 94% of symptomatic school-children aged between 11 and 14 years reported at least one degree of impairment on the Hanover Functional Ability Questionnaire. The activities which gave the most difficulty were carrying a school bag (65%), sitting at school (53%) and sports activities (50%). However, this study has been criticised for overstating the problem because of poor levels of child-parent agreement (Belague, Dudler & Nordin, 2003). These findings are parallel to the results of Jones and Macfarlane (2009). Using a similar instrument in 330 school-children with persistent NSLBP, Jones and Macfarlane (2009) found that 65% of symptomatic adolescents had at least two functional items restricted. The study specifically

showed that difficulties with carrying school-bags and standing in a line for 10 minutes experienced an approximately 2–3-fold increase in the risk for LBP [RR 2.1, 95% CI 1.1– 4.0 and RR 2.7, 95% CI 1.5– 4.9, respectively]. Using a reliable self-administered questionnaire in 622 school-children aged between 11 and 19 years, Bejia et al (2005) evaluated the functional consequences of recurrent NSLBP based on self-reports of school and sports absenteeism. A number of adolescents missed school (41%) and were prevented from playing sports (45%) because of recurrent NSLBP. These findings are in agreement with the results of Jones et al (2004) who reported that 30.8% of recurrent NSLBP cases were prevented from participating in sports or physical activity and 26.2% were absent from school because of recurrent NSLBP.

There are some epidemiological reports that have observed no functional implications for adolescent NSLBP. A study conducted in Norway by Kristensen et al (2001) among 316 school-children aged 15 years old, provided contradictory findings on the relevance of some of the functional consequences. The authors found that only 2% of the school-children were forced to stop one or more leisure time activities because of NSLBP. As a result, they concluded that much of adolescent NSLBP is inconsequential to function and could be a normal life experience.

2.7.2.3 Health-related quality of life

There are a few studies that have investigated the effect of recurrent NSLBP on adolescent HRQoL. This could be because the majority of studies on adolescent pain have targeted 'healthy' school-children (Watson et al, 2002; Bejia et al, 2005; Ayanniyi et al, 2011). However, the few studies in the literature that specifically evaluated adolescent HRQoL in relation to NSLBP have provided contrasting results (O'Sullivan et al, 2012; Pellise et al, 2009). A number of generic instruments have been used to evaluate HRQoL among adolescents. These include the Medical Outcomes Study Short Forms, "SF-36" (O'Sullivan et al, 2012); the "KIDSCREEN-52" or "KIDSCREEN-10" (Pellise et al, 2009; Belagué, Rajmil, Cedraschi, Pellise, Acuna & Ferrer, 2012) the "EQ-5D-Y" (Jelsma and Ramma, 2010) and the Paediatric Quality of Life Inventory, "PedsQL" (Petersen, 2008).

A recent cross-sectional study by O'Sullivan et al (2012) showed that chronic LBP was associated with reduced HRQoL among adolescents. This was related to the nature of the condition and the long-term negative consequences of LBP. Although the study involved a large sample of 1 283 adolescents and used a validated generic HRQoL instrument (SF-36), the age-range of the subjects was narrow [M= 17 years, SD= 0.3 years]. In contrast, Pellise et al (2009) found that adolescent LBP was not associated with decreased HRQoL on the KIDSCREEN-52 questionnaire. These findings were based upon 1 470 school-children aged

15 years of age. The difference between these results could be largely related to two factors: population and methodological differences. Pellise et al (2009) used a relatively younger sample and a different HRQoL instrument to O'Sullivan et al (2012). Perhaps, the effect of LBP on HRQoL reflects less in the younger age-groups. In addition, the operational definitions of LBP between the two studies were different. O'Sullivan et al (2012) evaluated the impact of "current" chronic LBP on HRQoL whilst Pellise et al (2009) considered adolescents with a previous history of LBP in a time frame of a month. However, a recent study by Belague et al (2012) showed similar findings to Pellise et al (2009). In their cross-sectional study conducted among 1 470 school-children with a mean age of 15.05 years, Belague et al (2012) reported that the overall effect of LBP on HRQoL was minimal except when LBP was associated with whole body pain. The study was based on a smaller version of the KIDSCREEN-52 instrument, called the KIDSCREEN-10, for the assessment of HRQoL.

2.8 Individual risk factors for non-specific low back pain

The majority of the recent research examining NSLBP in adolescents has focused on risk factors for the onset of symptoms, whilst research related to the risk factors for recurrences after the onset is less plentiful (Fritz and Clifford, 2010). However, a myriad of risk factors have been identified to be associated with NSLBP in adolescents (Trevelyan and Legg, 2011; Feldman et al, 2001) from individual to environmental factors (Watson et al, 2003; Grimmer and Williams, 2000). The ICF model recognises the important influence of individual factors in the development of LBP (Chen, Liu, Cook, Bass & Lo, 2009). This literature review will focus primarily on potential individual risk indicators for NSLBP identified in the literature such as family history, BMI, sedentary life-style, school-bag weight, sports activities, muscle flexibility and smoking. According to Fritz and Clifford (2010), an understanding of the risk factors for LBP is important from a primary prevention perspective.

2.8.1 Family history

A review of the literature by Belague et al (1999) identified family LBP history to be an important consideration in adolescent LBP. The authors speculated the role of genetics, environmental and psychosocial factors for this association. However, the influence of these factors has not been thoroughly investigated. A cross-sectional study by Bejia et al (2005) on 622 school-children aged between 11 and 19 years in Tunisia, found that a significant proportion of school-children with LBP (46%) had familial (parents or sibling) history of LBP compared to 22% without LBP ($p < 0.01$). In multivariate analysis, this represented an odds ratio of 3.80 [95% CI, 2.94–5.92]. These findings are consistent with those of Gunzburg et al (1999). In their study of 392 school-children with LBP, Gunzburg et al (1999) found that 64%

of symptomatic school-children had at least one parent with LBP ($p = 0.002$). Recent studies have shown similar findings (Yao et al, 2012; Masiero et al, 2008). A possible explanation for the association has been that adolescents are likely to be more aware of LBP for them to report it (Gunzburg et al, 1999).

In contrast, there are other studies that failed to establish any association between familial LBP and adolescent LBP. In a cross-sectional survey of both school-children ($n = 7\,361$) and parents ($n = 13\,553$) investigating the risk factors for NSLBP using a questionnaire, Kovacs et al (2003) found no significant association between parental (biological or not) history of LBP and adolescent report of NSLBP. These findings are consistent with those of Sjolie (2004b). However, they contradict any speculation of a genetic link between parental and adolescent LBP postulated by Belague et al (1999).

There is also cross-sectional evidence that parents (biological or not) may be unaware of the pain experienced by adolescents. Interestingly, Watson et al (2002) observed a moderate agreement ($k = 0.33$) between school-children and their parent reports of LBP, in a cross-sectional study to investigate the occurrence and characteristics of LBP among adolescents ($n = 1\,446$). Amongst school-children reporting and not reporting LBP, parental reports agreed in 33% ($n = 112$) and 95% ($n = 737$) of cases, respectively. These findings were also shared by Haraldstad, Sørnum, Eide, Natvig and Helseth (2011). The latter authors' conducted a cross-sectional study to determine the prevalence, impact on daily life and parents' perception on adolescent pain. Of the 828 child-parent reports compared, the agreement between parents and children was low.

2.8.1.1 Adult LBP

In adults, it is known that the best predictor of future LBP seems to be a previous incident of LBP (Watson et al, 2002). Recent evidence has shown that childhood LBP predicts adolescent LBP (Kjaer et al, 2011) which in turn predicts adulthood LBP (Hestbaek et al, 2006a). In light of this, the epidemiology of LBP in adults becomes an important aspect to consider in studies of adolescent LBP. Chronic LBP is one of the greatest adult public health disorders worldwide (Louw et al, 2007; Walker, 2000). In high-income countries, it has been regarded as the most prevalent musculoskeletal condition (lifetime prevalence, 70%-85%) and a common cause of disability (Woolf and Pfelger, 2003; Burton et al, 2006; Louw et al, 2007). The disability is mainly secondary to the chronic pain and to the loss of function (Louw et al, 2007). It is commonly reported between the ages of 35 and 55 years in all adults (Burton et al, 2006; Dionne, Dunn & Croft, 2006) and has been attributed largely to occupational risk factors (Punnett, Pruss-Ustun, Fingerhut, Nelson, Leigh, Tak & Phillips, 2005). The global burden of adult LBP seems to be increasing, especially in the low-income

countries in Africa (Woolf & Pfelger, 2003). This is in spite of the extensive research that has been directed into LBP (Walker, 2000). According to Louw et al (2007), the economic, social and public health implications of adult LBP have not been curtailed. Therefore, NSLBP continues to place significant pressure on already constrained health-care resources in poor countries (Birabi, Dienye & Ndukwu, 2012). This creates a huge need to evaluate, establish and document the contributing factors to the increased prevalence of adult LBP.

In Zimbabwe, there is a disturbing dearth of published literature on the prevalence and the relative impact of adult LBP. This is a significant shortcoming against a background of a global increase in LBP prevalence. However, a study conducted by Jelsma et al (2002) showed a glimpse into the possible existence of disabling adult LBP. The study was undertaken to establish the health conditions primarily responsible for adult disability and morbidity in a high-density area in Harare (Capital City of Zimbabwe). The authors conducted house-to-house screening visits followed by medical examinations and interviews on 10 839 residents. LBP was found to be one of the most common problems affecting the adult population after headaches, migraine and osteoarthritis. These findings are consistent with those reported by Useh, Igumbor and Madzivire (2002). In their study to ascertain the prevalence of occupational injuries amongst 198 practising physiotherapists in Zimbabwe aged between 23 and 76 years, Useh et al (2002) found that LBP was the most prevalent symptom. These findings indicate that LBP that could be highly prevalent in adults. However, these findings cannot be generalised to estimate the prevalence of adult LBP in Zimbabwe.

2.8.2 Smoking

Smoking in young people has been recognised as a global problem (WHO, 2013). The prevalence of smoking in adolescence varies between countries. It has been reported in 13.2% in the USA, 14.6% in India and 15.4% in Nigeria (WHO, 2013). Among other effects, smoking has been linked to NSLBP. In the literature, adult studies have been consistent to the idea that smoking is associated with chronic LBP (Goldberg, Scott & Mayo, 2000; Alkherayf and Agbi, 2009) but some offer contrasting evidence (Leboeuf-Yde, 1999). This relationship has also been less clear in the adolescent population (Cardon & Belague, 2004; Kaspiris, Grivas, Zafiropoulou & Tsadira, 2010), possibly due to the cross-sectional nature of the majority of the studies.

Earlier literature reviews on adolescent LBP conducted by Belague et al (1999) and Ebbelohj, Hansen, Harreby & Lassen (2002) indicated that smoking was significantly associated with LBP in adolescents. In accordance, a recent meta-analysis review evaluating the association between smoking and LBP conducted by Shiri, Karppinen, Leino-arjas, Solovieva and Viikari-Juntura (2010) provided evidence of a significant association

between active smoking and adolescent LBP [OR= 1.82, 95% CI 1.42-2.33]. Surprisingly, the association was found to be stronger in adolescents than in adults [OR= 1.16, 95% CI= 1.02-1.32]. These findings confirmed previous reports in the literature of Shehab and Al-Jarallah (2005), Feldman et al (2001) and Harreby et al (1999). In a survey of LBP in 1 389 Danish school-children aged between 13 and 16 years, Harreby et al (1999) found that daily smoking of cigarettes among Danish adolescents was significantly associated with reports of chronic LBP [OR= 3.03, 95% CI 2.14-4.30]. The authors attributed this to the prevalence of psychosocial problems. In spite of this evidence, the exact mechanism behind the association between smoking and adolescent LBP has remained elusive to date (Cardon & Belague, 2004). Nevertheless, plausible explanations includes decreased blood supply to the spinal structures and induced chronic cough leading to increased spinal pressure and pain (Leboeuf-Yde, 1999). However, the study by Bejia et al (2005) found no association between chronic LBP and cigarette smoking. In a study of 622 Tunisian school-children between the ages of 11 and 19 years, no significant relationship was observed ($p= 0.82$). Other studies shared similar findings (Kovacs et al, 2003; Masiero et al, 2008).

2.8.3 Body Mass Index

BMI is widely used as an index of body fatness and for screening weight categories that may lead to health problems (Freedman & Bettylou, 2009; Yao et al, 2012). It is a convenient measure of obesity especially in large scale epidemiological surveys and is calculated based on body weight and height (Jones and Macfarlane, 2005; Auvinen, Tammelin, Taimela, Zitting & Karppinen, 2008). The influence of BMI on adolescent LBP has been investigated in many studies in the literature. This has been necessitated by the growing evidence of obesity in the young and the possible association with LBP (Pirincci, Durmus, Gundogdu & Acik, 2010; Hershkovich, Friedlander, Gordon, Arzi, Derazne, Tzur, Shamis & Afek, 2013). However, the results have been controversial on the association between LBP and BMI (Cardon & Belague, 2004).

Recurrent NSLBP was significantly associated with BMI values of more than 25kg/m^2 in a study of 13-to-16 year-old Danish school-children by Harreby et al (1999). In the study including 1 889 adolescents, 20.9% of symptomatic school-children with recurrent NSLBP had BMI's greater than 25kg/m^2 compared to 14.7% without ($p < 0.001$). Harreby et al (1999) findings are consistent with the recent findings of Hershkovich et al (2013). In their study of 829 791 adolescents aged 17 years in Israel, a higher BMI was significantly associated with LBP in males [for overweight, OR = 1.097, $p < 0.001$; for obese, OR = 1.163, $p < 0.001$] and in females [for overweight, OR = 1.174, $p < 0.001$; for obese, OR = 1.211, $p < 0.001$]. Intriguingly, the relationship between LBP and BMI was dose-dependent; the odds ratios for LBP increased with increasing BMI values. However, interpretation of these results should

be done cautiously since the study was based on a specific age group. Nevertheless, these findings are consistent with those of (Sjolie, 2004b) who also used a narrow age range (range, 14.1-16.1 years) in a study including a relatively small sample of 88 school-children. Speculative theory explaining the mechanism underlying the association between higher BMI's and LBP in adolescents have hinted on increased mechanical loading of the spine (Shiri, Solovieva, Husgafvel, Taimela, Liisa, Huupponen, Viikari, Raitakari & Viikari, 2008).

On the other hand, there are studies that have provided contrasting findings. A systematic literature review conducted by Leboeuf-Yde (2000) of studies examining the association between body weight and LBP showed no strong association between BMI and LBP. An earlier non-systematic literature review by Belague et al (1999) showed similar results. In addition, a large number of cross-sectional studies published after the year 2000 showed similar results (Kovacs et al, 2003; Watson et al, 2003; Korovessis, Koureas & Papazisis, 2004). Prospectively, Jones, Watson, Silman, Symmons and Macfarlane (2003) showed that neither baseline BMI nor its temporal change was associated with LBP in a study including 1 046 school-children. In addition, case-control studies by Yao et al (2012) and Jones et al (2005) further confirmed the lack of statistically significant associations between NSLBP and BMI amongst 1 214 and 64 adolescents respectively.

2.8.4 School-bag related factors

Despite subjective evidence that carrying heavy school-bags “causes” LBP, the literature is inconclusive on the association between LBP and school-bag related factors (Jones and Macfarlane, 2005; Negrini and Carabalona, 2002). The effects of the school-bag not only relates to the weight of the school-bag, but to the duration and the method of carrying (Haselgrove et al, 2008). These school-bag related factors represent an “occupational” load (Dockrell, Kane & Keeffe, 2006) and a daily “mechanical load” (Watson et al, 2003) for the school-children.

Over recent years, Puckree et al (2004) reported that size and weight of the school-bags carried by school-children has increased due to the changes in the school curricula in SA. This may be for all scholars worldwide, as South African scholars are no different to those in other countries. As a result, there has been increasing concern in the literature regarding the possible effects of heavy school-bags on the health of school-children (Negrini, Politano, Carabalona, Tartarotti & Marchetti, 2004; Moore et al, 2007). This is evident by the numerous studies that have been conducted in the USA (Chiang et al, 2006; Navuluri & Navuluri, 2006), Europe (Watson et al, 2002; Jones et al, 2003), New Zealand (Trevelyan and Legg, 2011), Africa (Puckree et al, 2004; Ibrahim, 2012) and the Middle East (Shamsoddini et al, 2010).

Although the general understanding is that heavy school-bags could lead to NSLBP, scientific attempts to identify the maximum load that does not produce effects in school-children are on-going. There is a debate regarding a 10% versus 15% of body-weight cut-off point for safe weight of school-bags (Lindstrom-Hazel, 2009; Moore et al, 2007). Although a number of authors recommend a school-bag weight of less than 10% of the child's body weight (Dockrell et al, 2006; Moore et al, 2007; Smith & Leggat, 2007; Shamsoddini et al, 2010), there has not been a scientifically proven cut-off school-bag weight that guarantees safety (Navuluri and Navuluri, 2006). A number of studies challenge this so called "global standard" (Shamsoddini et al, 2010). In the Netherlands, Reneman, Poels, Geertzen and Dijkstra (2006) found that a relative school-bag weight of 15% induced biomedical changes in body posture, stride length and breathing frequency. Therefore, the authors recommended avoiding carrying a school-bag that is 15% or more of the child's body weight. In Canada, Brackley and Stevenson (2004) found a limit of 10% to 15% of body weight as a reasonable limit for adolescents to carry, but called for more research to examine school-bag use, school-bag load and personal characteristics.

2.8.4.1 School bag weight and LBP

According to Lindstrom-Hazel (2009), school-bags are used throughout the world in many different situations. School-children use them for carrying educational materials, personal items and lunch packs to school (Dockrell et al, 2006). However, the school-bag weight remains a controversial issue within literature with regard to adolescent LBP. Some studies found no relationship (Watson et al, 2002; Van Gent, Dols, De-Rover & Hira Sing, 2003; Dianat, Javadivala & Allahverdipour, 2011) and other studies found a significant association between the school-bag weight and adolescent LBP (Whittfield, Legg & Hedderley, 2001; Ibrahim, 2012). Recent literature reviews by Mackenzie, Sampath, Kruse, and Sheir-Neiss (2003) and Lindstrom-Hazel (2009) were inconclusive about the association between school-bag weight and LBP in school-children. Nonetheless, in ergonomic studies, the relative school-bag weight (school bag weight expressed as percentage of body weight) has been considered as one of the contributory factors for developing musculoskeletal symptoms (Dianat et al, 2011).

The mean weight of the school-bags reported in different countries have varied from 1.7 to 8.8 kg (Mohseni- Bandpei et al, 2007; Trevelyan and Legg, 2011; Dockrell et al, 2006; Negrini et al, 2004). This could be explained by methodological and school curricula differences in various countries. In addition, Negrini and Carabalona (2002) showed that school-bag weights differ between schools and among students of the same class depending on the day of the week. An Iranian study reported a low mean school-bag weight, measured over three days, of 1.73 ± 0.49 kg corresponding to 4% of the school-children's

body weight (Mohseni-Bandpei et al, 2007). In the USA, Navuluri and Navuluri (2006) showed a much greater mean school-bag weight of 7.49 kg (measured once) amongst a relatively small sample of 59 school-children, corresponding to 14.7% of the school-children's body weight. In SA, Puckree et al (2004) reported a moderate mean school-bag weight of 4.0 ± 1.3 kg (measured once) in 176 scholars between the ages of 11 and 14 years.

In a cross-sectional study conducted among 1 446 school-children between the ages of 11 and 14 years, Watson et al (2003) found that LBP was neither associated with schoolbag weight nor the relative school-bag weight. The authors collected objective data on the actual school-bag weight over a five-day period and computed the median daily load [Median =4.5kg, IQR 3.6–5.9 kg]. This represented a relative school-bag weight of 9.7% (IQR 7.1–12.6%). Surprisingly, the lowest risk for LBP was reported among those carrying the highest percentage body weight. Watson et al (2003) findings are consistent with those of Van Gent et al (2003). In their study of 745 school-children between the ages of 12 and 14 years, the authors found that the relative school-bag weight was not associated with back complaints. However, school-children carrying heavy bags (relative school bag weight of 18%) reported LBP less often than those carrying lighter bags. Similarly, these findings were shared by a number of studies all providing evidence of lack of significant association between LBP and school-bag weight (Korovessis et al, 2004; Dianat et al, 2011; Sheir-Neiss et al, 2003; Chiang et al, 2006). In addition, a prospective cohort study conducted on 933 school-children by Jones et al (2003) observed consistent findings of no significant association between LBP and school-bag related factors among 11 to 14 year olds.

In contrast, several other studies reported significant associations between school-bag weight-related factors and LBP complaints. Grimmer and Williams (2000) investigated school-bag use and the occurrence of LBP on 1 269 high school students in Australia. The authors found, students with LBP were carrying heavier school-bags. In Iran, the weight of the school-bags carried by secondary school students was reported to be strongly related to musculoskeletal complaints such as LBP (Shamsoddini et al, 2010). In another recent study conducted on 254 healthy Egyptian female students between the ages of six and 14 years, Ibrahim (2012) reported that, increases in school-bag weight was associated with an increased risk of back pain ($p < 0.000$). In addition, the subjects carrying school-bag weight which was 20% or more of their body weight reported more LBP.

2.8.4.2 Perceptions of school bag weight

Subjective perceptions of school-bag weight are an important index of the actual school-bag weight (Haselgrove et al, 2008). The argument is that since the weights of school-bags

carried every day to school are not constant, how school-children perceive the daily weight of the school-bag may be an accurate reflection of their body strength and endurance relative to the impact of the load (Haselgrove et al, 2008). Nevertheless, the relationship between perceived school-bag load and LBP in adolescents is marked with contrasting findings (Cardon & Belague, 2004).

In a two-year longitudinal study by Szpalski et al (2002), primary school-children between the ages of nine and 12 years who responded positively to the question “do you find your satchel too heavy?” had LBP. But, there was no relationship between the actual weight of the satchel and LBP. Although questions could be asked regarding the validity of self-reports from children used in the previously study, these findings are consistent with those of Gunzburg et al (1999) and Haselgrove et al (2008). In their study of 392 school-children aged 9 years, Gunzburg et al (1999) found that school-children with LBP significantly perceived their school bags to be heavy compared to those without ($p=0.02$). Actually, school-children who reported their school-bags to be heavy experienced a 60% increase in the odds of LBP. However, unlike in Szpalski et al (2002), the school bags were not weighed to confirm whether they were actually heavy or not. In addition, Haselgrove et al (2008) observed similar findings among 1 202 Australian adolescents. In contrast, studies of Van-Gent et al (2003) and Negrini and Carabalona (2002) found no significant association between the perceived weight of the school-bag and LBP in adolescents. In a carefully designed study by Negrini and Carabalona (2002), the variable associated with LBP was “fatigue during backpack carrying”, while the relative backpack weight and the “feeling the backpack is too heavy” were not directly associated with LBP.

2.8.4.3 Duration and method of carriage

Only a few studies have investigated whether the duration and method of carrying of school-bags are associated with adolescent LBP (Haselgrove et al, 2008; Grimmer and Williams, 2000). However, the findings are inconclusive. Yao et al (2012) found a strong association between the duration of carrying of school-bag and LBP. In their recent case-control study of 1 214 adolescents, the authors observed that LBP was associated with carrying the school-bag for more than 60 minutes ($p=0.01$). These findings are consistent with those of Negrini and Carabalona (2002). Using a small cohort of 237 school-children aged 11 years, Negrini and Carabalona (2002) reported that LBP was associated with duration of carrying the school-bag. Interestingly, a study conducted by Chiang et al (2006) on 55 USA school-children between 13-14 years old, showed a significant association between LBP and time spent carrying the school-bag when the time categories were re-coded into categories (0-10 minutes and 11-30 minutes) [χ^2 (1, N=52)= 5.03, $p < 0.05$]. According to the authors, LBP occurred after a certain “critical” point of school-bag-carrying time. This was because the

association was found after more than 10 minutes carrying the school-bag on the way to school and over 30 minutes on the way home. However, the quality of Chiang et al (2006) study may be questioned since the study had a relatively small sample size and a low response rate (n=55, response rate, 55%).

Significant postural changes have been reported to occur when carrying a bag over one shoulder (Korovessis et al, 2004; Negrini and Carabalona, 2002; Negrini and Negrini, 2007) and these postural deviations have been shown to be associated with spinal pain (Adam and Dolan, 2005). However, this has been criticised in other studies (Van Gent et al, 2003; Watson et al, 2003; Siambanes, Martinez, Butler & Haider, 2004). In a study by Shier-Neiss et al (2003), most of the students (87.6%) carried their school-bags using both shoulder straps and there was no significant difference in the reporting of back pain between those who used one strap and those who used two straps. In accordance, although 85% of adolescents reported carrying their school-bag over both shoulders, Haselgrove et al (2008) found no significant association between the method of carrying the school-bag and back pain in adolescents.

2.8.5 Sedentary lifestyle

An individual way of life has been recognised as one of the primary factors that could influence health (WHO, 2001). A sedentary lifestyle has been conceptualised as reflecting insufficient physical activity and an increased dependence on passive forms of leisure activities such as watching television, playing video games and computer use (Varo, Martinez, De Irala, Kearney, Gibney & Martinez, 2003; Tremblay, Colley, Saunders, Healy & Owen, 2010; Wielsen, 2013). In the literature, the most studied aspect has been the time spent on sedentary activities as compared to the actual activities engaged in or the postures adopted in these activities. Sedentary behaviour has been linked to obesity and other chronic health problems (Ford, Kohl, Mokdad & Ajani, 2005) but the relationship with NSLBP is not clear. A recent systematic review examining the association between sedentary lifestyle and NSLBP involving adult studies published between 1998 and 2006 reported no significant associations (Chen et al, 2009). In adolescents, a literature review conducted by Cardon and Belague (2004) provided conflicting results on the relationship between LBP and sedentary behaviour.

Some cross-sectional studies involving school-children observed a positive relationship between sedentary behaviour and LBP (Skoffer and Foldspang, 2008; Shier-Neiss et al, 2003). In a study including 1 126 school-children aged between 12 and 16 years, Shier-Neiss et al (2003) reported that adolescents with LBP spent significantly more hours watching TV than those without LBP. These findings are consistent with those of Skofter and

Foldspang (2008). In their study of 546 Danish school-children between the ages of 15 and 16 years, Skoffer and Foldspang (2008) found that LBP was positively associated with indicators of inactivity such as time spent watching television or video ($p=0.014$) and doing homework ($p=0.001$). However, these studies were cross-sectional in nature and unable to address the temporal relationship between LBP and inactivity. Nevertheless, a cross-sectional study conducted by Gunzburg et al (1999) showed intriguing results. The study showed that back pain was reported more in children who played video games for more than two hours per day compared to children who watched television for the same number of hours. This reflects the importance of other factors such as posture as confounding variable in the association between the amount of time spent sedentary and adolescent LBP. Among 5 000 Iranian school-children aged between 11 and 14 years, Mohseni-Bandpei et al (2007) confirmed the findings of Gunzburg et al (1999) in that LBP was associated with both the time spent watching television and the adopted posture while watching television.

Biomechanically, a sedentary lifestyle is preferable to individuals because of the low-energy consumption (Chen et al, 2009). However, the adverse health effects of the lifestyle have been premised on the exposure to prolonged sitting. In the literature, there are several studies that have provided evidence of the association between LBP and sitting in adolescents (Ayanniyi et al, 2011; Skoffer and Foldspang, 2008). In a cross-sectional study involving 4 400 school-children in Nigeria, prolonged sitting posture was the most implicated predisposing factor to LBP in adolescents between the ages of 10 and 19 years (Ayanniyi et al, 2011). In addition, Hancox, Milne and Poulton (2004) found that prolonged sitting in children and adolescents while watching TV was associated with being overweight and poor physical fitness in the long run. These findings were based on a longitudinal birth cohort study conducted in New Zealand. There is also evidence that prolonged sitting has direct influence on metabolism, bone mineral content, and cardiovascular health (Kjaer, 2004) possibly resulting in medical conditions which include osteoporosis and hypertension.

In contrast, a number of other studies found no association between sedentary lifestyle and adolescent LBP (Kovacs et al, 2003; Watson et al, 2003; Bejia et al, 2005; Yao et al, 2012). Yao et al (2012) justified the lack of association between sitting time and NSLBP among 1 214 adolescents in China because of the strict parental restrictions on watching television and online games. In a study to assess the role of mechanical and psychosocial factors in adolescent LBP, Watson et al (2003) conducted a cross-sectional study in a population of 1 446 school-children aged 11-14 years and found no association between the amount of time in sedentary activities (watching television and using computers) and NSLBP. Prospectively, Jones et al (2003) demonstrated that sedentary activity (time spent watching television or

playing computer games yesterday) was not associated with the risk for future NSLBP in a population-based cohort study conducted on 1046 school-children aged 11 to 14 years at baseline.

2.8.6 Sports participation

The occurrence of LBP has been evaluated in competitive athletes (Haydt, Pheasant & Lawrence, 2012) and in non-athletic population (Korovessis et al, 2004). However, the findings have been mixed. One of the contributing factors for the mixed reports has been the cross-sectional nature of the studies. The reviews of Ebbehøj et al (2002) and Cardon and Belague (2004) showed that inactivity and intensive sports exposure are associated with adolescent LBP. However, some studies did not find such association. In the literature, the risk for LBP in adolescents has been evaluated with regard to the type of sport or activity played (Sato et al, 2011; Sjolie, 2004a) and the frequency, duration or intensity of the physical activity (Wedderkopp, Kjaer, Hestbaek & Korsholm, 2009; Heneweer, Staes & Aufdemkampe, 2011). A number of authors observed an association between NSLBP and sports in non-athletic populations of adolescents (Grimmer and Williams, 2000; Watson et al, 2003; Korovessis et al, 2004; Fritz and Clifford, 2010; Trevelyan and Legg, 2011; Sato et al, 2011). Using logistic regression analysis, Kovacs et al (2003) found that self-reported NSLBP was associated significantly with practising any sport for more than twice a week [OR 1.23, 95% CI: 1.09–1.39] in 7 361 school-children aged between 13 and 15 years. These findings are consistent with those of Sato et al (2011). In their recent study of 43 630 Japanese pupils between the ages of nine and 15 years, Sato et al (2011) showed that LBP was associated with playing a number of sports such as volleyball [OR= 2.14, 95% CI 1.86–2.46], athletics [OR=2.18, 95% CI 1.89–2.52], and rugby [OR= 2.58, 95% CI 1.56–4.27] among others. In addition, the authors demonstrated a dose-response relationship between the amount of time spent participating in sports activities and the occurrence of LBP. Earlier on, Bejjani et al (2005) had reported similar findings among 622 Tunisian school-children between the ages of 11 and 19 years.

In contrast to the above studies, a study by Gunzburg et al (1999) conducted in Belgium with 392 school-children aged nine years found no association between adolescent LBP and sports activity. However, the authors focused on school-children relatively younger than in most studies. These findings are consistent with those of Murphy et al (2007) who found no significant relationship between sport activity and LBP among 679 school-children in the UK between the ages of 11 and 14 years. In addition, other studies showed no association between LBP and indicators of amount of physical activity such as weekly frequency. In their case-control study involving 1 214 Chinese adolescents, Yao et al (2012) found that LBP

was associated with playing basketball [$X^2 = 7.22$, $p = 0.01$] and gymnastics [$X^2 = 4.83$, $p = 0.04$] but not with weekly frequency [$X^2 = 14.39$, $p = 0.16$] and duration for each sport [$X^2 = 6.87$, $p = 1.65$]. These findings portray that sports intensity may not have an influence on LBP among adolescents. These findings are consistent with those of Masiero et al (2008). In their study of 7 542 Italian school-children between the ages of 13 and 15 years, Masiero et al (2008) found that LBP was significantly reported among school-children who practised aerobics and swimming compared to other sports. However, no significant association was found with the frequency of training.

2.8.7 Muscle Flexibility

Castro-Piñero, Girela-Rejón, González-Montesinos, Mora, Conde-Caveda, Sjöström and Ruiz (2013) adopted a definition of muscle flexibility as the “ability of a specific muscle or muscle group to move freely through a full range of motion.” It is well-established that the benefits of muscle flexibility includes improved range of motion, improved athletic performance and reduced risk of injury (Castro-Pinero et al, 2013). In the literature, adolescent LBP has been discussed in relation to hamstring muscle flexibility in many studies (Feldman et al, 2001; Sjolie, 2004b). However, the findings have been contradictory (Cardon & Belague, 2004).

Outside the clinical setting, the objective measurement of hamstring flexibility is not practical because of the sophisticated and expensive apparatus required such as the MRI (Stutchfield and Coleman, 2006). However, hamstring flexibility has been assessed indirectly using a number of procedures such as AKET using a goniometer (Sjolie 2004b; Koley and Likhi, 2011), Sit and Reach test (Feldman et al, 2001; Mikkelsen, Nupponen, Kaprio, Kautiainen, Mikkelsen, Kujala, 2006), Chair-Sit and Reach test (Jones, Rikli, Max & Noffal, 1998; Baltaci, Un, Tunay, Besler & Gerceker, 2003) and Passive straight leg raise test (Stutchfield and Coleman, 2006). Nevertheless, the method of choice in the literature has been based on the ease of use and preference in addition to scientific evidence (Scott-Davis, Quinn, Whiteman, Williams & Young, 2008).

A cross-sectional study by Feldman et al (2001) found that the occurrence of tight hamstrings, based on a SR test, were strongly associated with the development of NSLBP with an odds ratio of 1.04 (CI: 1.04 -1.06). However, as reported by the authors, the study had a moderately low response rate (62%). In line with these findings, Sjolie (2004b) demonstrated in multivariate analysis that poor hamstrings, based on AKET, were associated with recurrent NSLBP especially in males. In contrast to the Feldman et al (2001) and Sjolie (2004b), a cross-sectional study in a cohort of 1 389 schoolchildren by Harreby et

al (1999) found no significant correlation between LBP and the tightness of the hamstring muscles based on goniometric measurements.

2.9 Review of methodology

The methods in the literature that are reportedly used to determine the prevalence of LBP in adolescents have been highly variable. Based on a pool of articles included in a systematic review on the incidence and prevalence of LBP in children, Hill and Keating (2009) concluded that prevalence figures were different between studies because of the variations in data collection procedures. Since different methods of data acquisition could influence the outcome, Jeffries et al (2007) emphasised the importance of understanding the methods by which data are collected when comparing prevalence studies. According to a literature review by Belague et al (1999), which included studies on NSLBP in children and adolescents since 1992, the author's categorised the identified methodologies used to evaluate adolescent LBP into:

1. Cross-sectional studies based on a questionnaire looking at subjective morbidity.
2. Cross-sectional studies based on a physical examination to evaluate measurable morbidity.
3. Longitudinal studies (cohort studies) to measure the yearly incidence of LBP.

A systematic review by Jeffries et al (2007) on adolescent spinal pain identified 56 primary epidemiological studies and indicated that the majority of these studies, investigating adolescent LBP, were cross-sectional, administered in schools, utilising a self-administered questionnaire (Watson et al, 2002; Jones et al, 2004), structured interviews (Wedderkopp, Kjaer, Hestbaek & Korsholm, 2009) or mixed method of interviews (by mail, by telephone, or face-to-face) and questionnaires (Shehab et al, 2004; Koroivessis et al, 2004). Several authors argue that self-reports are the best way to validate the presence or absence of LBP in school-children, as pain is a subjective phenomenon, as compared to clinical physical examinations (Gunzburg et al, 1999; Jones et al, 2004; Bejia et al, 2006). According to Gunzburg et al (1999) there are very few clinical signs that could single out school-children with NSLBP. In a total of 392 children who underwent a lumbar spine medical examination only one clinical parameter of pain on palpation was suggestive of LBP out of 19 parameters assessed. These findings highlight the challenge in the diagnoses of LBP in adolescents clinically.

Although self-administered questionnaire are considered by many investigators as a method of choice for assessing the prevalence of LBP in adolescents (Jones et al, 2004, Bejia et al, 2006), the reliability has been reported to be comparable with other data collection

strategies. Staes, Stappaerts, Vertommen, Nuyens, Coppieters and Everaert (2000) in a study to compare self-administration of a questionnaire with face-to-face interviews in an investigation of LBP in 16 to 18 year old adolescents, showed that the method of data acquisition used does not influence the outcome of results. In accordance, Jones et al (2004) evaluated the criterion validity of a questionnaire in comparison with face-to-face interviews, in 119 school-children aged between 11 and 16 years, and reported concordance between repeated measures of the questionnaire, and between the questionnaire and interview as greater than 90%. In a test-retest (one-week apart) study to evaluate the reproducibility of a 28-item survey questionnaire for back pain problems in 257 Tunisian adolescents, Bejia et al (2006) found high levels of reproducibility (kappa coefficients for most items were substantial to almost perfect, between 0.71 and 1.00) for the questionnaire item. These findings indicate that a questionnaire approach and interviews are both reliable and valid in epidemiological studies investigating prevalence of LBP in adolescents. However, the questionnaire approach has been reported to be inexpensive and convenient especially in large scale epidemiological studies compared to interviews. Despite these advantages, the use of questionnaires is not without limitations as instructions may be ignored completely and questions may be answered inaccurately resulting in response bias, unlike interviews that can further explore respondents' answers (Staes et al, 2000).

2.10 Conclusion

Table 2: Summary of studies investigating adolescent LBP

Prevalent rates			Study details			Publication details	
Country	% ^a	Recall	Sample	Size ^b	Rate ^c	Year	Author
Kuwait	58	Lifetime	10-18 years	400	100%	2004	Shehab et al.
UK	40	Lifetime	10-16 years	500	93%	2004	Jones et al.
Spain	61	Lifetime	13-15 years	7361	93%	2003	Kovacs et al.
Norway	62	Lifetime	14-16 years	88	84%	2003	Sjolie
South Africa	58	Lifetime	13-18 years	1123	89%	2005	Jordaan et al.
Tunisia	28	Lifetime	11-19 years	622	98%	2005	Bejia et al.
Iran	15	Point	11-14 years	5000	96%	2007	Mohseni et al.
UK	15	Point	10-16 years	500	93%	2004	Jones et al.
Kuwait	35	Point	10-18 years	400	100%	2004	Shehab et al.
Nigeria	17	Point	10-19 years	4400	72%	2011	Ayanniyi et al.
South Africa	15	Point	13-18 years	1123	89%	2005	Jordaan et al.
Japan	10	Point	9-15 years	43630	61%	2011	Sato et al.
UK	13	Recurrent	10-16 years	500	93%	2004	Jones et al.
Finland	8	Recurrent	15 years	1503	92%	1999	Salminen et al.
Kuwait	36	Recurrent	10-18 years	400	100%	2004	Shehab et al.
Norway	32	Recurrent	14-16 years	88	84%	2004	Sjolie
Finland	27	Recurrent	12-18 years	11276	77%	2000	Vikat et al.
Canada	25	Recurrent	13-15 years	502	62%	2001	Feldman et al.
Netherlands	8	Recurrent	12-16 years	3485	92%	2006	Diepenmaat et al.
Mozambique	14	Recurrent	11-16 years	204	85%	2004	Prista et al.

c- Response rate; b- Sample size; a- Integer values

The aim of this literature review was to provide an overview of the historical background, prevalence and the associated individual risk factors to recurrent NSLBP in adolescents. Despite significant variability in the way that pain was defined and reported, adolescent LBP appears to be a relatively common experience for young people (Cardon & Belague, 2004; Jeffries et al, 2007; Louw et al, 2007; Hill & Keating, 2009). There is evidence that the prevalence increases with age, reaching adult rates by late adolescence (Watson et al, 2002). Lifetime prevalence of adolescent LBP has been reported to be 58% in Kuwait, 40% in the United Kingdom, 61% in Spain, 62 % in Norway and 58% in South Africa (Table 2). However, about 10% to 35% of adolescents may report point pain at any specific time whilst

13.1% to 32% may experience recurrent NSLBP (Jones et al, 2004; Sjolie, 2004b; Prista et al, 2004; Shehab et al, 2004). The prevalence figures varied between studies due to the methodological issues and population differences (Masiero et al, 2008). A number of individual risk factors have been described to be associated with LBP in adolescents. However, the majority of the studies on adolescent NSLBP have been cross-sectional in nature. Therefore, they fail to distinguish etiologic from prognostic factors (Belague et al, 1999). Family history of NSLBP, female gender, cigarette smoking, BMI, increased sports participation, sedentary lifestyle, tight hamstrings, and a heavy school-bag weight are some of the factors that have been reported to be related to adolescent NSLBP.

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CHAPTER 3: PHASE 1 METHODOLOGY

3.1 Introduction

The study was conducted in two continuous phases, namely Phase 1 and Phase 2. This chapter describes the methodology of the first phase of the research project investigating the prevalence and the associated individual risk factors for recurrent NSLBP. The following sub-sections will be discussed in this chapter: study design, research setting, study population, eligibility criteria, recruitment and sampling method, study instrumentation, and the data collection procedure. A description of the data management and the statistical tests used to analyse the data are also included in this chapter.

3.2 Study design

This study used a cross-sectional, descriptive study design. This design was used because the researcher was primarily interested in determining the prevalence figures for LBP and the associated risk factors in adolescents. A descriptive study is best suited for this purpose (Grimes and Schulz, 2002).

3.3 Research study setting

The research project was conducted in government secondary schools based in Harare. Zimbabwe is a land-locked country situated in Southern Africa bordered by South Africa, Mozambique, Zambia and Botswana. According to ZimStat (2012), Zimbabwe has a population of 12 973 808 million people. An estimated 3 million (25%) are adolescents aged between the ages of 10 and 19 years old (ZimStat, 2012). The country is divided into ten administrative provinces and Harare is the largest constituting 16% of the total population (see map of Zimbabwe, p. 184).

The education system in Zimbabwe is administered by the Ministry of Education, Sports, Arts and Culture. Each province has a provincial education office mandated to superintend schools in the respective provinces. There are 89 secondary schools in the Harare Province, of which 55 are government-administered schools (Chamba, 2012). Government secondary schools are classified into two categories (S_1 and S_2) based on socio-economic status. The S_1 category represents group “A” schools located in the low density areas (Chamba, 2012), where people of high socio-economic status live (Bandason and Rusakaniko, 2010). There are 17 secondary schools in S_1 category (Chamba, 2012). The S_2 schools represents group “B” schools located in the high density suburbs (Chamba, 2012), where people of lowest socio-economic status resides (Bandason and Rusakaniko, 2010). There are 38 secondary schools in the S_2 category (Chamba, 2012). Overall, the Zimbabwe education system consists of seven years of primary and six years of secondary education. The first four years

(Form 1 to 4) of secondary education are compulsory and are known as Ordinary level, and the last two years (Form 5 and 6) are optional and are known as Advanced level.

3.4 Study population

The target population comprised of full-time students (in Form 1 to 6) in the secondary schools run by the government in Harare, Zimbabwe. At the time of the study, a total of 71 458 adolescents were registered in government secondary schools in the Harare Province (Chamba, 2012).

3.5 Sample size determination

According to Kachigan (1986), referenced in the methodological review of the literature on the prevalence of LBP in adults by Loney and Stratford (1999), accurate sample size calculations are essential in prevalence studies to provide a crude idea of the number of participants that need to be recruited. As no study has been conducted in Zimbabwe on adolescent LBP, Epi Info version 7.1.1.0 Statcalc package for population surveys was used to estimate the sample size based on the following parameters:

- i. The estimated prevalence of recurrent non-specific LBP in school-children found regionally (13.5% according to Prista et al, 2004 for adolescents in Mozambique). Zimbabwe and Mozambique share similar socio-economic status.
- ii. Total population of school-children in the government-administered secondary schools in Harare, Zimbabwe (71 458).
- iii. The desired level of confidence interval (95%).
- iv. The acceptable margin of error (A precision effect of 3%).
- v. A design effect of 1.

The sample size was calculated to be 495. However, the number was adjusted upwards in anticipation of attrition from school absenteeism and possible refusals. The final sample size was 620 students.

3.6 Recruitment and Sampling

A two stage cluster sampling method was used to select schools and the study participants (Figure 2 below). In the first-stage of cluster sampling, the aim was to identify the participating secondary schools. Based on educational statistics provided by the Ministry of Education, a list of all government secondary schools was constructed in clusters of two categories, S_1 and S_2 . Each sampling unit was assigned a numerical number, written on a small piece of paper. The pieces of paper were then placed in two respective boxes representing S_1 and S_2 school categories. With closed eyes, one secondary school was selected from the S_1 cluster box, and two secondary schools were selected from the S_2 cluster box. The schools were selected based on probability proportional to number

technique, where number denoted the total number of secondary schools in each cluster. To be eligible, selected secondary schools needed to offer all classes from Form One to Six.

In the second stage of the cluster sampling, the aim was to select participating classes from selected secondary schools. Each school was asked to provide a list of all classes in each form/grade. All the classes in the respective forms were numerically listed on small pieces of paper, which were then deposited in the respective boxes representing the school-forms. With eyes closed, the researcher selected one class in each of the six boxes. Six classes were selected from each participating secondary school. All the school-children in the selected classes were then eligible to participate in the study.

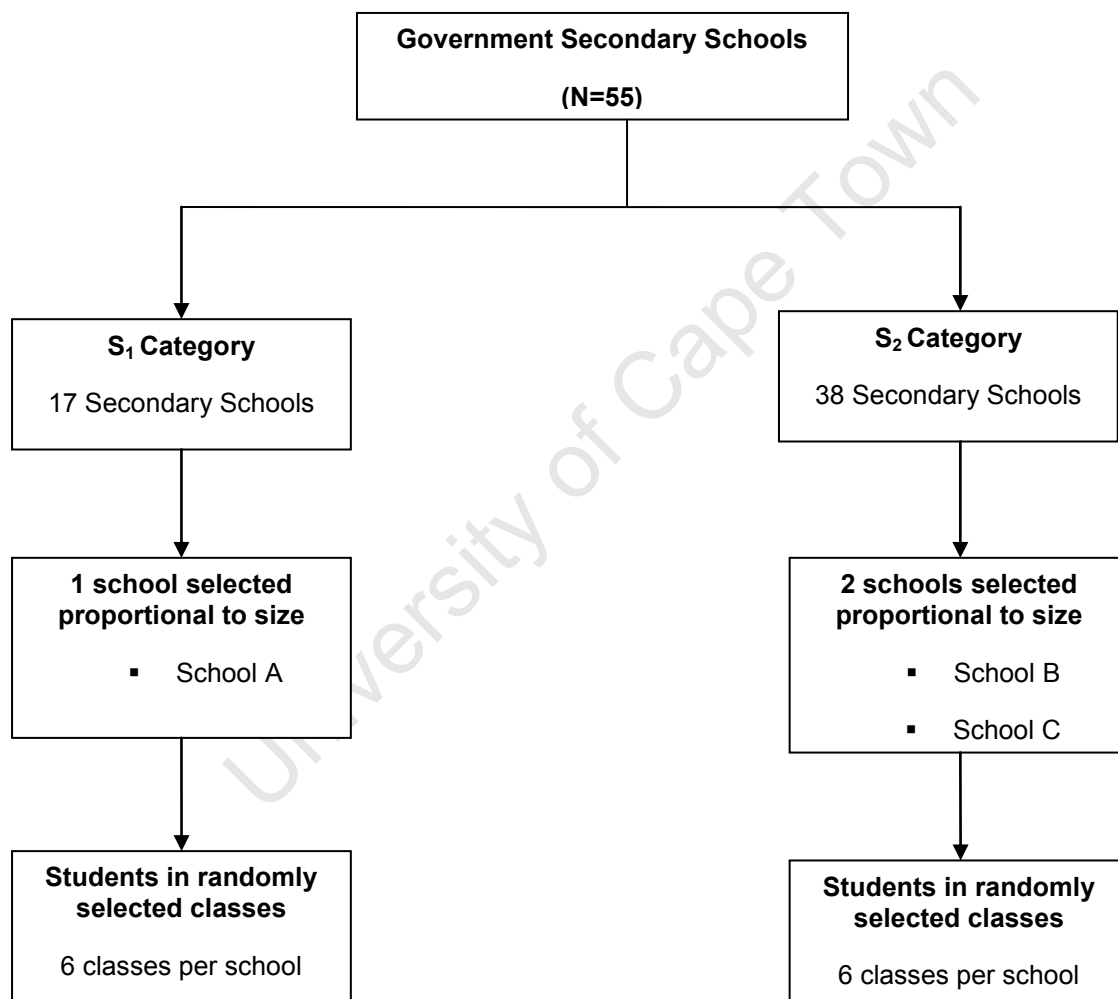


Figure 2: Recruitment flow chart for Phase 1 participants.

3.7 Inclusion Criteria

The sample consisted of all students who met the following eligibility criteria:

- Registered full-time students (Form One to Six) in one of the selected schools.

- Adolescents between the ages of 10 and 19 years (males and females).
- Students whose parents/legal guardians had signed the Informed Consent document.
- Students whose parents/legal guardian completed the Medical Health Questionnaire.
- Students who freely volunteered to participate in the study by signing the Assent Form.
- Students in the participating classes who were present on the day of the survey.

3.8 Exclusion criteria

- Students with spinal pathologies or orthopaedic conditions (inflammatory conditions, spinal tumours, fractures of the spine, pelvis and extremities) as reported by parents/legal guardians in the Medical Health Questionnaire. These conditions are seen as specific LBP.
- Students who sustained injuries or direct trauma to the back region as reported by parents/legal guardians on the Medical Health Questionnaire.
- Students with central and/or peripheral nervous problems which affect the muscle tone in the extremities and the trunk.
- Students with physical deformities including leg length discrepancy and scoliosis as reported in the Medical Health Questionnaire by parents/legal guardian.

3.9 Data Collection Instruments

3.9.1 The LBP study questionnaire

The study questionnaire (**Appendix A**) was designed to assess the prevalence of recurrent NSLBP and to screen for adolescents in schools with or without recurrent NSLBP. As there was no Zimbabwean questionnaire on adolescent LBP, the questions asked in the questionnaire were derived from previously validated instruments used in literature (Bejia et al, 2006; Fanucchi et al, 2009; Harreby et al, 1999; Watson et al, 2003; Gunzburg et al, 1999; Grimmer and Williams, 2000; Ayanniyi et al, 2011). The choice of a questionnaire as a survey tool was based on the fact that pain is a highly subjective phenomenon best evaluated by self-report (Haraldstad et al, 2010; Bejia et al, 2006). In addition, although self-administered questionnaires have been reported to yield similar results compared to other self-report methods such as face to face interviews (Staes et al, 2000), the use of questionnaires is inexpensive and economic with regard to time.

The instrument gathered demographic data regarding the respondent date of birth, gender, place of residence and educational level/form. **Section A** of the questionnaire determined the primary outcome measures of lifetime prevalence, point prevalence and the prevalence of recurrent NSLBP. For lifetime prevalence, respondents were specifically asked the following question “Have you ever experienced pain or discomfort in the lower part of your back which lasted for one day (24 hours) or longer in your life, not associated with menstruation in females?” To assist the respondents in understanding the anatomical region of the lower back, a mannequin was used with an arrow pointing to a posterior view of the lumbar region. As the study sought information on NSLBP only, respondents were specifically instructed to report on back pain localised to the identified region of the lumbar spine but not on pain related to the experience of menses.

The question on recurrent NSLBP was specifically asked regarding the last 12 months. In addition, to understand the nature and the character of the recurrent NSLBP experienced by adolescents, the researcher sought information on the frequency, intensity and the duration of LBP episodes. Pain intensity was evaluated based on the VAS from 0 (no pain) to 10 (maximum pain). The VAS has been reported to be valid and reliable in rating pain intensity (Olaogun, Adedoyin, Ikem & Anifaloba, 2004) and has been utilised in previous LBP studies (Masiero et al, 2008). The health-seeking behaviour for adolescents with recurrent NSLBP was also ascertained. This behaviour described seeking formal health care services or informal care from traditional healers (Barker, 2007). Items adapted from the modified Hanover Functional Ability Questionnaire were used to enquire about activity limitation related to recurrent NSLBP. This instrument has been used widely in previous studies as a measure of disability among adolescents with LBP (Watson et al, 2002; Jones and Macfarlane, 2009; Pellise et al, 2009). The instrument assesses limitations in nine daily activities such as reaching to get a book from a high shelf, bending down to put on socks and sitting up in bed (Jones and Macfarlane, 2009). These items were summed and categorised as low (1-2 limitations), moderate (3-4 limitations) and high (5-9 limitations).

Section B of the questionnaire sought information regarding the school-bags carried to school by the respondents. Respondents were specifically asked on school-bag use, their perception of the daily weight of their school-bags, the duration of carrying their school-bag carriage in categories of less than 5, 5-10, 11-20, 21-30 and more than 30 minutes, and also on the method of carrying their school-bag. **Section C** captured information regarding the physical activity profile of the respondents with regard to sports participation either at school or at home and on the number of hours they engage in sport per week. **Section D** of the questionnaire sought information regarding respondents smoking status, and the amount of cigarettes smoked by respondents per week.

3.9.2 Medical Health Questionnaire

The Medical Health Questionnaire (**Appendix B**) was used to determine the medical history of school-children as reported by parents or legal guardians. The Medical Health Questionnaire was adapted and modified to suit the design of the research study from a study conducted by Fanucchi et al (2009). The questionnaire provided the criteria for exclusion from the study. Students were excluded if they had spinal pathologies, or deformities such as scoliosis, spinal tumours, spinal trauma, and orthopaedic conditions such as fractures of the pelvis and lower limbs, leg length discrepancy and any neurological conditions which alter muscle tone of the lower limbs and the spine. These conditions fell out of the scope of the study. The questionnaire gathered information regarding the student history of LBP from parents/legal guardians. This enabled the parents' report on their child to be compared with the students' report of LBP. In addition, parents or guardians were asked to provide information on any member of the family, known to them, with a history of LBP and their relationship with the participating student.

3.10 Instrument development

3.10.1 Questionnaire content validity

The study questionnaires were subjected to a critical appraisal for content validity. Content validity, also known as intrinsic validity, ensures that an instrument adequately covers the content it is supposed to measure (Yaghmale, 2003). Content validity has been described as pivotal in the development of valid and reliable instrument (Terwee, Bot, De Boer, Van der Windt, Knol, Dekker, Bouter & De Vet, 2007). Five lecturers from the Department of Nursing, Physiotherapy and Community Medicine at the UZ-CHS were used as content experts. They were chosen on the basis of experience in epidemiological research studies and on preferential interest in musculoskeletal research. The experts were provided with objectives and decision-criteria that served as a basis of scoring the instruments. They had to rate each question/item of the questionnaires based on a criterion originally developed by Waltz and Bausell (1983) but adopted to use in the present study from Yaghmale (2003). The criteria evaluated each question on a four-point scale based on four factors: relevance, clarity, simplicity and ambiguity.

Each expert was given the study synopsis, a letter of rationale (**Appendix C**) and a copy of the criterion (Table 3). In addition, they were asked to recommend additions or omissions of items when necessary. On the analysis of the results, the questions rated 4 by all the content experts were left unchanged. However, questions which had 1, 2 and 3 ratings were either discarded or refined based on the recommendations proposed by the content expert.

Table 3: Criteria for Content Validity developed by Waltz and Bausell (1983)

1. Relevance
1= not relevant
2= item need some revision
3= relevant but need minor revision
4= very relevant
2. Clarity
1= not clear
2= item need some revision
3= clear but need minor revision
4= very clear
3. Simplicity
1= not simple
2= item need some revision
3= simple but need minor revision
4=very simple
4. Ambiguity
1= doubtful
2= item need some revision
3= no doubt but need minor revision
4= meaning is clear

3.10.2 Pilot study

After the validation of the study questionnaires, the researcher carried out a pilot study in two continuous phases. The pilot study was conducted for the following reasons:

1. To assess the comprehensibility and the clarity of the LBP study questionnaire.
2. To test the reproducibility (reliability) of the LBP study questionnaire.

The LBP questionnaire (English version) was piloted at one of the selected secondary schools using a randomly chosen class of 36 students in their final year of Ordinary level education (**Form four**). The self-report instrument was completed in the classroom during school hours in the presence of a senior teacher. Verbal explanations were given to students

in addition to a letter with standard information regarding the study. Further instructions were given to the respondents to ask questions for clarification purposes when necessary.

On average, students took 30 ± 5 minutes to complete the LBP questionnaire, which was more than the anticipated 10-15 minutes. This was attributed to a number of factors. Respondents were elated to be involved in a research project and in completing the LBP questionnaire. This was demonstrated by incessant deliberations and laughs amongst themselves, particularly on a question enquiring about the smoking history of the respondents. In addition, respondents had difficulty understanding some questions resulting in frequent interruptions seeking clarification from the researcher. Nevertheless, no changes were suggested by the respondents regarding the nature of the questions in the instrument. However, the researcher established the following feasibility concerns during the pilot procedure:

- It was important to communicate a day before the questionnaire administration with the school principals by telephone or a physical visit to the school, to arrange for time and assistance so as to avoid disturbing scheduled lessons. It was noted during the pilot study that students conducted themselves well in the presence of a school teacher.
- It was also important to organise students to sit a distance from each other to avoid copying or discussing responses amongst themselves. It was important to observe the students intently, and discourage students' discussions repeatedly.

Consequently, the English questionnaire was translated to create a Shona version (**Appendix A1**) by an independent translator. The translator was requested to aim for contextual meaning rather than word for word translation. Another independent translator was employed to translate the Shona questionnaire back into English. This was done to compare the conceptual equivalence of the questions with the original version of the English questionnaire.

3.10.3 Questionnaire test and re-test reliability

The LBP questionnaire was administered again a week later to the same sample of students. This was done to re-assess the average time taken to complete the questionnaire and to evaluate the reliability of the questionnaire. During the initial pilot, students were not told that they would be re-tested. The same procedure was used as during the first testing except that respondents were instructed to sit approximately 50 cm apart. In addition, students had an option of either completing an English or Shona questionnaire. A one-week interval was chosen, as indicated in the previous studies of Mehta, Thorpe and Freburger

(2002) and Bejia et al (2006), for two reasons. Firstly, to reduce the possibility of the so called “carry-over effect” (subjects remembering their initial responses) as described by Bejia et al (2006) and Salerno, Franzblau, Armstrong, Werner and Becker (2001). Secondly, to lessen the possibility of the LBP changing between the test and re-test period (Bejia et al 2006). It is known that LBP is characterised by unpredictable patterns of recurrences and remissions (Burton et al, 2006).

The respondents took a much shorter time (approximately 15 minutes) to complete the questionnaire compared to the first encounter. The student responses on the primary outcomes measures were compared between the test and re-test for reproducibility. The reproducibility of the instrument was tested using the kappa coefficient. The Kappa statistic assesses whether the agreement between responses in the test-retest study exceeds chance levels (Salerno et al, 2001). A criteria proposed by Landis and Koch (1977) described in Bejia et al (2006) was used to interpret the Kappa coefficient (Table 4 below).

Table 4: Criteria for interpreting the Kappa statistic by Landis and Koch (1977)

Value for Kappa, k	Interpretation
< 0	Less than chance agreement
0.01-0.20	Slight agreement
0.21-0.40	Fair agreement
0.41-0.60	Moderate agreement
0.61-0.80	Substantial agreement
0.81-0.99	Perfect agreement

3.10.4 Results for the test-retest reliability

Table 5: Kappa coefficients for the questionnaire items

Question (item)	Kappa value	Comment
Q1: Lifetime prevalence	0.72	Substantial
Q3: Prevalence of Recurrent NSLBP	0.51	Moderate
Q4: LBP Frequency	0.73	Substantial
Q5: LBP Duration	0.96	Perfect
Q7: Sciatica	0.32	Fair
Q8: Period prevalence	0.48	Moderate
Q10: Medical Treatment	0.56	Moderate
Q12: School Absenteeism	0.88	Perfect
Q13: School-bag	1	Perfect
Q14: School-bag weight perception	0.74	Substantial
Q15: Duration of carrying school-bag	0.86	Perfect
Q16: Method of carrying school-bag	0.83	Perfect
Q17: Sports participation	1	Perfect
Q19: Sports duration	1	Perfect
Q20: Sedentary time	0.60	Perfect
Q21: Smoking status	0.83	Perfect

The mean age of the respondents in the pilot study was 16.3 years (SD=1.67) with 37.5% of the respondents being males. The questionnaires were fully completed by respondents in both the initial test and re-test. As expected by the researcher, percentage agreement for the demographic details (age, gender and place of residence) was consistent between the initial test and the re-test, reflecting the questionnaire reliability in providing for the demographic details. Other perfect agreements were observed on the following items on the questionnaire: school-bag use (100%) and on smoking status (100%). For the primary outcome measures of LBP, moderate to substantial kappa coefficients (0.48-0.72) were observed as indicated in Table 5 above. However, the kappa values were comparable to the values of 0.462 to 0.831 obtained by Yao et al (2012) in a case control study to identify risk factors for LBP in adolescents. In addition, among Tunisian adolescents, Bejia et al (2006) reported kappa values for most items of a LBP questionnaire between 0.38 and 1. The results of this study suggested that the LBP questionnaire provided reproducible information for the investigation of LBP problems among adolescents, despite the low kappa coefficient calculated on the aspect of sciatica ($k=0.32$).

3.11 Procedure

3.11.1 Ethical and Institutional Approval

Ethical approval was obtained from HREC at the University of Cape Town [ref: 189/2012] and from the MRCZ [ref: MRCZ/B/356]. Institutional approval was sought from the Ministry of Education, Sports, Arts and Culture (**Appendix D**) [ref: C/426/3] and from Harare Provincial Education Director (**Appendix E**) [ref: G/42/1] to access the selected three government secondary schools. Further permission was sought from the school headmasters/headmistress (**Appendix F**) of the three participating secondary schools. The fieldwork for the first phase of the study was conducted between June and August 2012, during the second academic school term (**Appendix G**). For the purpose of clarity, the fieldwork was subdivided into three distinct stages: preparatory stage, intermediate stage, and questionnaire administration.

3.11.2 Preparatory stage

After the schools had agreed to participate, the researcher took time to visit the schools to establish background information. The researcher utilised the opportunity to address the school authorities on the nature and procedural issues of the research project and to agree on specific dates for data collection. In addition, the researcher utilised the opportunity to identify the participating classes and students in each of the participating secondary schools for the main study.

3.11.3 Intermediate stage

On an agreed date, the researcher attended the selected schools again to address the participating students. Verbal information was given explaining the rationale, procedure, risks and benefits of the research project to the students. At that stage, students who verbally agreed to participate were given a letter with standard information regarding the study (**Appendix H**), and consent form (**Appendix I**) for their parents/legal guardians. In addition, students were given the Medical Health Questionnaire to be completed by parents/legal guardian at home. The students had to choose parental documents in a language preferable to their parents (either Shona or English). The students were given seven days to return the parental documents to the class teacher in a sealed envelope. During this period, reminders were sent to the respective class teachers using cell-phone text messages and voice calls to ensure the return of the documents by students. Within the seven days, the researcher held meetings in person with parents/legal guardians to address parental concerns about the study. This was specified in the parent information sheet. The

researcher collected returned parental documents from the class teacher at the end of the seven days.

3.11.4 Questionnaire administration

On agreed dates with the school authorities, the researcher visited the three participating schools consecutively. Because each school had six participating classes, a maximum of three days of data collection were spent at each school. This was done to minimise disruptions of scheduled lessons. Only school-children with returned parental documents were eligible for the main study. Initially, students were given an information sheet (**Appendix J**) regarding the study and an assent form to sign (**Appendix K**) after being furnished with study information.

The questionnaires were completed in the classrooms during school hours in the presence of the researcher and the class teacher. Respondents had the option of choosing either an English or Shona questionnaire. The students were instructed to sit approximately 50 cm apart and to answer the questionnaires as individuals. However, they were reminded that this was not an examination process with wrong or right answers. To facilitate understanding, the researcher read the questionnaire aloud to students in the lower classes (Form One and Two's).

3.12 Ethical considerations

Since this study involved school-children still under parental guidance, a number of ethical considerations were taken into account. The study had ethical and institutional approval from responsible authorities. A summary of the study findings reporting on the group of students at the school (and not individual students) were to be sent to the school authorities on completion of the study. Eligible school-children had to have parental consent to participate. Parental concerns were addressed in person on specific dates outlined in the parent information sheet. However, student participation was on voluntary basis and no form of coercion was used. The researcher ensured that the students were furnished with understandable information on the nature, purpose, risks and benefits involved before signing the assent form. In addition, students had the option of choosing a questionnaire designed in a language (Shona or English) preferable to them.

The students were informed of the liberty to refuse to participate with no consequences following their refusal. For anonymity sake, the data were collected without the use of personal or school names. Furthermore, parental questionnaires were coded using identical numbers to those used for the questionnaires for the school-children for identification purposes. For confidentiality purposes, parental documents were sent sealed in an envelope

and the students were requested to return them in a provided sealed envelope. Furthermore, the researcher ensured that the questionnaires were answered as individually as possible with no discussion among the students. The students were made to sit with some distance apart to minimise sharing of responses. It was ensured that data collection occurred on agreed dates with the school authorities and only few classes were surveyed per day. This was done to minimise disruption of school lessons.

3.13 Data Management

The raw data for the first phase of the research project were collated and entered on a password-locked Microsoft Excel Spreadsheet. All the computerised data were double-checked against the original data on paper, and corrected if necessary. The hard copies of the returned consents, assent forms and study questionnaires are kept securely in the researcher's locked office cupboard.

3.14 Statistical Analysis

Data were processed using STATISTICA version 11 and SPSS version 21. According to Fagerland (2012), parametric tests should be used for studies with large samples even for heavily skewed data. The central limit theorem allows for the use of parametric tests when the sample size is relatively large. However, normality tests for continuous data were run for confirmation sake using the Kolmogorov-Smirnov test in association with the Lilliefors test. Descriptive statistics were used to describe baseline demographic characteristics of the respondents, including means with standard deviations for continuous data and frequencies for categorical data.

The primary outcome measures of lifetime prevalence, point prevalence and prevalence of recurrent NSLBP were expressed as percentage of the total population. In addition, the LBP prevalence figures were calculated separately for gender and age-group. The Chi-square test was used to evaluate the effect of gender and age on LBP prevalence. In addition, school-children with recurrent NSLBP were compared to those without with regard to sports participation, time spent sedentary, school-bag use, duration of carrying a school-bag, method of carrying the school-bag, perceptions of school-bag weight and smoking. All the univariate analysis to assess the association between categorical variables and recurrent NSLBP were based on the Chi-square test. The Fisher's exact test replaced the Chi-square test in 2×2 and 2×3 tables when the expected frequency in any of the cells was less than 5. The alpha level was set at 0.05.

The severity of LBP was evaluated based on VAS and the independent *t*-test was used to assess the difference between males and females. Pain intensity was dichotomised as mild pain (< 5 score on VAS) and severe pain (≥ 5 score on VAS). Functional consequences

were assessed by scores obtained from the Hanover Functional Disability Questionnaire. The scores were summed and categorised as 0- no limitations, low (1-2 limitations), moderate (3-4 limitations) and high (5-9 limitations). For analysis of agreement between child and parent reports on recurrent NSLBP status, the kappa statistic was used. The kappa statistic was interpreted based on a criteria provided by Landis and Koch (1977) shown on Table 4 above.

University of Cape Town

CHAPTER 4: PREVALENCE STUDY RESULTS

4.1 Introduction

This chapter presents results of the prevalence study (Phase 1 of the study) of NSLBP amongst a sample of secondary school adolescents in Harare, Zimbabwe.

4.2 Flow chart for participants

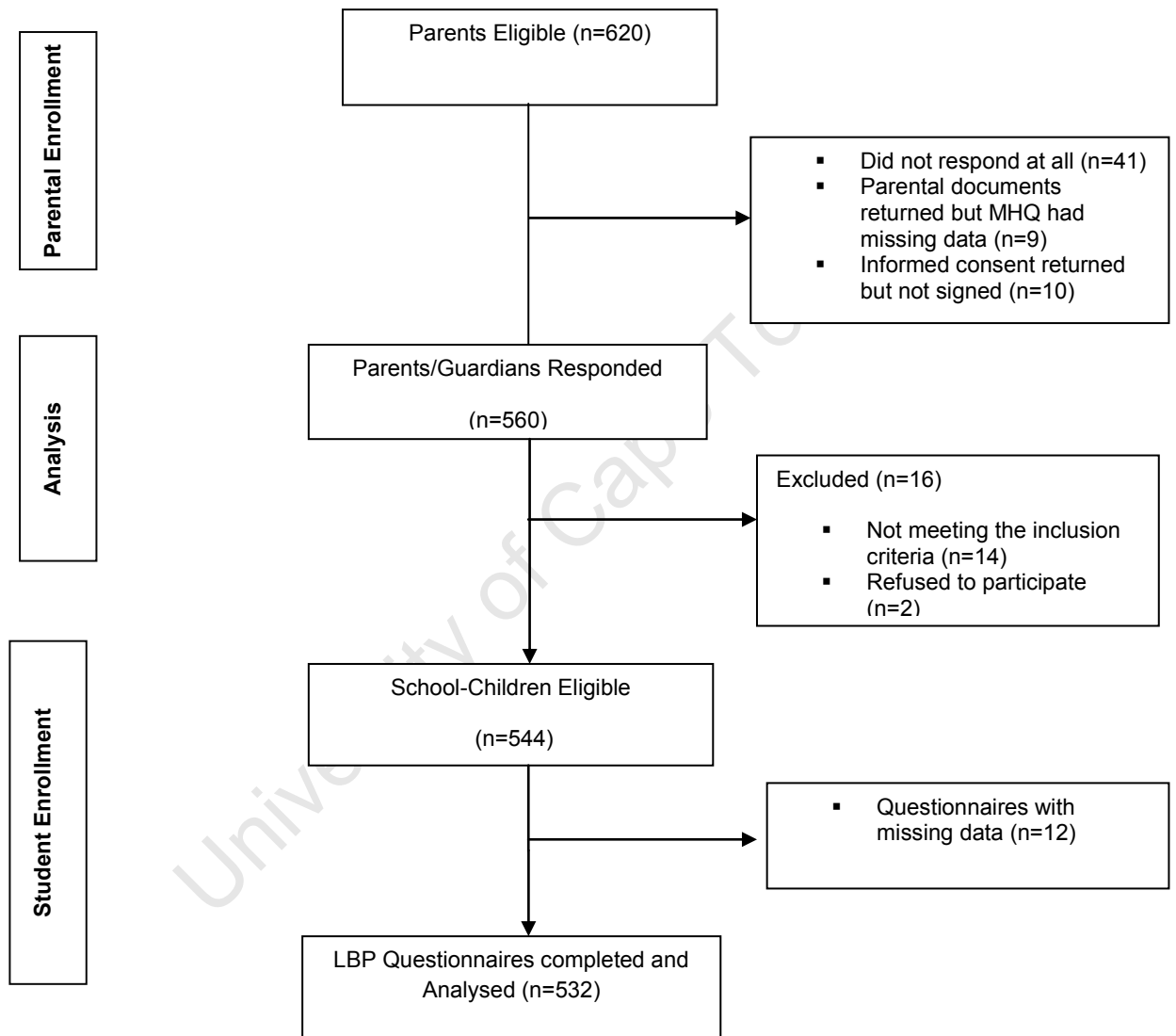


Figure 3: Flow chart for Phase 1 participants

Figure 3 above depicts the flow chart describing the participation rates for parents and the school-children in the study. Parental response rate was high. Of the 620 parents eligible, 560 parents returned the parental documents (Informed consent and the Medical Health Questionnaire) allowing for child participation. Analysis of the parental documents ensured that 14 school-children were excluded from the prevalence study for failing to meet the

inclusion criteria. Two school-children refused to participate in the study. However, of the 544 school-children eligible for the study, 532 (97.8%) completed the LBP survey instrument. The results were analysed based on the completed questionnaires.

4.3 Baseline characteristics for Phase 1 participants

Table 6: Baseline characteristics of the study participants (n=532).

Characteristic	Total	%	Cumulative %
All participants	532	100	
Females	286	53.8	
Males	246	46.2	
Age Groups (years)			
13	29	5.4	5.4
14	98	18.4	23.8
15	101	19.0	42.8
16	96	18.0	60.8
17	90	16.9	77.7
18	67	12.6	90.2
19	51	9.6	100.0
Form (Years of education)			
1 (8)	74	13.9	13.9
2 (9)	116	21.8	35.7
3 (10)	106	19.9	55.6
4 (11)	100	18.8	74.4
5 (12)	77	14.4	88.8
6 (13)	59	11.2	100

The demographic characteristics of the study participants are presented in Table 6 above. The final sample consisted of 532 school-children. The mean age of the sample was 16 years (SD=1.72, range 13-19 years). However, as shown in Figure 4 below, the age data for the school-children was not normally distributed ($K-S d=0.15$, $p<0.01$; Lilliefors $p<0.01$). Of the total school-children, 53.8% (n=286) were females. As indicated by the independent t -test, males were significantly older with a mean age of 16.2 (SD= 1.79) years compared to 15.8 years (SD= 1.65) for females [$t(530)=2.34$, $p=$

0.02]. Almost three-quarters (74.4%) of the participants were Ordinary level students with eleven years of education and below.

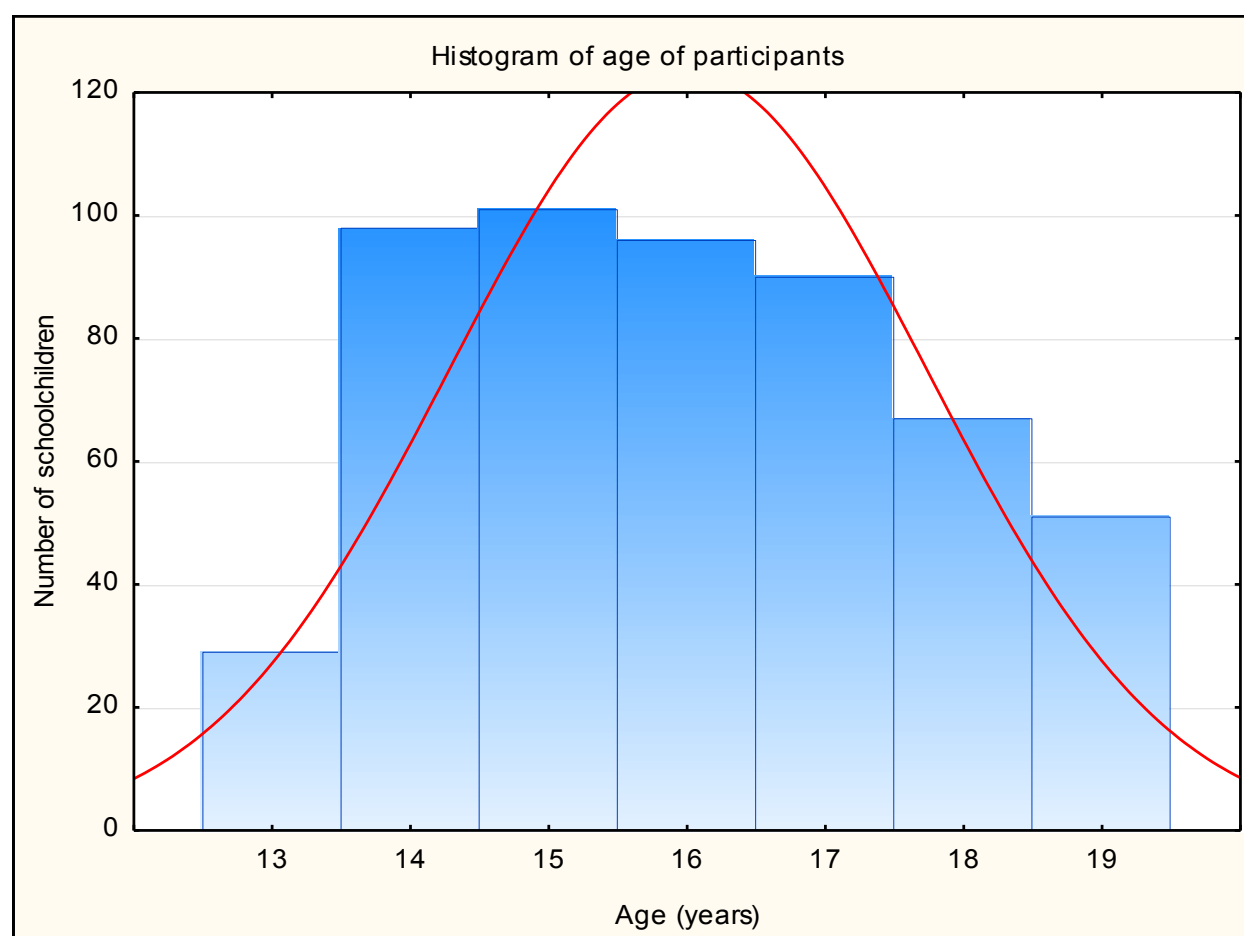


Figure 4: Distribution of Phase 1 participants by age (n=532).

4.4 Prevalence rates of non-specific low back pain

4.4.1 Lifetime prevalence

Table 7 below presents the lifetime prevalence of NSLBP according to age and gender for the Zimbabwean school-children. Overall, the lifetime prevalence was 42.9% [95% CI= 41.4-43.3]. There was no significant difference in the lifetime prevalence for NSLBP between females (43.0%) and males (42.7%), as indicated by the Chi-square test [χ^2 (1) =0.006, $p=0.94$]. These suggest that NSLBP is equally prevalent in both males and females amongst school-children. However, there was a significant trend towards increase in the proportion of school-children with LBP as age increased, despite inconsistencies at some ages [χ^2 for linear trend =73.3, $p< 0.001$]. The prevalence increased from 27.6% among school-children aged 13 years to 76.5% among those aged 19 years. However, for each age category, there

were no significant differences in the lifetime prevalence of LBP between males and females.

Table 7: Lifetime prevalence by age and gender for Phase 1 participants (n=532)

Age (yrs)	Males			Females			Total		
	n	LBP	%	N	LBP	%	n	LBP	%
13	15	4	26.7	14	4	28.6	29	8	27.6
14	34	6	17.6	64	14	21.9	98	20	20.4
15	50	10	20.0	51	16	31.4	101	26	25.7
16	42	18	42.9	54	27	50.0	96	45	46.7
17	35	19	54.3	55	30	54.5	90	49	54.4
18	39	24	61.5	28	17	60.7	67	41	61.2
19	31	24	77.4	20	15	75.0	51	39	76.5
Overall	246	105	42.7	286	123	43.0	532	228	42.9

4.4.2 Age of onset for lifetime low back pain

The mean age of onset for NSLBP among school-children was 14.4 years (SD=1.90). There were different peaks of onset between males and females. As indicated in Figure 5 below, LBP peaked earlier in females at the age of 13 years and peaked three years later in males at the age of 16 years. However, the mean age at onset of LBP was 13.9 years (SD=1.91) for females and 15.0 years (SD=1.75) for males. As indicated by the independent *t*-test, the difference was statistically significant [$t(226) = 4.21, p < 0.001$]. These results suggest that female school-children experience NSLBP at an earlier age compared to male school-children.

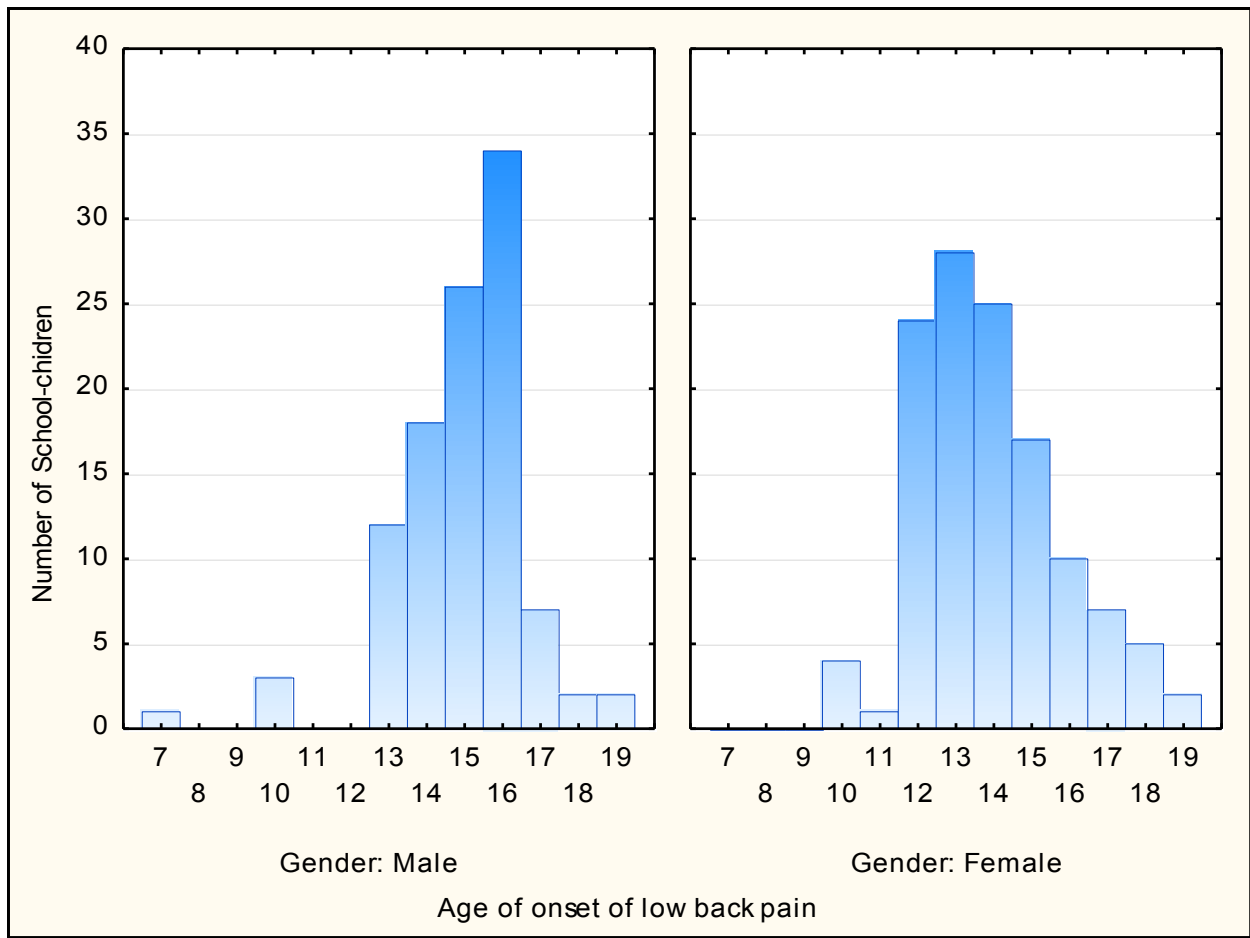


Figure 5: Onset of lifetime LBP between males and females (n=228)

4.4.3 Point prevalence of non-specific low back pain

Table 8 below presents data on point prevalence for the school-children according to age and gender. The overall point prevalence of NSLBP among Zimbabwean school-children was 10% (n=53). As indicated by the Chi-square test, females students (14.0%) were more affected than male students (5.3%) [$\chi^2 (1) = 11.2, p < 0.001$]. However, Fisher's exact two-tailed test revealed no significant gender effect for the point prevalence in that age category ($p=0.69$). Overall, there was a significant trend towards an increase in the proportion of school-children with point LBP as age increased, despite inconsistency among those aged 13 years [$\chi^2_{\text{trend}} = 29.8, p < 0.001$].

Table 8: Point prevalence by age and gender of Phase 1 participants (n=532).

Age (yrs)	Males			Females			Total		
	N	LBP	%	N	LBP	%	N	LBP	%
13	15	3	20.0	14	7	50.0	29	10	34.5
14	34	1	2.9	64	3	4.7	98	4	4.1
15	50	2	4.0	51	5	9.8	101	7	7.0
16	42	1	2.4	54	6	11.1	96	7	7.3
17	35	2	5.7	55	5	9.1	90	7	7.8
18	39	2	5.1	28	7	25	67	9	13.4
19	31	2	6.5	20	7	35	51	9	17.6
Overall	246	13	5.3	286	40	14.0	532	53	10.0

The mean intensity of NSLBP reported on the day of the survey was 3.5 (SD=1.64) on the Visual Analogue Scale. An independent *t*-test showed no significant difference between males ($M= 3.08$, $SD =1.12$) and females ($M= 3.68$, $SD =1.76$) in the LBP intensity [$t(51) = -1.15$, $p=0.26$]. In addition, as indicated by the one-way ANOVA test, there were no significant differences in the mean intensity of point NSLBP across the age categories [$F(6, 46) =1.69$, $p =0.14$]. These results suggested that the intensity of NSLBP felt on the day of the survey was not associated with gender and the age of the school-children.

4.4.4 Prevalence of recurrent non-specific low back pain

Table 9: Prevalence of recurrent NSLBP by age and gender (n=153).

Age (yrs)	Males			Females			Total		
	N	LBP	%	N	LBP	%	N	LBP	%
13	15	1	6.7	14	2	14.3	29	3	10.3
14	34	4	11.8	64	5	7.8	98	9	9.2
15	50	8	16.0	51	7	13.7	101	15	14.9
16	42	9	21.4	54	18	33.3	96	27	28.1
17	35	10	28.6	55	20	36.4	90	30	33.3
18	39	20	51.3	28	13	46.4	67	33	49.3
19	31	21	67.7	20	15	75.0	51	36	70.6
Overall	246	73	29.7	286	80	28.0	532	153	28.8

Table 9 above depicts data on recurrent NSLBP according to age and gender. The prevalence of recurrent NSLBP in the school-children was 28.8% (n=153). Males were more affected (29.7%) compared to females (28.0%), although this was not statistically significant [$\chi^2 (1) = 0.19, p=0.67$]. The prevalence of LBP increased with age despite a slight drop for the 14-year olds. The Chi-square test revealed a significant age-effect for recurrent NSLBP [$\chi^2 (6) = 90.9, p < 0.001$].

4.5 Summary of low back pain prevalence figures

Figure 6 below summarises the trends for the lifetime, point and recurrent prevalence for NSLBP. As depicted below, the prevalence increases with age, despite inconsistencies at some ages, for lifetime, point and recurrent NSLBP. Except for the 13 year-olds, the lifetime prevalence figures for non-specific low back pain are relatively higher than figures for recurrent low back pain which in turn are higher compared to point prevalence figures.

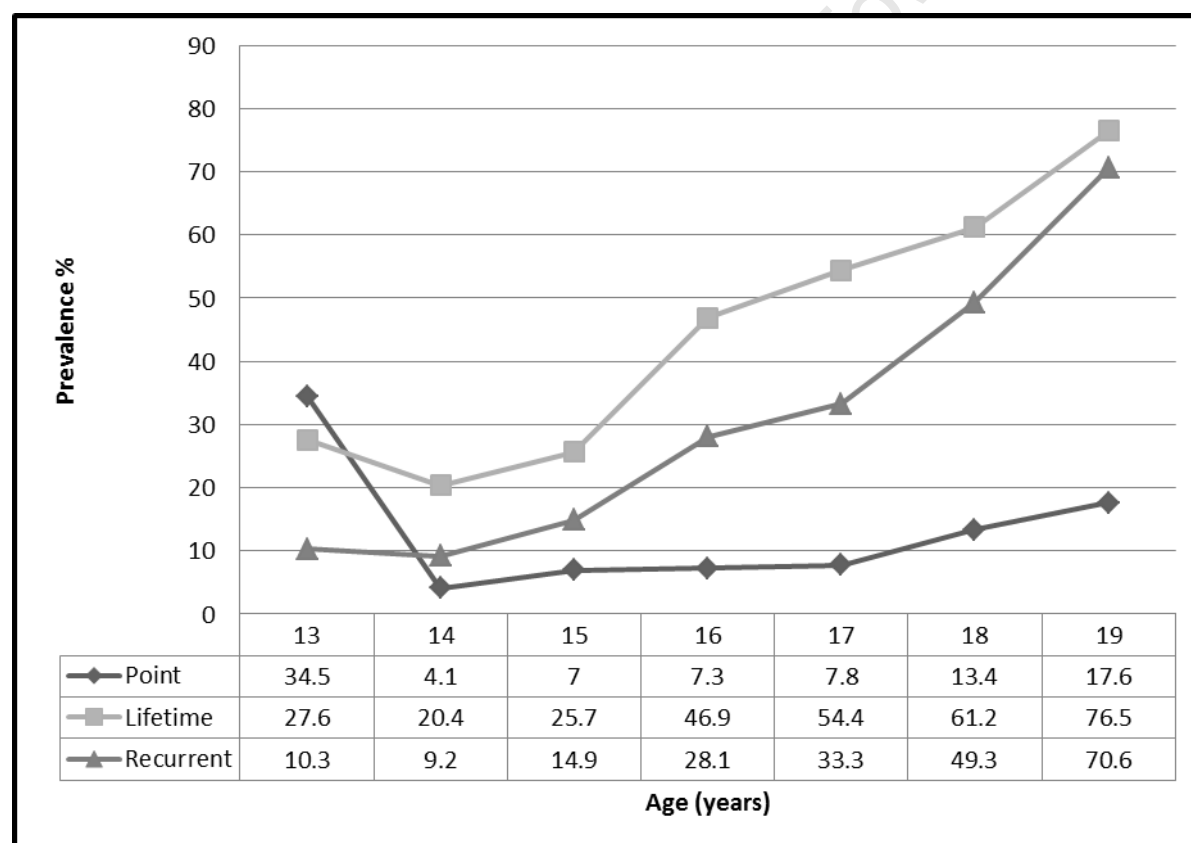


Figure 6: Lifetime, Point and Recurrent Prevalence of NSLBP in adolescence (n=532).

4.6 Characteristics of recurrent non-specific low back pain

Table 10: Characteristics of recurrent non-specific low back pain (n=153).

Characteristic		Males (%)	Females (%)	Total	χ^2	<i>p</i>
Frequency	Twice	13 (17.8)	20 (25.0)	33	1.78	0.41
	Thrice	21 (28.8)	17 (21.3)	38		
	> Thrice	39 (53.4)	43 (53.8)	82		
	Total	73	80	153		
Duration	1-7 days	62 (84.9)	69 (86.3)	131	1.26	0.74
	8-14 days	8 (11.0)	8 (10.0)	16		
	15-21 days	3 (4.1)	2 (2.5)	5		
	22-28 days	0 (0)	1(1.3)	1		
	≥ 1 month	0 (0)	0 (0)	0		
	Total	73	80	153		
Sciatica	Yes	17 (23.3)	15 (18.8)	32	0.48	0.49
	No	56 (76.7)	65 (81.2)	121		
	Total	73	80	153		
Medical Treatment	Yes	20 (27.4)	21 (26.4)	41	0.03	0.87
	No	53 (72.6)	59 (73.6)	112		
	Total	73	80	153		
Intensity(VAS)	Mean (SD)	3.9 (2.1)	5.5 (1.4)	4.8 (1.9)		

Table 10 above presents data on the characteristics of recurrent NSLBP with regard to frequency, duration and intensity of episodes experienced in the recall period of 12 months. In addition, data on sciatica and medical treatment for the recurrent NSLBP is illustrated. Recurrent NSLBP was associated with sciatica in 20.9% (n=32) of school-children. Both males and females were equally affected [$\chi^2 (1) = 0.48, p = 0.49$]. Although data not presented, the presence of sciatica among adolescents with recurrent NSLBP was not associated with age of the participants [$\chi^2 (6) = 8.61, p = 0.20$]. However, sciatica was significantly reported among the 19 year-olds [$\chi^2 (1) = 4.39, p = 0.04$].

The majority of school-children with recurrent NSLBP (n=82, 53.6%) experienced more than three episodes in 12 months. A significant proportion (19.6%) were having a recurrence on the day of the survey [$\chi^2 (1) = 22.3, p < 0.001$]. However, episodes of recurrent NSLBP were reported to last for less than a week for the majority of the school-children. In terms of gender, there were no significant differences in proportion between males and females in the report of frequency [$\chi^2 (2) = 1.78, p = 0.41$] and duration of LBP [$\chi^2 (3) = 1.26, p = 0.74$] experienced in the last 12 months.

4.6.1 Health seeking behaviour

Of the 153 school-children with recurrent NSLBP, 26.8% (n=41) reported having sought medical treatment for the symptoms. However, there was no significant difference between male (27.4%) and female (26.4%) students with respect to their health seeking behaviour [$\chi^2 (1) = 0.03, p = 0.87$]. In addition, health-seeking behaviour for recurrent NSLBP was not significantly associated with age [$\chi^2 (6) = 3.26, p = 0.78$], school type [$\chi^2 (1) = 2.92, p = 0.09$], frequency [$\chi^2 (2) = 1.65, p = 0.44$] and duration of an episode [$\chi^2 (3) = 4.66, p = 0.20$]. However, Table 11 below indicates that health-care seeking behaviour in school-children was significantly related to report of sciatica among school-children with recurrent NSLBP [$\chi^2 (1) = 47.9, p < 0.001$].

Table 11: The association between medical treatment and sciatica (n=153)

Characteristic		Sciatica		Total	Chi-Square	p value
		Yes (%)	No (%)			
Medical Treatment	Yes	24 (75)	17 (14)	41	$\chi^2 (1) = 47.9$	< 0.001
	No	8 (25)	104 (86)	112		
	Total	32	121	153		

In addition, Table 12 below indicates that health-seeking behaviour for recurrent NSLBP was significantly associated with pain intensity. For this analysis, pain intensity was dichotomised as mild pain (participants with < 5 score on VAS) and severe pain (participants with ≥ 5 score). The majority of school-children who sought treatment perceived the recurrent NSLBP to be severe in intensity.

Table 12: Association between medical treatment and pain intensity (n=153)

Characteristic		Pain Intensity		Total	χ^2 (1)	p value
		< 5 (%)	≥ 5 (%)		6.55	0.01
Medical Treatment	Yes	11 (16.4)	30 (34.9)	41		
	No	56 (83.6)	56 (65.1)	112		
	Total	67 (43.8)	86 (56.2)	153		

In addition, recurrent NSLBP was reported to be significantly intense by school-children who visited a health-care practitioner [$M=5.98$, SD (2.39)] compared to those who did not seek treatment [$M=4.32$ SD (1.53)] on the Visual Analogue Scale [t (151) = -5.03, $p < 0.001$]. In conclusion, these results indicate that treatment for LBP in school-children was associated with the report of sciatica and severe LBP.

4.6.2 Pain Intensity

The mean intensity of recurrent NSLBP was 4.8 ($SD=1.94$) on the Visual Analogue Scale. Females experienced intense pain [$M= 5.5$ SD (1.45)] compared to males whose mean intensity for recurrent NSLBP was 3.9 SD (2.06) [t (151) = -5.66, $p < 0.001$]. Across the age categories, Figure 7 below indicates that there were no significant differences in the mean intensity of recurrent NSLBP as determined by one-way ANOVA test [$F(6, 146)= 0.95$, $p=0.46$].

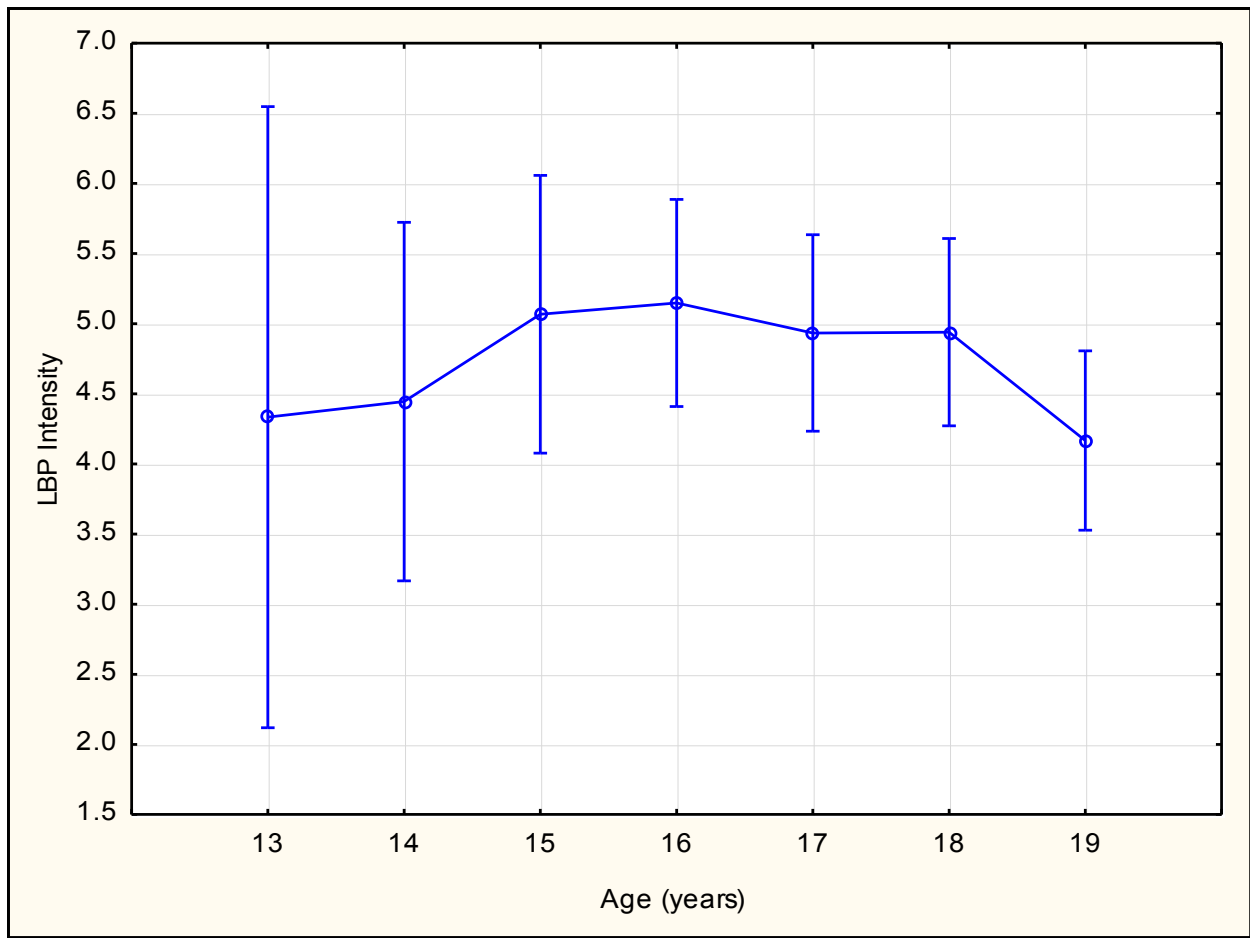


Figure 7: Mean Intensity of Recurrent NSLBP according to Age (n=153)

4.6.3 Functional limitations

Based on nine items adopted from the Hanover Functional Ability Questionnaire, school-children were asked to identify activities of daily living that were difficult to perform as a result of recurrent NSLBP. For analytical purposes, the disability scores were categorised into four limitation groups as 0-no limitations, 1-2 (low functional limitations), 3-4 (moderate functional limitations) and 5-9 (high functional limitations). Table 13 below indicates that 71.2% (n=109) of adolescents with recurrent NSLBP indicated having at least one of their activities of daily living compromised. Both males and females were equally affected for each category of functional limitations. However, Figure 8 indicates shows that the median disability score for female participants with recurrent NSLBP was four (IQR 2-5) and for males was three (IQR 2-5). As indicated by the Mann Whitney *U* test, the difference in the median ranking of disability scores between males and females was not statistically significant [$Z = -1.33$, $p = 0.18$].

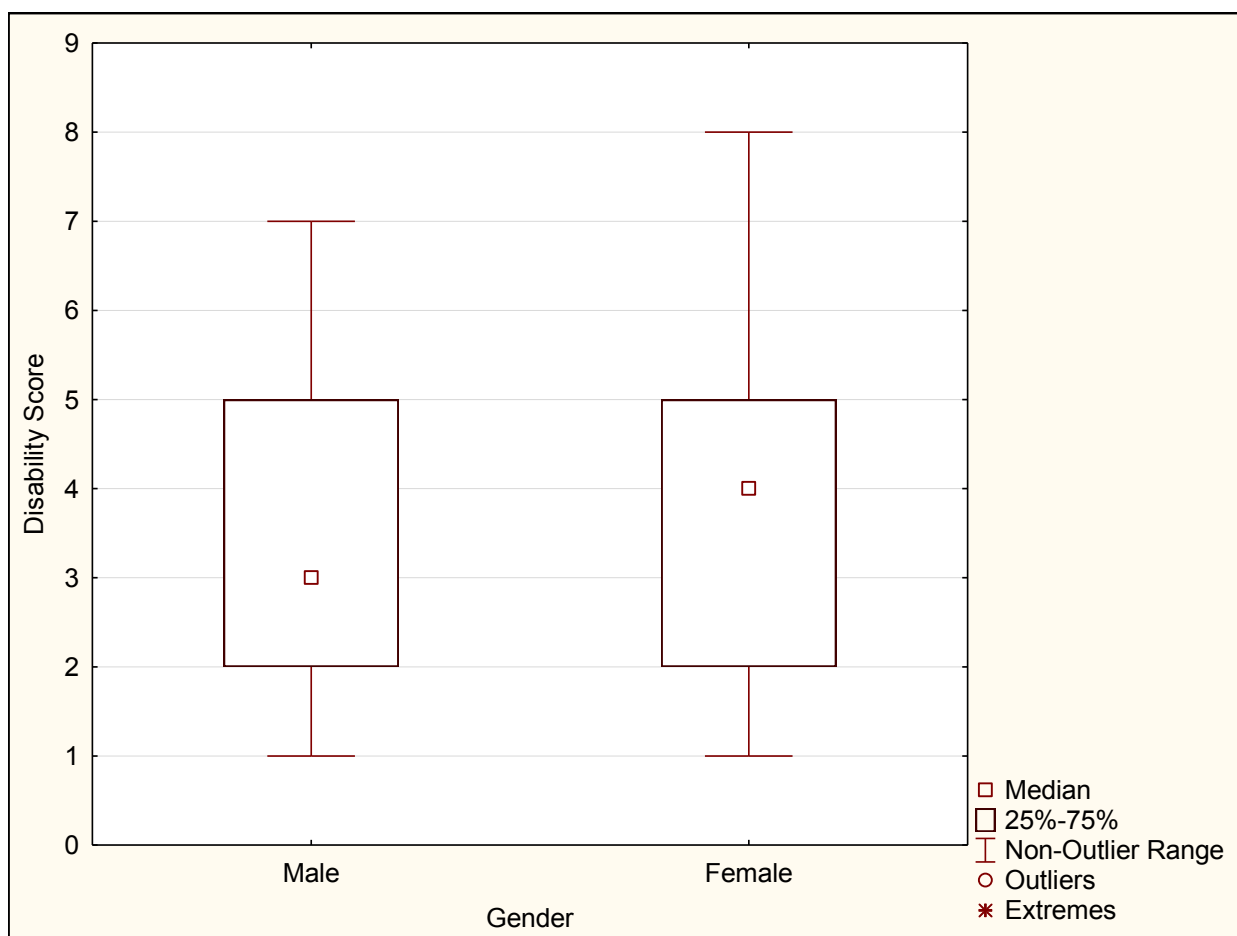


Figure 8: Box plot for participants with at least one functional limitation (n=153)

Table 13: Functional limitation scores by gender (n=153).

Disability scores	Males (%)	Females (%)	Total	Chi-square	<i>p</i> value
0 (no limitation)	22 (30.1)	22 (27.5)	44	$\chi^2 (1) = 0.13$	0.72
1-2 (low)	22 (30.1)	20 (25)	42	$\chi^2 (1) = 0.51$	0.48
3-4 (moderate)	11 (15.1)	13 (16.3)	24	$\chi^2 (1) = 0.04$	0.84
5-9 (high)	18 (24.7)	25 (31.3)	43	$\chi^2 (1) = 0.82$	0.36
Total	73	80	153		

Of interest were adolescents with high functional limitations. Table 13 above indicates that there were 28.1% (n=43) of school-children with recurrent NSLBP who reported having

difficulties with at least five activities of daily living. Both males and females were equally affected [$\chi^2(1) = 0.82, p = 0.36$]. However, an independent *t*-test was conducted to compare the mean age of adolescents between those with high disability scores and low disability scores. There was significant differences between adolescents with high disability scores ($M = 17.5$ years, $SD = 1.62$) and those with low disability scores ($M = 16.9$ years, $SD = 1.58$) [$t(151) = 1.97, p = 0.05$]. These results suggest that adolescents with disabling recurrent NSLBP were older than those with less disabling recurrent NSLBP.

Table 14: Daily living activities restricted (n=43)

Activity of daily life	Males	Females	Total (%)	$\chi^2(1)$	<i>p</i> value
Sitting on a school chair for a 30 minute lesson	14	16	30 (70)	0.94	0.33
Reaching up for a book on a high shelf	11	19	30 (70)	1.10	0.29
Standing over a long time at school or home	9	17	26 (60)	1.42	0.23
Walking for a long time for 30 minutes	13	11	24 (56)	0.01	0.94
Participation in sports at school or home	13	21	34 (79)	0.88	0.35
Bending down to put on socks	10	23	33 (77)	7.79	0.005
Carrying a school bag	6	17	23 (53)	5.06	0.02
Sitting up in bed from lying	10	9	19 (44)	1.62	0.20
Running fast for class or bus	8	9	17 (40)	0.31	0.58
Total	18	25	43		

Table 14 above indicates data on the specific activities of daily living reported by school-children with high disability scores as difficult to perform. The majority (79.1%) found sports participation difficult with no significant differences between males and females [$\chi^2(1) = 0.88, p = 0.35$]. Another activity reported to be difficult to perform was bending down to put on socks, an activity significantly reported by females compared to males [$\chi^2(1) = 7.79, p = 0.005$]. Other activities which gave the participating school-children difficulties included sitting on a chair for a 30-minute school lesson (69.8%) and reaching up to get school books from a high shelf (69.8%). Both genders were equally affected for the activities. Although 53.5% of adolescents reported difficulties with carrying school-bags because of recurrent

NSLBP, female students were significantly affected compared to male students [$\chi^2 (1) = 5.06, p=0.02$]. Nevertheless, there were no school-children with recurrent NSLBP who reported missing school because of LBP complaints. In addition, there was no significant association found between medical treatment and the level of disability imposed by recurrent NSLBP (Table 15 below).

Table 15: Health-seeking behaviour for participants with high disability scores (n=43)

Characteristic		Disability score		Total	$\chi^2 (1)$	p value
		< 5 (%)	5-9 (%)			
Medical Treatment	Yes	28 (25.5)	13 (30.2)	41	0.36	0.55
	No	82 (74.5)	30 (69.8)	112		
	Total	110	43	153		

4.7 Agreement between adolescent and parental reports of recurrent NSLBP

For analysis of agreement between school-children reports of recurrent NSLBP to parents report of the child's LBP status, comparisons were made on school-children's responses to the question "For the last 12 months, have you ever had pain in your lower back that lasted for one day or longer?" on the LBP study questionnaire and by the parents/guardians response to "In the past 12 months, has your child ever complained to you or any other family member of regular pain or discomfort in the lower part of his/her back, which lasted a day or longer, not related to the menstrual cycle in females?" in the Medical Health Questionnaire. Table 16 below indicates that amongst the school-children with or without recurrent NSLBP, responses from parents/guardians agreed in 16.3% and 98.7% of the cases, respectively.

Table 16: Agreement between child and parental reports (n=532).

Characteristic		Parental report of child LBP		Total
		Yes (%)	No (%)	
Child Recurrent NSLBP	Yes	25 (16.3)	128 (83.7)	153
	No	5 (1.3)	374 (98.7)	379
	Total	30	502	532

The Kappa statistic was used to assess whether agreement between school-children to parental reports exceeded chance levels and interpreted based on the criteria in Table 4.

The proportion of chance agreement was high (75%) and the value of kappa was 0.20 with a prevalence index and bias index of -0.65 and 0.23 respectively. These results indicate that much of recurrent NSLBP reported by school-children was not confirmed by the parents or guardians. However, as indicated in Table 17 below, there was a significant association found between adolescents' report of sciatica and parental responses to child recurrent NSLBP status. In addition, adolescent report on medical treatment was not significantly associated with parental responses to child recurrent NSLBP status. These results suggest that parents/guardians were more likely to agree with the child's response of recurrent NSLBP if the child had reported sciatica [$\chi^2 (1) = 6.55, p=0.01$] but not medical treatment [$\chi^2 (1) = 1.29, p= 0.26$].

Table 17: Parental responses to child report on sciatica and medical treatment (n=153)

Adolescent report		Parental responses		Total	χ^2	p
		Child has LBP (%)	Child has no LBP (%)			
Sciatica	Yes	10 (40)	22 (17.2)	32	6.55	0.01
	No	15 (60)	106 (82.8)	121		
	Total	25	128	153		
Medical Treatment	Yes	9 (36)	32 (25)	41	1.29	0.26
	No	16 (64)	96 (75)	112		
	Total	25	128	153		

4.8 Adolescent LBP and Parental LBP

There was a significant association found between adolescent recurrent NSLBP and parental/guardian report of LBP [$\chi^2 (1) = 4.33, p=0.04$]. Of the 532 Medical Health Questionnaires analysed, 17.5% (n=93) of parents/guardians reported a previous history of LBP. In addition, as indicated in Table 18 below, 37.6% of school-children with recurrent NSLBP had parents/guardians with LBP compared to 26.9% without recurrent NSLBP.

Table 18: Association between adolescent recurrent NSLBP and parental LBP (n=532)

Variable		Parental LBP		Total	Statistic	
		Yes (%)	No (%)		χ^2 (1)	<i>p</i>
Adolescent LBP	Yes	35 (37.6)	118 (26.9)	153	4.33	0.04
	No	58 (62.4)	321 (73.1)	379		
	Total	93	439	532		

4.9 School-bag characteristics

The data on the use, perceived school-bag weight, duration and method of carrying the school-bag by school-children with and without recurrent NSLBP are reported in Table 19 below.

Table 19: School bag characteristics of participants (n=532)

School-bag characteristic		LBP (%)	No LBP (%)	Total	X ² (df=1)	P
School bag use	Yes	151 (98.7)	374 (98.7)	525	0.00	0.99
	No	2 (1.3)	5 (1.3)	7		
Weight Perception	Heavy	72 (47.7)	41 (11)	113	85.9	<0.001
	Average	60 (39.7)	153 (40.9)	213	0.06	0.80
	Light	19 (12.6)	180 (48.1)	199	57.7	<0.001
Duration of carrying	< 5 min	8 (5.3)	77 (20.6)	85	18.5	<0.001
	5-10 min	14 (9.3)	81 (21.7)	95	11.1	<0.001
	11-20 min	19 (12.6)	74 (19.8)	93	3.83	0.05
	21-30 min	49 (32.5)	78 (20.9)	127	5.70	0.02
	> 30 min	61 (40.4)	64 (17.1)	125	32.2	<0.001
Method of carrying	Back	68 (45)	152 (40.6)	220	0.85	0.36
	Shoulders	56 (37.1)	148 (39.6)	204	0.28	0.60
	Hands	27 (17.9)	74 (19.8)	101	0.25	0.62

4.9.1 Use of school-bag and recurrent NSLBP

School bags were used by 98.7% (n=525) of the total school-children in the survey. As indicated in Table 19 above, there was no significant association found between use of a school-bag and the report of recurrent NSLBP among Zimbabwean adolescents. Although data not presented, there was also no significant association found between gender and school-bag use [$\chi^2 (1) = 1.81, p = 0.18$]. This indicates that school-children across the age spectrum carried school-bags to school.

4.9.2 Perceived weight of school-bags

As indicated in Table 19 above, the majority of the school-children perceived the school-bag weight to be average. There was no significant difference in proportion perceiving an average school-bag weight between school-children with recurrent NSLBP (39.7%) and those without (40.9%). However, school-children with recurrent NSLBP significantly reported school-bags to be heavy [$\chi^2 (1) = 85.9, p < 0.001$]. Almost half of school-children with recurrent NSLBP (47.7%) reported a heavy school-bag compared to 11% without pain. On the other hand, 48.1% of school-children without a report of recurrent NSLBP perceived the school bags as light compared to 12.6% with pain [$\chi^2 (1) = 57.7, p < 0.001$]. These results suggest that recurrent NSLBP among adolescents is related to the perceptions of a heavy school-bag. As indicated by the chi-square test, there was no significant difference in proportion between males and females for perceiving the school-bags to be heavy [$\chi^2 (1) = 0.15, p = 0.70$] and light [$\chi^2 (1) = 2.27, p = 0.13$] in weight.

4.9.3 Duration of carrying the school-bag

The data on the duration of carrying a school-bag for school-children with and without recurrent NSLBP are presented in Table 19 above. The duration of carrying the school bag was measured as the average time the participant has to carry the school-bag to and from school. Overall, as indicated by the Chi-square test, the report of recurrent NSLBP was related to the duration of carrying the school-bag [$\chi^2 (4) = 58.3, p < 0.001$]. However, recurrent NSLBP was significantly reported among school-children who spend over 20 minutes carrying the school-bag every day. In addition, the prevalence of recurrent NSLBP increased with duration of carrying the school-bag. Figure 9 below illustrates this trend, the prevalence rose from 5.3% for those who carried the school bag for less than 5 minutes to 40.4% for those who carried the school bag for more than 30 minutes daily.

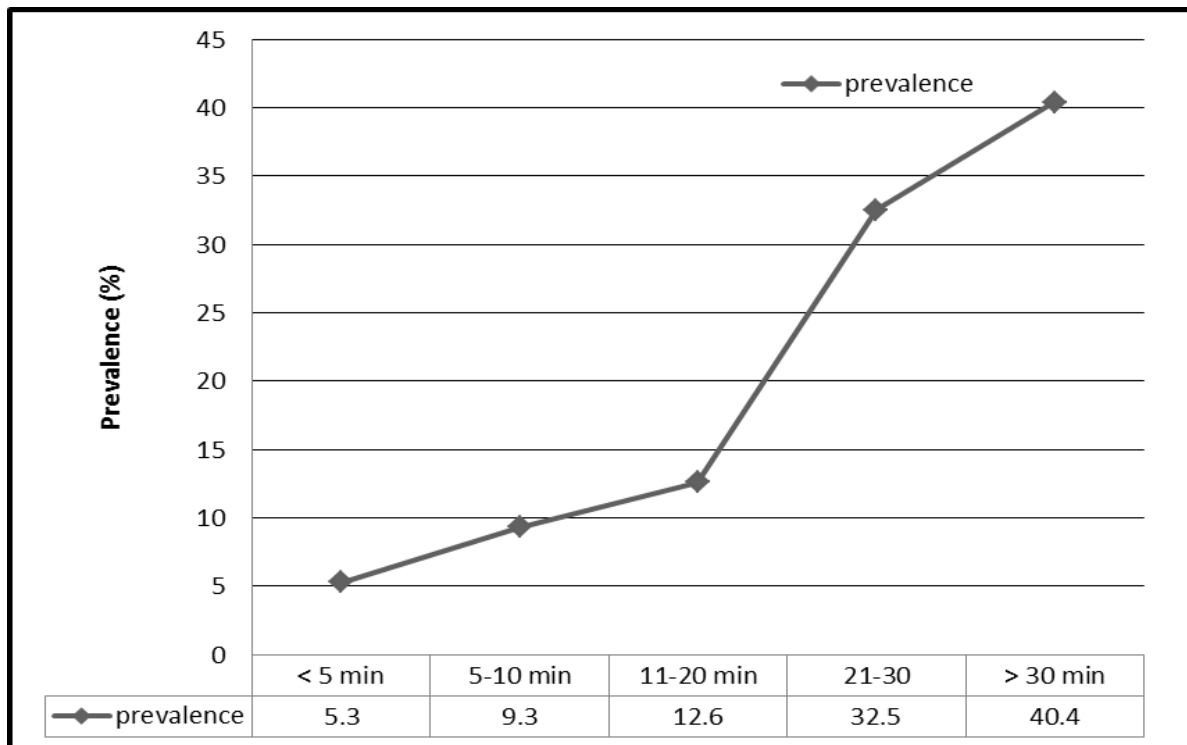


Figure 9: Prevalence of recurrent NSLBP by duration of carrying the school-bag (n=153)

4.10 Method of carrying the school-bag

The methods used to carry the school bags were different for the participants and the data are presented in Table 19 above. The majority of school-children (41.4%) commonly carried their school-bag over both shoulders (back). However, no significant association was found between that method of carrying the school-bag and recurrent NSLBP [$\chi^2 (1) = 0.85, p = 0.36$]. Other ways of carrying the school-bags reported were on one shoulder (38.9%) and as hand luggage (19.2%). Both methods were not associated significantly with the report of recurrent NSLBP. These results suggest that the method of carrying the school-bag was not related to the report of recurrent NSLBP among Zimbabwean adolescents.

4.11 Sports participation in adolescents

Table 20 below indicates data on sport participation by school-children and the amount of time spent participating in sport per week. As can be seen below, 40.8% (n=217) of the total school-children participated in competitive sport or exercised regularly at school or at home. However, there was a significant difference in proportion of school-children participating in sport between those with recurrent NSLBP (32.7%) and those without pain (44.7%) [$\chi^2 (1) = 5.85, p = 0.02$]. These results suggest that school-children without recurrent NSLBP participated more in sport compared to those with pain. Both males and females without recurrent NSLBP equally participated in sport [$\chi^2 (1) = 2.61, p = 0.11$].

In addition, data on time spent participating in sports are shown below (Table 20). The majority of school-children (n=68, 31.3%) spent 6-10 hours per week in competitive sports or exercises at school or at home. However, recurrent NSLBP was significantly reported among school-children spending 0-2 hours per week in sports. For the 2-4 hours group, there was no significant difference in sports participation between school-children with recurrent NSLBP and those without. However, the majority of school-children who spent 4-10 hours in sports participation had no recurrent NSLBP. These results indicate that recurrent NSLBP was associated with fewer hours in sport participation.

Table 20: Sport participation in school-children (n=532)

Characteristic		LBP (%)	No LBP (%)	Total	χ^2	<i>p</i> value
Sports participation	Yes	50 (32.7)	167 (44.1)	217	5.85	0.02
	No	103 (63.7)	212 (55.1)	315		
Duration (hrs)	0-2 hrs	24 (48)	16 (9.6)	31	37.8	< 0.001
	2-4 hrs	14 (28)	36 (21.6)	48	0.90	0.34
	4-6 hrs	8 (16)	55 (32.9)	63	5.36	0.02
	6-10 hrs	2 (4)	55 (32.9)	68		< 0.001*
	> 10 hrs	2 (4)	5 (3.0)	7		0.66*
	Total	50	167	217		

*- Fisher exact two tailed test

The majority of the school-children played a single sport. The six most commonly played sport were basketball (7.3%), football (5.6%), athletics (4.7%), volleyball (4.3%), tennis (3.4%) and rugby (3.4%). However, there were no significant differences in proportion between school-children with recurrent NSLBP and those without pain participating in these sporting activities. These results suggest that recurrent NSLBP is not related to a specific sporting discipline in adolescents.

4.12 Smoking and recurrent NSLBP

Table 21 below indicates data on the smoking status for the school-children. For analysis purposes, current (active) smokers were analysed separately from previous (lifetime) smokers. Of the 532 school-children, 9.2% (n=49) indicated that they have never smoked cigarettes in their lifetime. However, only 3.2% were “current smokers” having indicated that they at least smoked one cigarette in the past week. Nevertheless, there was no significant association found between smoking (active and lifetime) and recurrent NSLBP among the school-children.

Table 21: The relationship between smoking and LBP in school-children (n=532).

Smoking status		LBP (%)	No LBP (%)	Total	Chi-Square (df=1)	p value
Active Smokers	Yes	4 (2.6)	13 (3.4)	17	0.23	0.63
	No	149 (97.4)	366 (96.6)	515		
	Total	153	379	532		
Lifetime smokers	Yes	12 (7.8)	37 (9.8)	49	0.48	0.49
	No	141 (92.2)	342 (90.2)	483		
	Total	153	379	532		

4.13 Sedentary lifestyle and recurrent NSLBP

The data below represent the average time spent sedentary on leisure and entertainment activities for the participants per day. Recurrent low back pain was significantly associated with report of spending between four to six hours per day sitting ($p < 0.001$). On the other hand, the majority of the school-children without recurrent NSLBP spent less than four hours per day sedentary. There were no significant differences in proportion between school-children with recurrent NSLBP and those without among those who spend six-10 hours and ≥ 10 hours sitting per day.

Table 22: Association between sedentary time and recurrent NSLBP (n=532)

Characteristics		LBP (%)	No LBP (%)	Total	χ^2 (1)	P
Time spent in sitting/day	0-<2 hrs	14 (9.2)	61(16.1)	75	4.34	0.04
	2-<4 hrs	47 (30.7)	231(60.9)	278	39.9	<0.001
	4-<6 hrs	70 (45.8)	43 (11.3)	113	77.1	< 0.001
	6-<10 hrs	20 (13.1)	33 (8.7)	53	2.32	0.13
	≥10 hrs	2 (1.3)	11(2.9)	13	1.16	0.28

4.14 Results Summary

This study showed that non-specific LBP is relatively common among Zimbabwean adolescents in secondary schools with an average lifetime prevalence of 42.9% [95% CI= 41.4-43.3]. Males and females were equally affected, but LBP peaked significantly earlier in females. Nevertheless, point NSLBP was associated with the female gender. Almost a third (28.8%) of the adolescents reported having experienced recurrent NSLBP in the last 12 months prior to the study, with the majority reporting more than three episodes. However, most cases reported were mild short episodes presenting with some functional limitations but not leading to medical treatment. Nonetheless, treatment for recurrent NSLBP in school-children was associated with the report of sciatica and severity.

Univariate analysis showed that recurrent NSLBP was significantly associated with increasing age and a parental history of LBP. In addition, schoolbag related factors such as perceptions of a heavy school-bag, duration of carrying a school-bag significantly related to the report of recurrent NSLBP among adolescents. With regard to sport participation, recurrent NSLBP was reported among adolescents who either did not participate in sports completely or participated for less than two hours per week. In addition, adolescents who reported spending four to six hours every day on leisure activities such as watching TV reported recurrent NSLBP more frequently.

CHAPTER 5: PHASE 2 METHODOLOGY

5.1 Introduction

This chapter describes the methodology for phase 2 of the study. Based on the results of the prevalence survey, phase 2 aimed at comparing the influence of specific individual risk factors in school-children with and without recurrent NSLBP. The following sub-headings are presented under phase 2 methods: study design, target population, eligibility criteria, data collection tools, pilot study and ethical considerations.

5.2 Study design

A 1:1 matched case-control study design was conducted. Adolescents with a history of recurrent NSLBP were included into the case group. The symptomatic cases were matched to adolescents with no previous or current history of LBP (asymptomatic controls) on age, gender, school type and class. Case-controls studies have been reported to yield useful scientific findings in resource constrained situations of time and money (Grimes and Schulz, 2002).

5.3 Research setting

The study was conducted in government secondary schools previously used in the first phase of the study.

5.4 Target population

The target population included all school-children who indicated a previous history of recurrent NSLBP regardless of intensity and duration. Results of the first phase of the study showed that 153 school-children had experienced recurrent NSLBP in the last 12 months prior to the study.

5.5 Inclusion criteria

Not all respondents with recurrent NSLBP were included in the second phase of the study. Using the criteria outlined below, respondents who met the criteria below were included in the recurrent NSLBP category and were included in the study:

- Respondents who had sought treatment (from medical doctors, pharmacists, nurses, physiotherapists or traditional healers).
- Respondents whose pain was moderate to severe in intensity (VAS score of ≥ 5).
- Respondents whose recurrent NSLBP interfered with daily functional activities (a score of ≥ 5 on disability items).
- Respondents with recurrent NSLBP accompanied by sciatica.
- Respondents who verbally agreed and were willing to sign a statement of consent.

5.6 Exclusion criteria

- Respondents with “point” pain on the day of the physical measurements. This was because the current episode of LBP would limit their performance in some of the tests.
- Respondents who did not carry school bags to school on the day of the physical measurements.
- Respondents whose high hairstyles did not allow accurate height measurements to be performed.
- Respondents absent on the day of data collection.

5.7 Recruitment of Participants

Figure 10 below indicates a flow chart for the recruitment of study participants for the second phase of the study. From a completed data collection sheet of the first stage of the study, 32 respondents were identified to be eligible as symptomatic cases based on the inclusion criteria. The distribution of the respondents from the selected secondary schools is shown in the Table 23 below. To obtain the asymptomatic control sample, school-children in the same school and class matched for age and gender as the symptomatic cases with no history of non-specific LBP were randomly selected. The final sample therefore consisted of 32 adolescents with recurrent NSLBP (symptomatic: 13 males, 19 females) and 32 matched controls with no history of LBP (asymptomatic: 13 males, 19 females).

Table 23: Distribution of the 32 symptomatic cases by school

*Participating School	School Type/Category	Number of adolescents recruited
School A	S ₁	9
School B	S ₂	8
School C	S ₂	15

*No real school names were used.

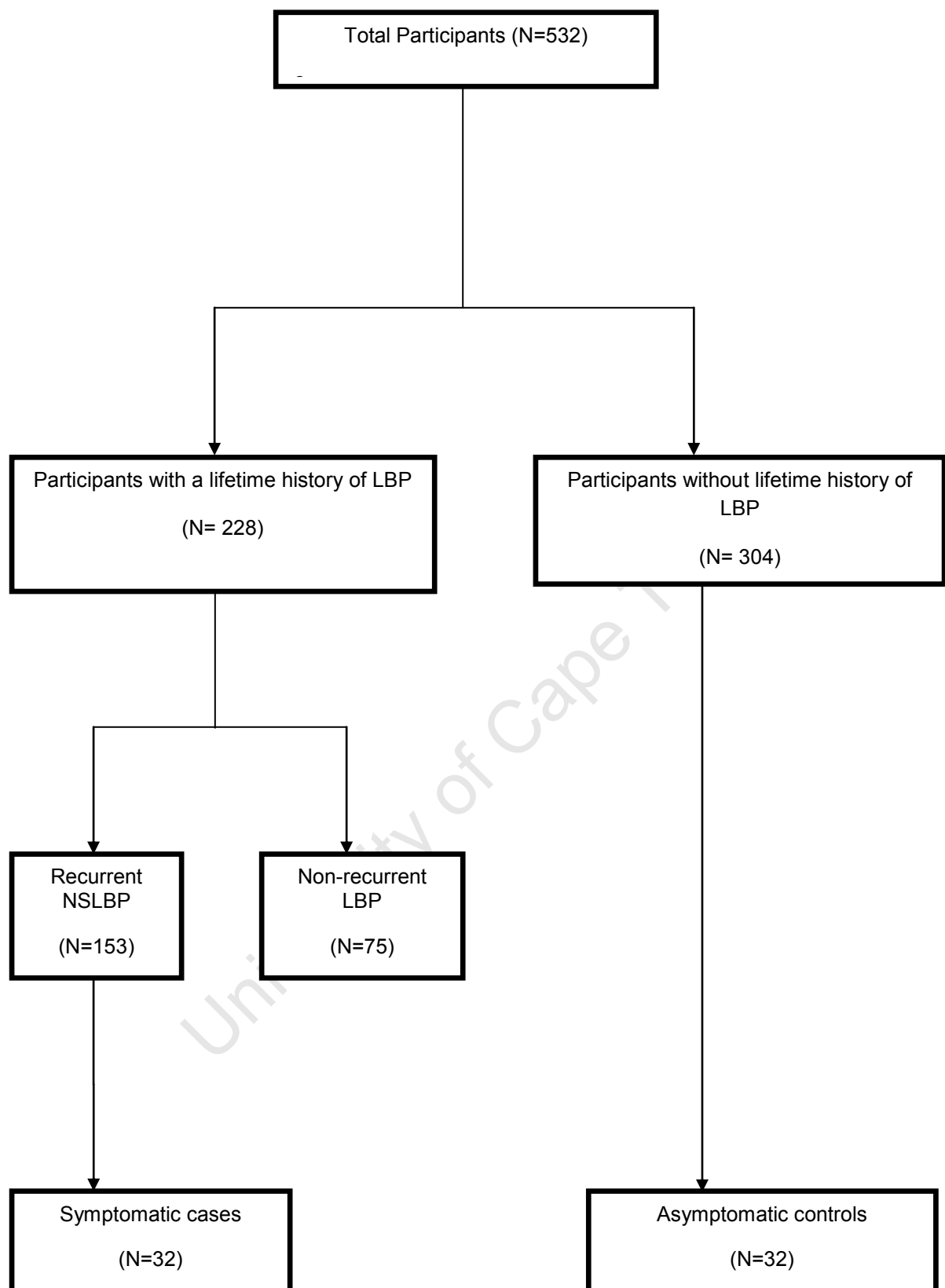


Figure 10: Recruitment flow chart for Phase 2 participants (n=64)

5.8 Instrumentation and Validity

5.8.1 Health-Related Quality of Life Questionnaire (HRQoL)

The EQ-5D-Y questionnaire (**Appendix L**), modified from the EQ-5D version for adults, was developed specifically to assess the HRQoL in children and adolescents (Ravens-Sieberer, Wille, Badia, Bonsel, Burstrom, Cavrini, Davlin, Egmar, Gusi, Herdman, Jelsma, Kind, Olivares, Scalone & Greiner, 2010). The EQ-5D-Y was tested in population surveys involving children from many cultures such as Italy, Germany, SA, Sweden, Spain and Netherlands (Eidt-koch, Mittendorf & Greiner, 2009; Jelsma and Ramma, 2010; Ravens-Sieberer et al, 2010; Wille, Badia, Bonsel, Burstrom, Ravens-sieberer, Scalone, Cavrini, Devlin, Egmar, Greiner, Gusi, Herdman, Jelsma, Kind, 2010). This formed the basis of using of the questionnaire in this study.

The questionnaire contains fifteen (15) items measuring five main domains: (1) Mobility, (2) Looking after Myself; (3) Doing Usual Activities; (4) Having Pain or Discomfort; (5) Feeling Worried, Sad or Unhappy. Each domain has three levels of problems reported: no problems, some problems or severe problems to give an objective health state of the participant (Jelsma and Ramma, 2010). In addition, the questionnaire has a vertical, graduated VAS to rate the general health between 0 (worst health state imaginable) to 100 (best health state imaginable) (Jelsma and Ramma, 2010; Wille et al, 2010). All the items refer to the health state "today" (Ravens-Sieberer et al, 2010).

The instrument has been subjected to critical assessment and has been found to be a valid and reliable measure of HRQoL in children eight years and older (Eidt-koch et al, 2009). A recent validity study conducted by Ravens-Sieberer et al (2010) among population samples of children and adolescents in above-mentioned countries concluded that the EQ-5D-Y was a reliable, feasible and valid instrument for the measurement of HRQoL in children and adolescents. However, unlike the adult version, it is not yet valid to derive utility scores.

5.8.2 Tape measure

An inflexible steel tape measure was used to measure standing height based on the guidelines outlined by Parnell (2011). To ensure reliability, two measurements were taken to calculate the average by the researcher. The measurements had to agree within 0.1 cm to be accepted, otherwise the researcher had to re-measure and select the average of the two best measures that agree the most.

Hamstring flexibility measurements were based on the CSR test as described in Baltaci et al (2003) and Jones et al (1998) studies. Of the several hamstring flexibility tests available in the literature, the CSR was employed because of cultural reasons. Female Zimbabwean

school-children wear short skirts (slightly above the knee) thus making it difficult for other traditional tests such as straight-leg raise (SLR) or sit and reach (SR) that exposes students to be used. To ensure accuracy, two measurements to the nearest 0.1 cm were taken for both legs (dominant leg vs. non-dominant leg) to calculate the average score. The leg yielding the best result determined the CSR score for the student.

5.8.3 Body weight scale

A standard body weight scale was used (Tanita White Daffodil Day Weight Scale UM-051) for two basic measurements: the participant's body weight and the participant school bag weight. The procedures for body weight measurements were based on the guidelines provided for schools by Parnell (2011). The weight scale was checked for accuracy against a known weight of sandbags weighing 5kg prior to its use.

5.8.4 Pilot study

A pilot study was conducted to assess the inter-rater reliability in height and flexibility measurements using two raters. A physiotherapist from UZ-CHS was recruited as the second rater. A convenient sample of 12 Physiotherapy Third Year students was used. Permission to conduct the pilot study was approved by the Chairperson of Rehabilitation Department from UZ-CHS (**Appendix M**). The physiotherapy students gave verbal consent to participate in the pilot study.

A private measuring area was established in the exercise laboratory. All the physical measurements were taken on the same day using the same instrument but following specific guidelines. The researcher measured the group of students first immediately followed by the second rater. For each variable, two separate measurements were performed on each participant to calculate the average. Table 24 indicates the intra-class correlation coefficient (ICC) results obtained for standing height and CSR scores between the two raters.

Table 24: Intra-class Correlation Coefficient

Intraclass Coefficient Correlation		
Number of subjects:	12	
Number of raters (k):	2	
Model:	The same raters for all subjects	
Type:	Absolute agreement	
Measurement:	rater_1	
	rater_2	
Measures	ICC ^a	95% CI
Average height measured ^b	0.9932	0.9769-0.9980
Average CSR measured	0.9564	0.9483-0.9588
a. The degree of absolute agreement among measurements.		
b. Estimates the reliability of average k ratings.		

5.9 Procedure

Fieldwork for the second phase of the study began in October 2012 during the last academic school term. The three participating schools were visited on separate occasions. The procedure included one week preparatory phase and two weeks of data collection.

5.9.1 Preparatory stage

The first visit to each school was to explain the study procedural issues to the school authorities and to identify symptomatic cases and recruit the asymptomatic controls. Verbal information was given explaining the nature of the second phase of the study outlining the procedure, risks and benefits to the students. At that stage, students who verbally agreed to participate were given an information letter (**Appendix N**) and an assent form (**Appendix O**) to sign. The assistant teachers were requested to sign as witnesses. However, on the aspect of the school-bags, the participating students were blinded to the fact that the study was about the relationship between LBP and school-bag weight. To that effect, participating students were told that the study was about “standing posture assessed when carrying a school bag” with no other information provided. This was done to capture the typical weight

of school bags and avoid the tampering of the schoolbag weight by students. In addition, this opportunity enabled dates and time for main study data collection to be fixed in each of the participating schools.

5.9.2 Fieldwork stage

Data collection took place on specific dates agreed upon with the school authorities. All the three participating schools provided an assistant teacher to organise the venue and to mobilise previously identified participating students from their different classes. Collection of data was done in the mornings for the reason suggested by Korovessis et al (2004). This was done to minimise the effect of fatigue on students and to counter possible diurnal variation in the physical measurements such as height. Moreover, this effort was to capture the typical weight of the school-bags.

An empty classroom was used for all the physical measurements. After the students had been assembled, the researcher reiterated the study protocol and discussed their concerns. Instructions on how to complete the HRQoL questionnaire were also provided.

Subsequently, the researcher requested the assistant teachers to make all the participating students randomly select a number placed in a box. The number was their entry number for the physical measurements. The assistant teacher would write the entry number for each student against the identity code number on a data sheet (**Appendix P**). Thereafter, all the participating students were instructed to wait outside the classroom and be notified by the assistant teacher to enter for their turn. This was done to blind the researcher to the groups (whether symptomatic group or asymptomatic control group) the participating students belonged to. The role of the principal researcher was only to conduct all the physical measurements and record the measurements against the student entry number on a data sheet (**Appendix Q**). The physical measurements were conducted in a circuit fashion in this order: CSR, body and school-bag weight and lastly height measurements. The EQ-5D-Y questionnaire was administered to each student soon after their physical measurements were completed.

5.9.2.1 Chair Sit and Reach test

The procedure used for measuring hamstring flexibility using the CSR test was based on the description by Baltaci et al (2003) and Jones et al (1996). The flexibility measurements were conducted before all other measurements were taken. This was because the test required a three minute warm up of static stretches supervised by the researcher before the actual measurements were performed.

The researcher began by explaining the rationale of the CSR test and demonstrating the procedure to the student. The students were instructed to remove any heavy outer clothing including school blazers, school jerseys, heavy socks, hats and shoes. Thereafter, the researcher together with the student would perform a three-minute general static stretch involving the shoulder arm stretches, trunk rotations stretches with arms on the waist, bilateral quadriceps femoris stretches in standing and the toe-touch stretches in the standing position. After that, a standard school-chair (seat height, 40cm) stabilised against a wall was provided for the student to sit on. The students were allowed to practice two demonstration trials before the actual test trial.

For the test trial, the researcher would instruct the participant to move forward to the front edge of the chair. The participants were then asked to point out their dominant leg side. Thereafter, the participants would be asked to straighten out (extend the knee) that leg keeping the heel on the floor but the foot facing forward (ankle in plantergrade, 90 degrees). The remaining leg was to be kept bent at the hip and knee with the sole of the foot flat on the floor. The instruction was to reach down the extended leg with hands superimposed to reach the toes but not stretching beyond the point of pain. However, if the extended leg begins to bend at the knee, the procedure was re-started. If this persisted after two corrective attempts, the researcher would record the CSR score reached at the moment the knee started to bend.

At the last stretch, the reached position would be held for five seconds while the researcher took the measurement. This measurement represented the distance from the tip of the middle finger to the middle toe. Reaches short of the toes were considered as negative scores, and those past the toes were positives. Subsequently, the procedure would be repeated for the non-dominant leg side.

5.9.2.2 Body Weight

The student's body weight measurements were conducted after the CSR test for hamstring flexibility. However, a period of two minutes rest was allowed in between the tests. The participants were instructed not to wear shoes but to empty their pockets of cell-phones, pocket bibles and mathematical sets. Before measuring each student, the researcher ensured that the weight scale was reading 0.0kg. In addition, after every measurement, the researcher would place a standard sandbag weighing 5kg to check for the accuracy of the scale.

Each body weight measurement began with the student stepping onto the scale platform with both feet with the instructions to look straight ahead and arms hanging naturally at their

side. The researcher would read and record the weight value to the nearest decimal point. The student would step off the weight scale, and the researcher would ensure that it reads 0.0kg again after placing a 5kg sandbag onto the scale, before taking second measurements. The body weight measurements had to agree within 0.1kg, otherwise a third measurement was taken. The student's weight was considered as the average of two best measurements that agreed within 0.1 kg.

5.9.2.3 School bag weight

After the body weight measurements were completed, participants were weighed whilst carrying their school bags. The participants would wear the school-bags prior to stepping onto the scale. The researcher had to ensure that the participants were carrying the school bags in the usual way they would carry the school bags to school. The school-bags were weighed as presented to the researcher by the participants without assessing for the contents of the bag.

Upon stepping onto the weighing scale, the participants were instructed to look straight ahead and hands hang naturally by their side. The researcher recorded the total weight (body weight plus bag weight) shown on the scale to the nearest 0.1kg. After each measurement, the researcher would ensure that scale read 0.0kg after weighing a known 5kg sandbag. Thereafter, a second measurement would be conducted and recorded. The two measurements had to agree within 0.1 kg; otherwise a third was conducted. An average of the two best recorded scores represented the total weight of the participant and the school-bag. However, the school-bag weight for each student was considered as the difference in weight between the total average weight obtained and the average student weight obtained initially.

5.9.2.4 Height

The height measurements immediately followed the school bag weight measurements. The school hats and shoes had to be removed. The participants would stand upright against the wall with instructions to make contact with the wall with their heels and their shoulders. In addition, the participants had to look straight ahead with hands hanging by their sides and legs together (Grimmer and Williams, 2000). Prior to the measurement, the researcher would place a 30 cm ruler on top of each student's head and mark a point on the wall with a board marker. The participants were instructed to remain still while this was being done (Steele et al, 2001). Other points were marked on the floor, at the tip of the big toes, to standardise subject positioning. The vertical length from the ground to a point marked on the wall represented the participant standing height. The assistant teacher would be instructed

to hold the tape measure stationary on the floor whilst the researcher aligned the tape measure to the top marking on the wall.

5.9.3 Eq-5d-y administration

After all the physical measurements were completed for each participant, the students were given the HRQoL questionnaire to complete in the classroom before the next student entered. The researcher gave verbal instructions on how to complete the questionnaire and provided assistance when necessary.

5.10 Ethical considerations

Phase 2 of the study was a follow-up study to a questionnaire-based survey screening for adolescents in secondary schools with recurrent NSLBP. Institutional approval had been sought earlier from the school authorities. In addition, parents of the participating students had been notified about the follow-up study in the parent information letter. However, students who participated in the second phase of the study had to give further assent for the physical measurements to be conducted. All the physical measurements of height, weight and hamstring flexibility were all based on validated procedures and were performed in the presence of senior teachers from the participating schools.

For the sake of confidentiality, all the physical measurements were conducted in empty classrooms. Furthermore, to avoid stigma and embarrassment, students' measurements were neither disclosed to members of school staff nor to other students. During data collection, no measurements were called out loudly or shown to other participating students. For the school bag measurements, the researcher weighed them as presented by the participants without assessing for inside contents. For the sake of anonymity, no personal names were used during data collection. The participating students were identified by their code numbers from the first phase of the study.

5.11 Data Management

All the raw data for the second phase of the research project was collated and entered on Microsoft Excel spread sheets. All computerised data was double-checked against the original data on paper, and corrected if necessary. The hard copies of the EQ-5D-Y questionnaire are kept under lock and key in the researcher's office cupboard.

5.12 Statistical analysis

Statistical analysis was performed using Statistica version 11. The Shapiro Wilk test was used to assess normality of variables because of the relatively small sample. Descriptive statistics, including mean with standard deviation for normally distributed continuous data, and median with the interquartile range for skewed data, were used to describe for the entire

sample. Comparisons were made between adolescents with and without recurrent NSLBP using t -tests or χ^2 tests of association for continuous and categorical data. The Fisher's exact test replaced the Chi-square test in 2×2 and 2×3 tables in case the expected frequency in any of the cells was less than 5. In all analyses, the statistical significance was set at 0.05. To test for association between BMI and LBP, students' weights were grouped into four categories: underweight, normal, overweight and obese based on age-specific percentile values provided by WHO (2007).

University of Cape Town

CHAPTER 6: RESULTS FOR CASE CONTROL STUDY

6.1 Introduction

This chapter presents results for the second phase of the study aimed at establishing association between objectively measured individual risk factors and recurrent NSLBP in adolescents. School-children with recurrent NSLBP, presented as symptomatic cases, were matched for age, gender, school class and type with school-children without recurrent NSLBP. All the participants agreed to participate and complete all the necessary measurements, yielding a 100% response rate.

6.2 General characteristics of the participants

Table 25: Baseline characteristics for Phase 2 participants (n=64)

Characteristics	Participants (n=64)
Age (Median, IQR) years	17 (15-18)
Gender (Male/Female)	26/38
Years of Education (Mean, SD) years	11 (1.61)
Weight (Mean, SD) kg	62.5 (6.39)
Standing Height (Mean, SD) cm	158.9 (10.3)
BMI (Mean, SD)	24.8 (3.02)
CSR (Mean, SD) cm	- 0.7 (3.32)

The characteristics of the study participants for Phase 2 are shown in Table 25. The sample consisted of 64 school-children, 32 symptomatic cases with recurrent NSLBP and 32 asymptomatic controls with no previous history of LBP. As can be seen in Figure 11 below, the age distribution of the participants was not normal as indicated by the Shapiro Wilk's test [$W= 0.93$, $p < 0.01$]. The median age of the participants was 17 years (IQR 15-18). In terms of gender, there were 26 males (13 symptomatic cases vs 13 asymptomatic controls) and 38 females (19 symptomatic cases vs 19 asymptomatic controls).

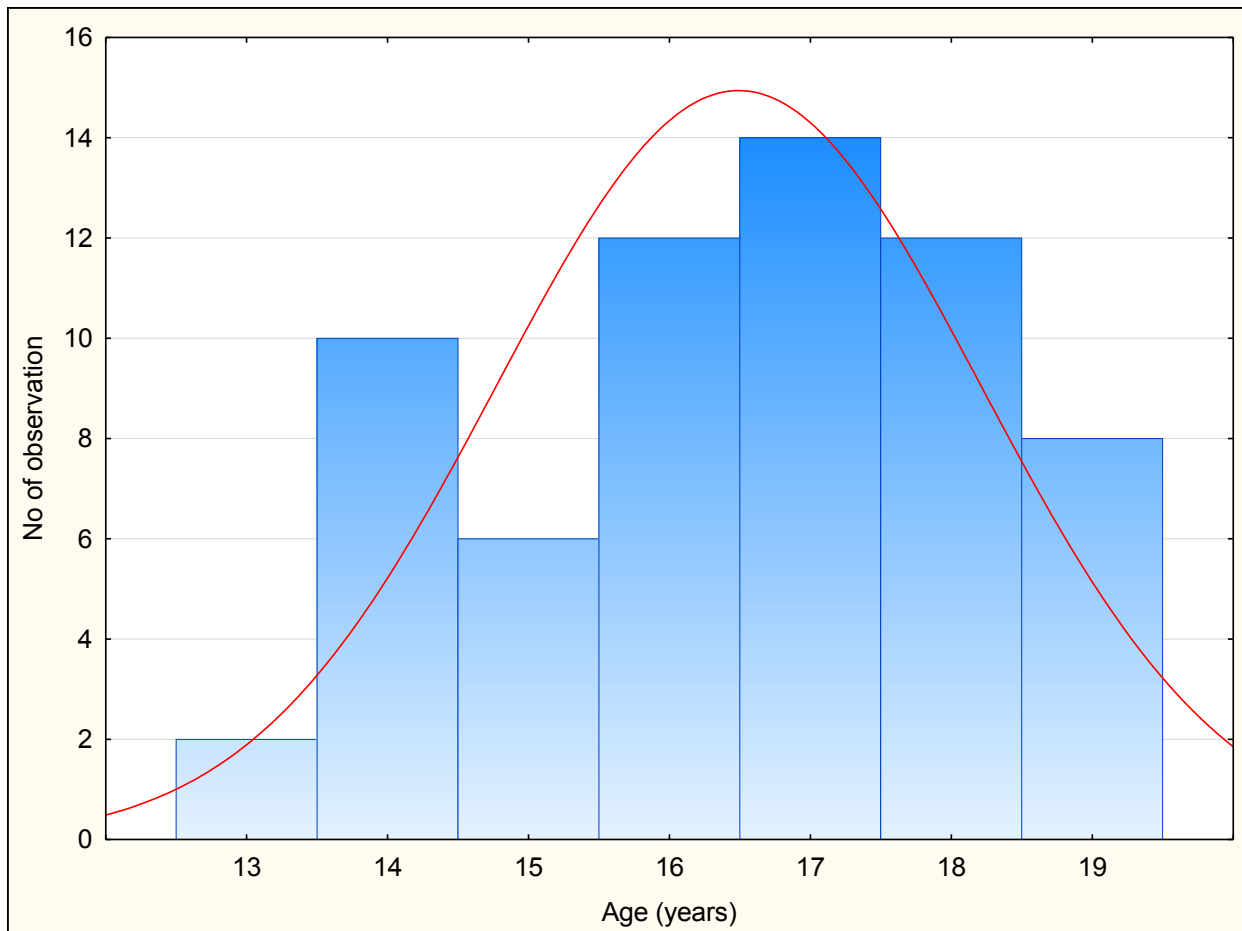


Figure 11: Histogram for the age distribution (n=64)

The body-weight data for the school-children followed a normal distribution [$W=0.99$, $p=0.68$]. The average body weight was 62.5 kg (SD =6.39). As indicated by the independent t -test, the difference in the mean body weight between symptomatic cases [$M=63.0$, SD = 7.23 kg] and asymptomatic controls [$M=62.1$, SD =5.50 kg] was not statistically significant [$t(64) = -0.56$, $p=0.58$]. In addition, data for height was normally distributed [$W=0.97$, $p=0.14$] with an average height of 158.9 cm (SD =10.3). However, there was no significant difference between symptomatic cases [$M=161.1$, SD =10.9 cm] and asymptomatic controls [$M=156.7$, SD =9.29 cm] in the mean height [$t(62) = -1.74$, $p=0.09$].

6.3 BMI and recurrent NSLBP

The average BMI of the school-children in Phase 2 was 24.8 (SD =3.02) kg/m² (Table 25). Between the symptomatic and the asymptomatic control groups, there was no significant difference in the mean BMI [$t(62) = 1.65$, $p=0.10$]. For those with recurrent NSLBP, the mean was 24.2 (SD=2.88) kg/m² compared to 25.2 (SD= 3.07) kg/m² without recurrent NSLBP. There was no significant difference in the proportion between symptomatic cases and asymptomatic controls in the categories for normal weight and overweight. In addition,

as indicated by the Fisher exact two tailed test, no significant differences were found in the obese and the underweight category. Additionally, there was no significant difference in the mean BMI between males ($M=25.4$, $SD=3.70$) and females ($M=24.4$, $SD=2.42$) in the sample [$t(62) = 1.33$, $p=0.19$].

6.4 Relative schoolbag weight and recurrent NSLBP

The data on the measured weight of the school-bags for Phase 2 participants are presented in Table 26 below. The weight data for the school-bags followed a normal distribution [$W=0.98$, $p=0.59$] with a mean weight of 5.02kg ($SD=0.93$, range 2.5-7.4kg). As indicated in Table 26 below, the mean school-bag weight for participants with recurrent NSLBP (symptomatic cases) was significantly higher compared to the mean school-bag weight for those without recurrent NSLBP (asymptomatic controls). In addition, the mean relative school-bag weight (mean school-bag weight expressed as a percentage of mean body weight) for all the participants was 8.1% ($SD=1.91$, range 3.9-13.1). However, there was no significant difference between symptomatic cases with recurrent NSLBP and asymptomatic control participants without LBP [$t(62) = -1.55$, $p=0.13$].

Table 26: Relative school-bag weight and recurrent NSLBP (n=64)

Outcome Measure		Cases (N=32)	Controls (N=32)	Difference between groups	
				Statistic (df)	p value
School-bag weight/ kg	Mean (SD)	5.27 (0.92)	4.78 (0.89)	$t(62) = -2.16$	0.03
Relative school-bag weight (%)	Mean (SD)	8.51 (2.08)	7.78 (1.69)	$t(62) = -1.55$	0.13
School-bag weight (%)	< 10% of BW*	23 (71.9)	29 (90.6)	Fisher exact	0.11
	≥ 10% of BW	9 (29.1)	3 (9.4)		

*BW- Body weight

As shown above in Table 26, according to a recognised cut-off point of 10%, the relative school-bag weight was dichotomised into two categories of heavy school-bags ($\geq 10\%$) and light ($< 10\%$). Almost a third (29.1%, $n=9$) of school-children with recurrent NSLBP carried heavy school-bags ($\geq 10\%$ of body weight) and 90.6% ($n=29$) of school-children without recurrent NSLBP were measured to carry light school-bags ($< 10\%$ of body weight). However, as indicated by the Fisher exact test, no significant association was found between heavy school-bags ($\geq 10\%$ of body weight) and the report of recurrent NSLBP.

6.5 Association between LBP and Hamstring flexibility

Table 27 below indicates flexibility characteristics of Phase 2 participants based on a hamstring chair-sit and reach test (CSR). As indicated in Table 25 above, the mean CSR score for all the participants was -0.70 cm (SD=3.32, range -8 to 5 cm). Between the groups (cases vs. controls), there was a significant difference in the mean CSR score [$t(62) = 3.18$, $p=0.002$]. The mean score for the symptomatic group was -1.91 (SD= 3.47) cm as compared to the mean score of 0.56 (SD=2.70) cm for the asymptomatic control group. This indicates that participants without recurrent NSLBP were flexible compared to participants with LBP.

Table 27: Results of CSR test for Hamstring flexibility (n=64)

Outcome Measure		Cases (N=32)	Controls (N=32)	Difference between groups	
				Statistic (df)	p value
CSR (cm)	Mean (SD)	-1.91 (3.47)	0.56 (2.70)	$t(62) = 3.18$	0.002
CSR (cm)	< 0 (inflexible)	22 (68.8)	11 (34.4)	$\chi^2(1) = 7.57$	0.006
	≥ 0 (flexible)	10 (31.2)	21 (65.6)		

In addition, to assess the association between hamstring flexibility and the report of LBP, the CSR scores were dichotomised as inflexible (CSR < 0 cm) and flexible (CSR \geq 0 cm). As indicated in Table 27 above, the majority of symptomatic cases (n=22) were in-flexible with a CSR score of less than 0 centimeters. In contrast, the majority of asymptomatic controls (n=21) were flexible with a CSR score of at least zero and above. The Chi-square found a significant association between hamstring flexibility scores based on the CSR test and the report of recurrent NSLBP [$\chi^2(1) = 7.57$, $p= 0.006$]. Additionally, as indicated by one-way ANOVA test, there were no significant differences in the mean CSR scores for hamstring flexibility across the weight status [$F(3, 60) = 0.44$, $p = 0.72$].

6.6 The relationship between HRQoL and recurrent NSLBP

Table 28 below indicates a comparison of the dimensions of the EQ-5D-Y that evaluated the HRQoL between symptomatic cases and asymptomatic controls. The EQ-5D-Y has five health-related dimensions; mobility, looking after myself, doing usual activities, having pain or discomfort, and feeling worried or sad. There were no significant differences in the domains of mobility, self-care, usual activities, and pain between symptomatic cases and asymptomatic controls. However, a significant difference was found between the two groups for the domain of feeling worried, sad or unhappy. Of the 32 symptomatic cases, 20

indicated that they were a bit worried or unhappy compared to nine asymptomatic participants. In contrast, there were 23 control participants who indicated that they were not worried compared to 11 cases with recurrent NSLBP. As indicated by the Fisher exact test, these findings suggest that the report of LBP was significantly associated with feeling worried, sad or unhappy ($p = 0.004$).

Table 28: Comparisons of the EQ-5D-Y dimensions (n=64)

Dimension		Cases (N=32)	Controls (N=32)	Statistic	p value
Mobility	No problem	27	24	Fisher exact	0.54
	Some problems	5	8		
	Lot of problems	0	0		
	Total	32	32		
Looking after self	No problem	32	31	Fisher exact	1.00
	Some problems	0	1		
	Lot of problems	0	0		
	Total	32	32		
Doing Usual Activities	No problem	29	26	Fisher exact	0.63
	Some problems	2	5		
	Lot of problems	1	1		
	Total	32	32		
Pain or discomfort	No pain	22	27	Fisher exact	0.24
	Some pain	10	5		
	Lot of pain	0	0		
	Total	32	32		
Worried or Sad	No worried	11	23	Fisher exact	0.004
	Bit worried	20	9		
	Much worried	1	0		
	Total	32	32		

6.6.1 The EQ-5D-Y VAS and recurrent NSLBP

The VAS on the EQ-5D-Y indicates the general health of individuals on a scale of 0 (worst imaginable health) to 100 (best imaginable health) on the day of the survey. As assessed by the Shapiro Wilk test, the VAS scores were not normally distributed [$W = 0.80$, $p < 0.001$]. The median score for all the participants was 95 (IQR 90-100) on the EQ-5D-Y visual

analogue scale. Figure 12 below depicts a box plot comparing the median VAS scores between the symptomatic group and the asymptomatic group. The median VAS score for participants with recurrent NSLBP was 95.0 IQR (90-100) and 94.0 IQR (87-100) for the asymptomatic participants. The Mann Whitney U test indicated no significant difference in the rank order of the VAS scores between the two groups ($U= 479$, $p= 0.66$). These results indicate that recurrent NSLBP was not associated with the general health of the participants.

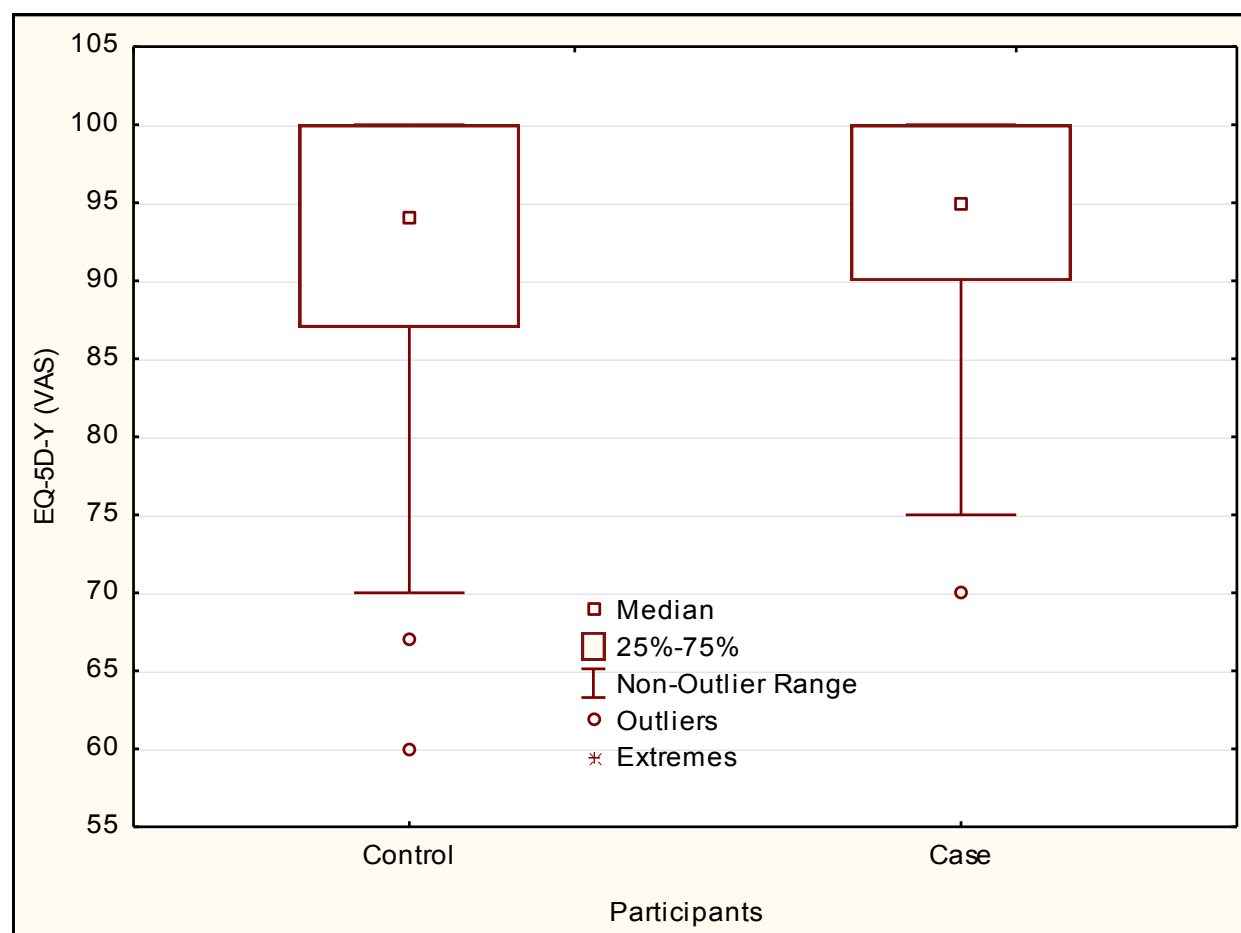


Figure 12: Box plot of the EQ-5D-Y VAS scores of participants (n=64)

6.7 Results Summary

In summary, this case control study indicated that the report of recurrent NSLBP among school-children was associated with absolute school-bag weight. The mean weight of the school-bags carried by school-children with recurrent NSLBP was significantly higher compared to those without. However, the school-bag weight as a percentage of students' body weight did not seem to have an influence on the report of recurrent NSLBP. In addition, recurrent NSLBP was reported more in school-children with tight hamstrings based on the CSR test. With regard to HRQoL, recurrent NSLBP had no significant effect on health-related quality of life in all dimensions of the EQ-5D-Y, except in one domain. The majority of

participants with recurrent NSLBP reported being a bit worried, sad or unhappy. As indicated by the VAS, recurrent NSLBP did not have a significant effect on the general health of the participants.

CHAPTER 7: PREVALENCE STUDY DISCUSSION

7.1 Introduction

This chapter discusses the results of the prevalence study among a sample of secondary school adolescents. The results will be discussed with reference to the aim and objectives of the study and in comparison with the findings of similar studies.

7.2 Response rates

The response rate from parents (94%) and adolescents (97.8%) was excellent. This is comparable with other cross-sectional studies in the literature (Kovacs et al, 2003; Mohseni-Bandpei et al, 2007; Shehab et al, 2005; Ayanniyi et al, 2011). Bias due to non-participation could not have influenced the observed results. Interplay of factors could have contributed to the high response rates. The self-administration of the study questionnaires to adolescents in structured environments (schools) could have had a positive impact. In addition, parents were informed of the study having had formal approval from the Ministry of Education, Sports, Arts and Culture and from the school principals. This could have encouraged them to participate in a school-based project that evaluated the health of their school-child.

7.3 Non-specific low back pain in adolescents

7.3.1 Lifetime prevalence

The lifetime prevalence of NSLBP was 42.9% among 532 Zimbabwean school-children aged between 13 and 19 years. This implies that two in every five adolescents had experienced a previous episode of non-specific LBP in their lifetime. Contrary to the traditional beliefs, these results confirm the assertion by Burton et al (2006) that LBP is a relatively common symptom in the young. In addition, the present study showed that the prevalence increased with increasing age from 13 years (27.6%) to 19 years (76.5%) despite inconsistencies at some ages. This has been reported in other cross-sectional studies (Ayanniyi et al, 2011; Jordaan et al, 2005; Jones et al, 2004) and indicates that LBP becomes increasingly common with age. These findings together with a well-known fact that adolescent LBP predicts adult LBP (Hestbaek, et al, 2006a; Jeffries et al, 2007) exposes a significant future health-care problem in Zimbabwe.

A review of the literature has indicated that the absolute lifetime prevalence figures of non-specific LBP in adolescents varies between studies. Nonetheless, the lifetime prevalence rate observed in this study falls within the range (7%-80%) reported in systematic reviews of adolescent LBP studies (Jeffries et al, 2007; Louw et al, 2007; Hill and Keating, 2009). The findings of this study are specifically consistent with the cross-sectional results of Jones et al (2004) who reported a lifetime prevalence of 40.2% among 500 school-children between the

ages of 10 and 16 years in the UK. In contrast, other studies have reported relatively higher lifetime prevalence than observed in Zimbabwe. Shehab et al (2004) reported a lifetime prevalence of 57.8% in 400 school-children aged between 10 and 18 years in Kuwait, so did Jordaan et al (2005) who reported a lifetime prevalence of 58% in 1 123 adolescents aged between 13 and 18 years in SA. These variations have been attributed to methodological or population differences (Smith and Leggat, 2007; Hill and Keating, 2009). For example, Jordaan et al (2005) used a relatively larger sample compared to this study. However, the possibility that LBP could have been under-reported in the present study cannot be over-ruled. This is because the screening question on lifetime prevalence had a kappa coefficient of 0.72 indicating substantial but not perfect agreement. This finding highlights the possible existence of recall bias secondary to a phenomenon described by Milanese and Grimmer (2010) of memory decay in lifetime events. Hence, it is possible that some adolescents forgot about past episodes of LBP yielding under-estimated prevalence figures.

7.3.1.1 The association between lifetime prevalence and gender

The present study showed no significant difference in the lifetime prevalence between males and females. These findings indicate that non-specific LBP affects males and females equally during adolescence. A few studies have shown similar findings of no significant gender difference in the literature (Jones et al, 2004; Murphy et al, 2007; Ayanniyi et al, 2011). Ayanniyi et al (2011) reported lifetime prevalence figures of 59.7% and 57.5% for males and females respectively [$\chi^2=1.493$, $p=0.222$] among 4 400 Nigerian school-children aged between 10 and 19 years. However, according to the authors, no explanation has been postulated in the literature for this. In addition, Jones et al (2004) showed consistent findings of no significant gender-effect in a cross-sectional study involving 500 school-children in the UK.

In contrast, the majority of studies indicates to a higher prevalence of LBP in females compared to males (Watson et al, 2003; Kovacs et al, 2003; Shehab et al, 2005) and yet others report a higher prevalence in males (Jordaan et al, 2005; HersHKovich et al, 2013). Although the actual reasons for the higher prevalence of spinal pain among females are unknown (Haselgrove et al, 2008), several authors have attributed this to the potential influence of menses. Pain emanating from menses has been confused with non-specific LBP (Grimmer and Williams, 2000; Harreby et al, 1999). Unlike the present study, Harreby et al (1999) observed this relationship between female gender and adolescent LBP but did not exclude LBP-related to menses in their methodologies. However, the onset of non-specific LBP peaked earlier in females (13 years) compared to males (16 years) in the present study. The reasons for this are not clear, but could be related to puberty-related factors such as menstruation and an accelerated growth spurt in females compared to in males (Grimmer

and Williams, 2000; Wedderkopp et al, 2005). This finding is in accordance with the report of Shehab et al (2004) who reported an earlier onset in females (13 years) compared to males (14 years) in 400 school-children aged between 10 and 18 years. In contrast, Jordaan et al (2005) reported that non-specific LBP commenced earlier in males than in females. In addition, the authors found that the lifetime prevalence of non-specific LBP was slightly higher in males compared to females (53.6% vs. 51.8%). Although this was not statistically significant, the authors attributed these findings to the higher concentration of testosterone during pubertal growth in males. According to Jordaan et al (2005), this results in the accelerated growth rate of the vertebral bodies which possibly leads to increased stress on the innervated structures of the spine resulting in pain. However, there is no scientific evidence for this hypothesis in the literature.

7.3.2 Point prevalence

The point prevalence of non-specific LBP was found to be 10% among Zimbabwean adolescents in schools. This means that one in every ten school-children reported having LBP on the day of the survey. From an epidemiological perspective, these findings represent the “current” burden of adolescents with non-specific LBP in secondary schools of Harare, Zimbabwe. In accordance, a recent systematic review of cross-sectional studies investigating the prevalence of LBP conducted by Louw et al (2007) evaluated point prevalence of non-specific LBP to be between 10% and 14% in African adolescents. Therefore, our findings confirm the endemic nature of non-specific LBP in adolescents. However, due to the nature of the cross-sectional study, these findings exposed a need for longitudinal studies to investigate for the temporal behaviour of point prevalence of non-specific LBP in adolescents. The point prevalence rates of non-specific LBP have been observed to vary between cross-sectional studies depending on the operational definition of “point”. Ayanniyi et al (2011) and Mohseni-Bandpei et al (2007) considered point pain as LBP on the day of survey and reported point prevalence figures in school-children of 17% and 15%, respectively. Jones et al (2004) and Bejia et al (2005) regarded it as LBP occurring during the course of the week and reported point prevalence figures of 15% and 13%, respectively.

There was a significant gender difference in the point prevalence of non-specific LBP among adolescents with a higher prevalence among females, a finding inconsistent with some previous reports (Jones et al 2004; Jordaan et al 2005) but similar to others (Shehab et al, 2004; Kovacs et al, 2003). In the present study, the point prevalence for males was 5.3% compared to 14.0% for females. This indicates that point LBP is associated with adolescent females. The reasons for this are not clear but could be in some gender (biological) or gender differences (behavioural differences) between males and females (Wedderkopp et al,

2005). Kovacs et al (2003) reported that females have a lower pain tolerance. The report of pain may be affected by self-report peculiarities between males and females. Females have been known to report the slightest of pain (lower pain threshold) (Kovacs et al, 2003; Haraldstad et al, 2010). Ayanniyi et al (2011) speculated that male participants worry less about pain compared to females. However, in contrast to the speculation by Ayanniyi et al (2011), the present study found no significant difference in the mean intensity of point LBP between males and females. This possibly indicates that both genders worry evenly about pain with regard to pain intensity. In addition, the study showed that the severity of point LBP was neither related to the age of the school-children as there was no significant difference in the mean intensity of point LBP across the age-spectrum.

7.3.3 Recurrent NSLBP

In the present study, recurrent NSLBP cases were identified based on a Delphi agreed definition provided by Stanton et al (2011). A small subset (28.8%) of school-children reported having experienced recurrent NSLBP in the last 12 months. In other words, more than half (67.1%) of the school-children who reported a lifetime history of non-specific LBP developed recurrent NSLBP. These findings provide support to recent epidemiological reports that LBP is recurrent in nature (Jones et al, 2004; Hestbaek et al, 2006a). Previously, non-specific LBP has been described as persistent, classified based on the duration of symptoms as acute, sub-acute or chronic (Burton et al, 2006). However, this study shows that much of adolescent LBP is recurrent characterised by symptomatic periods interspersed by symptom-free periods.

Sparse data are available regarding the prevalence of recurrent NSLBP in adolescents in the literature. The few studies that are available have reported different prevalent rates depending on the definition of recurrent NSLBP and the methods used. In accordance with the present study's findings, Sjolie (2004b) reported the prevalence of recurrent NSLBP in 32% of Norway school-children. However, this study showed a marked difference in the methodology with the present study. Sjolie (2004b) used a relatively small sample (n=88) and younger population of school-children with a mean age of 14.7 years. Additionally, the operational definition of recurrent NSLBP was different. The authors considered recurrent NSLBP as pain experienced for more than seven days over 12-months. There was no specific emphasis on the intensity and frequency of episodes that constituted a recurrence of LBP. This lack of homogeneity on the definition of recurrent NSLBP and its characteristics between studies has been identified as the primary cause of variability in the prevalence figures (Stanton et al, 2011).

In contrast to the findings of this study, a cross-sectional study by Jones et al (2004) that specifically evaluated recurrent NSLBP among 500 school-children aged 10 and 16 years in the United Kingdom, reported a lower prevalence of 13.1%. In the specific study, recurrent NSLBP was specified as LBP experienced “regularly” with no clarity on the definitional parameters such as duration of the painful episodes and the symptom-free period, pain intensity and frequency. In addition, a study conducted in Mozambique reported a prevalence of 13.5% in a study involving 204 school-children aged between 11 and 16 years (Prista et al, 2004). Similarly, Salminen et al (1999) reported a prevalence of recurrent NSLBP of 8% among 1 503 Finnish school-children aged 14 years. However, the high prevalence of recurrent NSLBP among Zimbabwean adolescents in comparison with the above-mentioned studies could be attributed to other possible factors. Since the study had no monetary benefits, it is highly unlikely that the school-children exaggerated or reported a non-existent problem. Therefore, recurrent NSLBP may indeed be an issue of major concern among Zimbabwean adolescents in secondary schools. However, due to the cross-sectional nature of the study, it is possible that respondents reported on multiple discrete episodes of non-specific LBP rather than one chronic condition with specified parameters. This could be attributed to two possible factors: the reliability of the screening question for recurrent NSLBP could have been questionable ($k=0.51$) and subjective morbidity could have inflated the prevalence figures through a concept described by Milanese and Grimmer (2010) as forward telescoping.

Although the adopted definition of recurrent NSLBP used in this study illustrates the key elements that characterise recurrent NSLBP and has an added advantage of being a Delphi consensus definition, its validity has not been tested in research involving adolescents. Therefore, cross-sectional studies similar to this study based on this definition needs to be interpreted with caution. However, the use of consensus-based definitions in LBP research allows for an improved ability to compare studies (Stanton et al, 2011).

7.3.3.1 Association between recurrent NSLBP, age and gender

There was no significant difference in the prevalence of recurrent NSLBP between males (29.7%) and females (28.0%); a finding shared by Jones et al (2004) and Bejia et al (2005). This indicates that recurrent NSLBP among Zimbabwean adolescents is not associated with gender. In the UK, Jones et al (2004) found similar results with 12.4% males and 13.9% females reporting recurrent NSLBP among 500 school-children aged between 10 and 16 years. However, other studies provided contradictory evidence emphasising female or male gender as a significant risk factor for recurrent NSLBP during adolescence. Harreby et al (1999) and Sjolie (2004b) used logistic regression to determine variables that had an independent effect on LBP among school-children. They reported significant odds ratio of

2.14 and 2.9 respectively for recurrent NSLBP in females. However, the factors that perpetuate recurrences of LBP in females are speculative and have not been fully investigated (Haselgrove et al, 2008). Females have been reported to have weaker trunk strength compared to males (Johnson et al, 2009). This, coupled with the changing anthropometric features that occur with puberty, may increase the risk for spinal pain in females (Haselgrove et al, 2008). On the other hand, Jordaan et al (2005) and Burton et al (1996) reported on male preponderance for recurrent NSLBP among adolescents. Given these inconsistent reports in the literature, it is important in future studies to clarify or re-examine the gender differences in the prevalence of recurrent NSLBP based on longitudinal studies.

In the present study, the prevalence of recurrent NSLBP was found to increase with age (from 10.3% at 13 years to 70.6% at the age of 19 years). This finding reinforces age as an important risk factor for the report of LBP in adolescents. Prior findings by Prista et al (2004) and Jones et al (2004) have been consistent with these results. Additionally, recurrent NSLBP was significantly associated with the older age groups of 18 and 19 years as compared to the younger age groups. This indicates that LBP becomes increasingly recurrent with advancing age. The contextual reasons for this increasing trend are not clear. However, Kristjansdottir and Rhee (2002) hinted that older adolescents may be more vulnerable to LBP compared to the younger adolescents because of being more active. Chiang et al (2006) justified the increase of LBP with age on the increasing educational demands with age. On the other hand, these findings may imply that older adolescents have a better understanding of the concept of recurrent NSLBP than younger adolescents (Szpalski et al, 2002; Haselgrove et al, 2008). Nevertheless, the fact that recurrent NSLBP was significantly reported in the older Zimbabwean adolescents highlights a major concern for the health professionals, the afflicted individuals and possible employers (workforce). These adolescents are about to commence adulthood, work-life or professional (tertiary) education already burdened with LBP. Given the possibility that the condition may even degenerate into a painful and chronic condition in adulthood, further investigations of this nature are important to establish baseline information on the magnitude of musculoskeletal disorders such as LBP in adolescents before work-related exposure.

7.4 Characteristics of recurrent NSLBP

A number of parameters were evaluated to assess the characteristics of recurrent NSLBP reported among Zimbabwean adolescents. This was done to understand the nature of recurrent NSLBP in adolescents with regard to frequency, intensity, and duration of episodes. However, a limited number of studies have specifically examined these aspects of recurrent NSLBP.

7.4.1 Frequency and duration of episodes

In the present study, more than half ($n=82$) of the school-children with recurrent NSLBP reported having experienced at least three episodes of LBP in 12 months. This strongly indicates that recurrent NSLBP is a common phenomenon and adolescents are vulnerable to many recurring episodes in a period of time; a finding shared by many authors (Jones et al, 2004; Hestbaek et al, 2006a; Jones and Macfarlane, 2009). In the majority of adolescents (85.6%), an episode of LBP was reported to last for a short period of time (less than seven days). Rarely was an episode reported to last for more than two weeks. This could reflect a favourable natural history of recurrent NSLBP in adolescents, a finding supported by Burton et al (1996). These results are consistent with those reported by Jones et al (2004) who found that the majority of LBP experiences reported in 400 school-children lasted less than seven days (78.2%).

7.4.2 Intensity of recurrent NSLBP

The school-children were asked to rate, on average, the perceived intensity of the various episodes of LBP they had experienced over a 12 months period. The mean intensity was reported to be 4.8 on the VAS. These findings support the conclusions of many epidemiological studies that reported on adolescent LBP being benign or mild (Pellise et al 2009; Watson et al, 2003; Ayanniyi et al, 2011; Masiero et al, 2008). Although with no clear details on the method used to evaluate the intensity of back pain, Ayanniyi et al (2011) observed that 56% ($n= 3185$) of the school-children with back pain reported the pain to be mild. From a primary prevention perspective, this finding is comforting and partially dismisses the need to lend exaggerated importance to symptoms of LBP in adolescents. However, recurrent NSLBP was reported to be significantly intense in females compared to males. The mean intensity for females was 5.5 ($SD=1.45$) compared to 3.9 ($SD= 2.06$) for males. This is not surprising as males and females have been reported to perceive pain differently (Masiero et al, 2007). Females are known to have a lower pain tolerance and lower pain thresholds (Kovacs et al, 2003; Haselgrove et al, 2008). In contrast, other studies have showed that LBP intensity was not influenced by gender. Masiero et al (2008) investigating non-specific LBP among 1 180 school-children aged between 13 and 15 years showed no significant difference in the mean intensity between males and females. This conflicting evidence highlights the importance of future studies to investigate the factors influencing the reporting and perception of pain between males and females.

7.4.3 Sciatica

Non-specific LBP has been reported to occur with or without symptoms of sciatica (Woolf and Pfleger, 2003). The present study found that a small proportion of Zimbabwean adolescents (20.9%) had recurrent NSLBP associated with sciatic symptoms. The presence

of sciatica in LBP patients has been regarded as an important indicator for severe (Boćkowski et al, 2007) and continuous LBP (Jones and Macfarlane, 2009). This suggests that adolescents with recurrent NSLBP characterised by sciatic symptoms deserve attention. There are a few population-studies that specifically evaluated the presence of sciatica in adolescents with recurrent NSLBP. In a clinical study conducted on 36 hospitalised patients between the ages of 10 and 18 years, Bockowski et al (2007) found that 52% had LBP and sciatica. Despite the small sample size used, the study highlighted the common occurrence of sciatica in adolescents with LBP. Watson et al (2002) reported a 31% prevalence of sciatica among 1 446 school-children aged between 11-14 years. Harreby et al (1999) considered sciatica as radiating pain down to the leg to below the knee and reported a prevalence of 4.7% among a cohort of 1 389 Danish school-children aged between 13 and 16 years. Unlike Harreby et al (1999) study, the present study had a broader definition of sciatica encompassing pain or discomfort experienced in a wider range of anatomical locations such as the buttocks, thighs, calves and feet. This could explain the higher prevalence of sciatica in the present study. However, the reported prevalence of sciatica among Zimbabwean adolescents with recurrent NSLBP could have been under-estimated. This is due to the cross-sectional nature of the study and the reliance on self-reported data. In addition, the reliability study conducted prior to the main study indicated that school-children had challenges understanding the concept of sciatica as evidenced by a fair kappa value ($k=0.32$).

The present study also indicated an association between sciatica and medical treatment. As matter of fact, 75% ($n=32$) of school-children who reported having sciatica had sought medical attention in the last 12 months. However, the present study did not differentiate the primary reason for medical treatment between sciatica and LBP. In addition, the details on the health-professional consulted were not captured. Nevertheless, these findings suggest an increased utilisation of health-care resources by adolescents reporting sciatic symptoms associated with recurrent NSLBP. The same conclusion was reached by Bockowski et al (2007) based on the clinical assessment of adolescent patients hospitalised with LBP. In addition, the present study observed an interesting relationship between sciatica and parental knowledge of child's recurrent NSLBP status. The parents/legal guardians knew about their child's recurrent NSLBP status if the child had reported symptoms of sciatica but not medical treatment. These findings strengthen the importance of sciatic symptoms in adolescents with recurrent NSLBP. However, these findings question the validity of reporting sciatic complaints in adolescents with LBP.

7.5 Consequences of recurrent NSLBP

7.5.1 Health seeking behaviour

Health-care seeking behaviour was reported in 26.8% of school-children with recurrent NSLBP. One in every four adolescents with recurrent NSLBP visited a medical practitioner in the last 12 months. This represents only 7% of the total cross-sectional sample of school-children in the study. These findings indicate that school-children rarely sought medical attention for recurrent NSLBP. This could be attributed to the benign nature of the condition. These findings are consistent with studies of Jones et al (2004) and Bejia et al (2005) who reported the prevalence of LBP necessitating medical treatment at 23.1% (representing 6.5% of the entire study sample) and 32.2% (representing 9.2% of the entire cohort). In another cross-sectional study conducted by Watson et al (2002) among 1 446 school-children aged 11-14 years 24% had visited a doctor with regard to LBP symptoms. The authors attributed the low health-seeking behaviour to the trivial nature of the symptoms. However, there is only one study that indicated contrasting evidence on the health-seeking behaviour of adolescents with LBP. Among Italian school-children, a study conducted by Masiero et al (2008) reported that health-seeking behaviour was as high as 77% of the 7 452 school-children who participated in the study. According to the authors, socio-cultural differences explain the varying reports in the health-care utilisation by adolescents with LBP. In addition, it is possible these variations could be attributed to the differences in the availability and affordability of medical services in various countries. In Nigeria, Ayanniyi et al (2011) found that the majority of school-children with LBP (27%) relied on self-medication (use of over-the-counter pharmacological products such as diclofenac, ibuprofen and aspirin) as compared to visiting a health professional (20%). Generally, health-professionals such as medical doctors and physiotherapists are expensive to consult especially considering the recurrent nature of the condition. Therefore, this restricts the use of health professionals by adolescents with LBP.

In this study, the factors leading to seeking health care among adolescents with recurrent NSLBP are not clear. However, this study indicated that the health-seeking behaviour among adolescents with recurrent NSLBP was associated with the pain intensity and the report of sciatica. These findings indicate that recurrent NSLBP is a medical concern among adolescents when severe (≥ 5 on VAS) or reported in combination with sciatica. This coincides with earlier findings of Ayanniyi et al (2011) and Bockowski et al (2007) who concluded that medical consultations for LBP among adolescents were because of severe pain or sciatic symptoms respectively. Although recurrent NSLBP was unlikely to lead to treatment in this study, the proportion of school-children who sought medical treatment for recurrent NSLBP in this present study could have been exaggerated. This conclusion is

made because the parents/guardians of the participating school-children failed to corroborate their children's recurrent NSLBP status. As a matter of fact, 83.7% of adolescent recurrent NSLBP cases reported were not known by parents. This raises concerns regarding the significance of recurrent NSLBP symptoms reported during adolescence. A number of factors may account for the lack of knowledge of adolescent recurrent NSLBP by parents. Watson et al (2002) argued that LBP may not be severe enough for adolescents to inform their parents. It is also possible that parents/guardians may have perceived reported symptoms of adolescent LBP as inconsequential (Haraldstad et al, 2010). According to Watson et al (2002), parents may forget about their child's symptoms or interpret them as not related to the back area. In Zimbabwe, it is generally believed, anecdotally, that LBP among the young age groups is associated with socially unacceptable behaviours such as early indulgence in sexual activities. Therefore, fear of admonishment from parents may cause adolescents to withhold symptoms of LBP. However in this study, parents knew about their child's recurrent NSLBP status if the child had reported sciatica but not treatment for LBP. This raises questions on the reliability of data for LBP medical treatment as reported by adolescents. In the Zimbabwean context, parents are responsible for consulting and paying for the medical services in case their child needs a health professional. Therefore, parents should have been aware of their child's recurrent NSLBP status for the adolescents who sought medical treatment. However, this was not true. The fact that sciatica was associated with parental knowledge of child recurrent NSLBP status suggests a possible existence of various other musculoskeletal problems such as lower limb muscular or joint pain which warranted medical treatment.

7.5.2 Functional consequences

The functional consequences of recurrent NSLBP were evaluated based on 9-items adopted from the Hanover Functional Ability Questionnaire. Almost three-quarters of adolescents with recurrent NSLBP (71.2%) expressed having difficulties with at least one activity of daily living. Both males and females were equally affected. These findings suggest that recurrent NSLBP was not severe enough to warrant a medical consultation in most of the cases, and may later present with functional consequences. This finding was shared by a number of authors (Watson et al, 2002; Jones and Macfarlane, 2009). In a community study, Watson et al (2002) found that 94% of school-children aged between 11-14 years with LBP had at least one degree of impairment on the same instrument. In addition, Jones and Macfarlane (2009) found that 65% of school-children with persistent LBP reported having at least two functional disabilities in a four-year prospective study conducted on a cohort of 330 school-children.

However, only a small proportion (28.1%) of adolescents reported having difficulties with at least five activities of daily living because of recurrent NSLBP. This indicates that recurrent

NSLBP rarely causes severe disability in adolescents. The activities that caused most difficulties for school-children were sport participation, bending down to put on socks, sitting on a chair for a 30 minute lesson and reaching-up to get school-books from a higher shelf. Females found certain activities significantly more difficult such as bending down and carrying a school-bag compared to males. In accordance with these findings, a cross-sectional study involving 500 school-children by Jones et al (2004) in the United Kingdom showed that 30.8% of the school-children with recurrent NSLBP had difficulties with participating in sports or physical activity than other cases of LBP. Additionally, Watson et al (2002) reported sport participation, sitting at school and carrying a school-bag as the activities which gave the most difficulty for school-children with LBP. In the present study, the factors that accounted for the association between the above-mentioned difficult activities and recurrent NSLBP are not clear. However, the activities seem to represent increased loading of the lumbar spine resulting in the exacerbation of existing pain.

Interestingly, this study indicated that severe functional disability secondary to the recurrent NSLBP was not associated with health-seeking behaviour in adolescents. This is in agreement with the findings of Watson et al (2002) among 1 446 school-children aged between 11 and 14 years who reported that LBP had an impact on daily life but does not translate to seeking health care. In addition, none of the school-children with recurrent NSLBP reported missing school in the present study. In contrast, recurrent NSLBP has been reported to cause school-absenteeism in some studies (Jones et al, 2004). In a previously described study by Jones et al (2004), 26.2% missed school because of recurrent NSLBP. This study's findings indicate that functional problems secondary to recurrent NSLBP are not worthy of medical care during adolescence. In addition, these findings could mean better coping strategies by adolescents with recurrent NSLBP or further illustrate the benign nature of the condition.

7.6 Subjectively-reported individual risk factors

7.6.1 School-bag use

There are no studies on the association between schoolbag-related factors and LBP among adolescents that have been published in Zimbabwe. The present study, therefore, serves as the baseline to describe any possible association between the two. The present study similar to other studies indicated that the majority of scholars carried bags to school (Puckree et al, 2004; Shamsoddini et al, 2010) and commonly carried the school-bags over both shoulders; a finding consistent with reports of Haselgrove et al (2008) and Sheir-Neiss et al (2003). According to Haselgrove et al (2008), a combination of education, changing fashion trends, and the design of more comfortable two strap backpacks explains the carrying of school-

bags over both shoulders by adolescents. However, the report of recurrent NSLBP among Zimbabwean adolescents was not associated with the method of carrying the school-bag. There were no significant differences in proportion between school-children with recurrent NSLBP and those without on the preferred method of carrying their school-bag. In line with these findings, Haselgrove et al (2008) observed no significant association between back pain and method of carrying a school-bag in a cross-sectional study conducted on 1 202 adolescents in Australia. This was despite over 85% of adolescents reporting carrying bags over both shoulders. These findings suggest that recurrent NSLBP among adolescents may not be related to the method of carrying bags. This could be due to school-children invariably changing the method of carriage due to the load of the school-bag as 41.9% (n=220) carried them on both shoulders, 38.9% (n=204) preferred the use of one shoulder, and 19.2% (n=101) carried school-bags as hand luggage. In contrast Puckree et al (2004) investigated the carrying of school-bags among 167 scholars between the ages of 11 and 14 years and found that carrying over both shoulders was significantly associated with back pain in SA. This was probably due to the majority of scholars (65%) using a back pack which 40% carried over both shoulders and the rest (35%) using a single strap bag. In addition, a recent study conducted in Egypt by Ibrahim (2012) found that school-bags carried over both shoulders and on one shoulder significantly related to LBP in 254 school-children aged between 6-14 years. The findings of the present study differ from Ibrahim (2012); this may be due to a younger sample (the present's study cohort was older-between 13 and 18 years of age). Between the ages of 12-14 years, the spine is reported to be at its most critical stage of development and stresses imposed by asymmetrical loading of carrying school-bags may reflect as pain or spine deformity (Grimmer and Williams, 2000; Vikat et al, 2000; Puckree et al, 2004). Using only one shoulder to carry the school-bag has been described as the most "inefficient" method of carrying school-bags due to of increased energy demands compared to carrying over both shoulders (Chiang et al, 2006).

Although method of carrying school-bags was inconsequential to LBP, the total time spent carrying the bag (to and from school) was significantly associated with the report of recurrent NSLBP among Zimbabwean adolescents in schools. The prevalence of recurrent NSLBP increased linearly with time from 5.3% (carrying less than 5 minutes daily) to 40.4% (carrying more than 30 minutes daily). However, recurrent NSLBP was significantly reported in school-children who spent over 20 minutes daily carrying the school-bag. These findings suggest that daily duration of carrying the school-bag for over 20 minutes may be associated with recurrent NSLBP in adolescents. This finding corresponds to that of Chiang et al (2006) and Negrini and Carabalona (2002). The fact that the association was found after over 20 minutes suggests that LBP might occur after a certain critical point of carrying the school-

bag. In spite of a low response rate (55%) and narrow age range, Chiang et al (2006) found that carrying for 11-30 minutes to school and for over 30 minutes from school was associated with LBP in 100 school-children between the ages of 13 and 14 years. Our findings reveal a major concern for the Zimbabwean adolescents in secondary schools who carry school-bags every school day.

7.6.1.1 Perceptions on school-bag weight

According to Haselgrove et al (2008), perceptions on school-bag load provide a useful general measure of the school-bag weight. The authors considered subjective perceptions on bag weight as reflective of personal characteristics such as muscle strength and muscle endurance. Along the same lines, Negrini and Carabalona (2002) reported that perceptions of a heavy school-bag may indicate poor trunk muscle endurance and control. Studies involving adults have reported decreased trunk muscle strength and control to be important risk factors for chronic LBP (Bayramoglu, Akman, Kilinc, Cetin, Yavuz & Ozker, 2001). In the present study, the majority of the school-children (40.5%, n=213) perceived the school-bags to be average in weight. However, a significant proportion of school-children with recurrent NSLBP perceived the school-bags to be heavy. These findings indicate that recurrent NSLBP during adolescence may be associated with a heavy school-bag. Prior findings have been inconsistent. Szpalski et al (2002) showed that school-children who responded positively to the question “do you find your satchel too heavy?” reported LBP. In addition, Van Gent et al (2003) found severe back pain associated with perceptions of a heavy school-bag among 745 adolescents aged 12-14 years. Haselgrove et al (2008) identified the perceived weight of the school-bag as a predictor of spinal pain in adolescents. In contrast, Negrini and Carabalona (2002) found “fatigue during backpack carrying” but not “feeling the backpack too heavy” directly associated with LBP. The conflicting evidence creates a need to verify for the possible association between perceived weight and the actual weight of the bag in future studies.

7.6.2 Sports participation

The narrative reviews of Ebbehøj et al (2002) and Cardon and Belague (2004) implicated intensive sports exposure as a risk factor for LBP in adolescents. Fritz and Clifford (2010) described the relationship between physical activity and LBP as curvilinear as both high and low levels of physical activity are associated with LBP in adolescents. In the present study, the role of participation in competitive sports at school or at home was studied. Sport participation among Zimbabwean adolescents was modest. Only two in every five school-children participated in competitive sport at school or home. The most commonly played sports were basketball and football, with the majority of the school-children (31.3%, n=68) spending 6-10 hours playing sports per week. There were no significant differences in

proportion between adolescents with recurrent NSLBP and those without with regard to the specific type of sport played.

The present study found that recurrent NSLBP was associated with non-participation in sports and the time spent playing sport. Significantly, there were more adolescents without recurrent NSLBP (44.1%) who engaged in sport compared to those with recurrent NSLBP (32.7%). In addition, recurrent NSLBP was reported in adolescents who spent less than four hours per week playing sports. No specific type of sport or physical activity was associated with recurrent NSLBP. These findings indicate that sport participation for four-10 hours, regardless of type of sport, may be protective of recurrent NSLBP among adolescents. Although this study's findings are consistent with results of Kaspiris et al (2010) and Szpalski et al (2002) who found sport participation had no significant influence on LBP, a number of studies have observed contradictory findings. Using logistic regression analysis, Kovacs et al (2003) found that self-reported LBP was associated significantly with practising any sport for more than twice per week in 7 361 school-children aged between 13 and 15 years. Along the same lines, Sato et al (2011) also indicated significant association between LBP and participation in a variety of sports, such as volleyball, athletics, judo, gymnastics, golf, and rugby with odds ratio exceeding 2 for each sport among 43 630 school-children aged between 9 and 15 years. The above-mentioned studies had larger samples and a relatively younger sample population compared to the present study. This may explain the discrepancy in the results. In addition, sport participation is not compulsory in many secondary schools in Zimbabwe. Increased educational demands may deprive students of sporting time. On average, Zimbabwean students spent eight hours at school, as classes commence at eight in the morning until mid-afternoon at four. These factors possibly explains the reduced level of sports participation of only 40.8% (n=217) reported in the present study compared to 79.5% in Sato et al (2011). Moreover, more than three-quarters (79.1%) of school-children with recurrent NSLBP indicated having difficulties with sports participation on the Hanover Functional Ability Questionnaire. However, due to the nature of this study, it is not clear if sport participation "caused" LBP or pre-existing symptoms of LBP were exacerbated by sport participation resulting in school-children avoiding taking part.

7.6.3 Smoking and recurrent NSLBP

Very few studies have addressed the correlation between tobacco consumption and LBP in school-children (Belague et al, 1999) with contradictory results (Kaspiris et al, 2010). Only 3.2% (n=17) of the total school-children reported to be active smokers and 9.2% (n=49) reported to have smoked in their lifetime. The present study found no association between smoking (lifetime and current) and recurrent NSLBP among Zimbabwean adolescents in schools. In accordance with the results of this study, Bejia et al (2005), Kovacs et al (2003)

and Masiero et al (2007) found no evidence of an association between smoking and LBP in adolescents. However, because the subject of smoking is a sensitive subject in the Zimbabwean context, there is a possibility that the problem could have been under-reported. This is possible with the cross-sectional nature of the data. A study conducted in a similar setting by Bandason and Rusakaniko (2010) on the prevalence of smoking and its associated factors among secondary school students indicated a relatively higher prevalence rate of current smokers of 8.5% and for ever-smoked at 28.8% in 650 school-children with a mean age of 16 years. However, a recent meta-analysis review of studies evaluating the association between smoking and LBP found a stronger association between “current” smoking and LBP in adolescents with an odds ratio of 1.82 (95% CI, 1.42-2.33) than in adults [OR 1.16, 95% CI, 1.02-1.32] (Shiri et al, 2010).

7.6.4 Sedentary lifestyle and recurrent NSLBP

Literature on the relationship between sedentary lifestyle and LBP among adolescents yielded mixed findings (Cardon and Belague, 2004). In the current study, the amount of time spent engaged in sedentary activities was compared between school-children with recurrent NSLBP and those without. Among Zimbabwean adolescents, the study indicated that recurrent NSLBP was significantly associated with the report of spending four to six hours engaged in the sedentary activities. These findings highlight the possible influence of prolonged sitting on spinal health. These findings add support to the conclusions of Sheir-Neiss et al (2003) who reported that adolescents are prone to LBP because of the time spent engaged in sedentary activities. Mohseni-Bandpei et al (2007) indicated similar findings that LBP was associated with watching television and the position of watching. In pre-adolescents, Gunzburg et al (1999) found that playing video games for two hours was linked to reports of LBP but watching television for the same number of hours was not. These findings indicate that the type of sedentary activity mostly engaged in may be an important factor in the report of LBP among adolescents. In a large cross-sectional study of 5 999 adolescents by Auvinen et al (2008), the authors found that the time spent in sedentary activities was related to adolescent LBP but the different kinds of sedentary activities were singly not associated with LBP. Therefore, in light of these findings, a comprehensive understanding of the impact of sedentary time on adolescent LBP may be enhanced by evaluating other aspects related to prolonged sitting such as type of activity engaged in or the sitting postures adopted.

In contrast, there are a number of studies that have provided contradictory findings on the association between LBP and the amount of time spent on sedentary activities (Watson et al, 2003; Yao et al, 2012; Bejia et al (2005); Kovacs et al, 2003). In China, Yao et al (2012) attributed the lack of association to the restrictions imposed by parents on watching

television and on-line games. Jones et al (2003), prospectively, demonstrated that previous sedentary activity (time spent watching TV or playing computer games yesterday) was not a short term risk factor for future LBP in a population-based cohort study conducted on 1046 school-children, aged 11 to 14 years at baseline.

CHAPTER 8: CASE CONTROL STUDY DISCUSSION

8.1 Introduction

This chapter discusses results of the second phase of the study which was conducted as a follow-up study to the prevalence survey. The results were discussed with reference to the specific objectives of the study.

8.2 Characteristics of the case-control sample

To the authors' knowledge, this is the first case-control study of the risk factors of recurrent NSLBP in an adolescent population in Harare, Zimbabwe. In the literature, few studies have used a case-control design to evaluate for risk factors of NSLBP among adolescents (Jones et al, 2005; Yao et al, 2012) compared to studies with cross-sectional designs (Ayanniyi et al, 2011; Watson et al, 2003) or longitudinal designs (Szpalski et al, 2002; Jones et al, 2003). In the current study, a sample of 64 adolescents (32 symptomatic cases and 32 asymptomatic controls) was used; a sample size comparable to a matched case-control study of Jones et al (2005). Among 54 adolescents, Jones, Stratton, Reilly and Unnithan (2005) evaluated biological risk indicators for recurrent NSLBP in the United Kingdom. In contrast, Yao et al (2012) conducted a 1:1 case-control study on a relatively larger sample ($n = 1\,214$) of adolescents in China.

A case-control design for the present study was appropriate to gain a basic understanding of some of the influential risk factors by comparing adolescents with and without recurrent NSLBP. The sample size of 64 school-children was modest and appropriate for feasibility reasons. It was not viable to conduct all the physical measurements of the second phase of the study on a larger sample because of time constraints. Only students with clinically significant recurrent NSLBP were identified and matched for age, gender, school type and class to students without a previous history of NSLBP for the Phase 2 study. Physical measurements were then conducted on the identified subjects. The participation rate was high (100%) as all the students completed the necessary measurements. Therefore, bias due to non-participation had no effect on the observed results.

There are two case-control studies in the literature on adolescent NSLBP (Jones et al, 2005; Yao et al, 2012). A comparative analysis of the two studies mentioned above with the current study revealed that our study sample was older and heavier. The sample used by Jones et al (2005) had mean age of 14.9 (SD=0.7) years and an average BMI of 21.1 kg/m². Yao et al (2012) reported a mean age of 15.14 \pm 2.13 years and an average BMI of 19.30 \pm 2.15 kg/m². The variations in the BMI could be explained partly by population differences particularly the age and anthropometric characteristics. Additionally, the present sample indicated poor muscle flexibility of the hamstring muscles with a negative mean value of 0.70

cm (SD=3.32) based on a CSR test. This indicates that the majority of the adolescents in the sample had reduced muscle flexibility. In accordance, Jones et al (2005) demonstrated muscle flexibility concerns with regard to lumbar and hip range of motion in their study sample. Adolescents especially between the ages of 15 and 18 years have been reported to have “stiff” muscles (Jordaan et al, 2005) secondary to rapid bone growth associated with the pubertal growth spurt (Feldman et al, 2001).

8.3 Recurrent NSLBP and BMI

A review of the literature on LBP by Cardon and Belague (2004) that included studies published since 1988 revealed no clear association between LBP and body mass index in adolescents. Some have reported an association between BMI and adolescent LBP but this association has not been validated by others. However, despite the lack of evidence-based confirmation of a possible role of BMI in the pathogenesis of LBP in adolescents, body mass index has been used widely as a measure of body fatness (Freedman and Bettylou, 2009) and in screening for weight categories leading to health problems (Yao et al, 2012).

In the present case-control study, no statistical association was found between recurrent NSLBP and BMI among Zimbabwean adolescents. These findings suggest that recurrent NSLBP may not be related to weight status after adjusting for age, gender and school class among adolescents. The reasons for this are not clear, but this might be justified with the moderate BMI measured for the school-children in the current study. The lack of association between LBP and BMI is in accordance with the results of many studies (Kovacs et al, 2003; Yao et al, 2012; Mohseni-Bandpei et al, 2007). For example, a recent case-control study by Yao et al (2012) in 1 214 Chinese adolescents (607 cases with LBP vs. 607 controls without LBP) with a mean age of 15 years found a negative association between BMI and LBP. The authors justified the negative association by the small physique of Chinese adolescents exemplified by low BMI values (19.45 ± 2.67 for case group vs. 19.25 ± 2.64 for control group). Along the same lines, Jones et al (2005) found no association between BMI and recurrent NSLBP using a relatively small sample of 56 adolescents in the UK (cases=28 vs. controls=28) with a mean age of 14.9 years (SD=0.7). Cross-sectionally, Mohseni-Bandpei et al (2007) also found no association between BMI and the prevalence of LBP among 5 000 Iranian secondary school-children between the ages of 11 and 14 years. Prospectively, Poussa et al (2005) found that neither BMI nor its change over years was associated with persistent LBP among 430 school-children. However there are studies that have established a positive association between LBP and BMI in adolescents. In a large cross-sectional study involving 1 126 school-children between the ages of 12 and 18 years in the United States, Sheir-Neiss et al (2003) reported larger BMI values in adolescents with LBP. Based on these results, it is possible that our sample size could have been too small to study the effects of

BMI on recurrent NSLBP among adolescents. In addition, based on a recent study involving 829 791 adolescents aged 17 years in Israel, HersHKovich et al (2013) found that adolescents with higher BMI's had higher odds ratios for LBP. Despite this the evidence of association, mechanisms underlying the association between increased BMI and LBP in adolescents have been described as "poor" (Shiri, Karppinen, Leino-Arjas, Solovieva & Viikari, 2009; HersHKovich et al, 2013). However, it is postulated that higher BMI's as in obesity could increase the mechanical load on the spine predisposing to pain due to compressive and increased shear forces (Shiri et al, 2009).

8.4 School bag weight and recurrent NSLBP

The mean weight of school-bags for the Zimbabwean adolescents in the case-control study was 5.02 (SD=0.93) kg; a finding comparable to some but not all studies. Some studies have reported different results with regard to the mean school-bag weight from 1.7 to 8.8 kg (Mohseni- Bandpei et al, 2007; Trevelyan and Legg, 2011; Dockrell et al, 2006; Negrini et al, 2004) depending on the age ranges of students in the included studies (Dockrell et al, 2006). For example, the mean weight of school-bags in our study was lighter than found by Sheir-Neiss et al (2003) who measured school-children aged between 12 and 18 years (8.3kg) but heavier than found by Puckree et al (2004) of 4.0 ± 1.3 kg among 176 scholars aged between 11 and 14 years. These variations in mean school-bag weight in the literature could reflect differences in the sample size and age of the participants. Sheir-Neiss et al (2003) had a relatively larger sample size (n= 1 126) compared to this study and in turn the study had a relatively older sample compared to the sample of Puckree et al (2004).

The wide range of school-bag weights (2.5-7.4kg) for the school-children in the present study could be partly explained by the varied educational demands among the subjects of different ages and school grades. Some students bring more books to school each day compared to others (Dockrell et al, 2006). However, the weight of the school-bags may have been under-estimated as they were weighed only once. A single baseline measurement of the school-bag weight may not have accurately reflected daily exposure of the school-children who carry bags every school-day. Previous studies have found substantial variability in school-bag weight depending on the day of the measurement (Negrini and Carabalona, 2002; Dockrell et al, 2006; Watson et al, 2003; Shamsoddini et al, 2010). According to a study by Dockrell et al (2006) on school-bag weight and the effects of school-bag carriage on 57 students with a mean age of 13.1 years, schoolbags were heaviest (Friday) and lightest (Tuesday) on specific days of the week. The authors found the range of bag weights between 1.6kg-11.3kg measured over five days; a finding comparable with the results of the present study.

The present study indicated that the mean school-bag weight for the school-children with recurrent NSLBP was significantly higher compared to the asymptomatic controls. The magnitude of difference between the groups in the mean weight of the schoolbags strongly suggests that recurrent NSLBP may be associated with the school-bag weight. Other studies had similar findings (Shamsoddini et al, 2010; Navuluri and Navuluri, 2006). Shamsoddini et al (2010) found that school-children reporting musculoskeletal symptoms of the shoulder, back and extremities had a significant mean school-bag weight of 2.59 (SD=0.63) kg compared to 2.31 (SD=0.67) kg for those without ($p < 0.05$). However, in contrast to the present study, the study had a cross-sectional design conducted on a relatively larger and much younger sample of 213 Iranian students (mean age, 13.4 ± 0.53 years) and the school bags were weighed for 15 different days. On the contrary, other studies provided conflicting results. Yao et al (2011) case-control study found that the weight of the school-bag among 1 214 adolescents was not related to LBP, as the case in several other cross-sectional studies (Bejia et al, 2005; Mohseni-Bandpei et al, 2007).

Several studies have focused on the school-bag weight relative to the body weight of the school-child (Moore et al, 2007; Chiang et al, 2006). This study showed that the mean weight of the school-bags was 8.1% of the body weight of the school-children investigated. This is less than the global standard of 10% proposed as a risk factor for LBP. In addition, the mean relative schoolbag weight was slightly higher for school-children with recurrent NSLBP ($M = 8.51$, $SD = 2.08$) compared to those without ($M = 7.78$, $SD = 1.69$), although this was not statistically significant. An explanation for the lack of significant association between relative school-bag weight and recurrent NSLBP could be that the school-bag weights carried in the present study were relatively low. In contrast, a study by Ibrahim (2012) found that Egyptian adolescents carrying a schoolbag whose weight was 20% of their body weight were more likely to report back pain. Although it seems that Zimbabwean adolescents are carrying "safe" school-bags with regard to weight, these findings suggest that controlling the school-bag weight may not be enough to prevent recurrent NSLBP in school-children. However our data provide indirect support for the 10% cut off point for relative school-bag weight for school-children, but future studies are needed to determine an appropriate cut-off point specific for the Zimbabwean population of school-children carrying school-bags. Previous studies have reported similar findings (Chiang et al, 2006; Watson et al, 2003). Among 100 adolescents between 13 and 14 years, Chiang et al (2006) reported a relative school-bag weight of 9.6% with no relationship with the report of LBP. However, the results for the cross-sectional study are subject to cautious interpretation due to a low response rate (55%). In one of the most carefully designed cross-sectional studies by Watson et al (2003) including 1 446 school-children, the median average load was 9.7% of the body weight but

there was no association with LBP. Actually the lowest risk of reporting LBP was found among those with carrying the highest percentage of body weight (Watson et al, 2003).

8.5 Hamstring flexibility and recurrent NSLBP

Muscle flexibility has been described as an essential component of health-related fitness especially in men (Castro-Pinero et al, 2013; Mikkelsen et al, 2006). The associated benefits of muscle flexibility are well documented, and include reduced injury risks, improved range of motion and motor performance. In adolescents, the association between hamstring flexibility and LBP is unclear (Cardon and Belague, 2004). Some investigations found hamstring tightness predictive of LBP in adolescents (Feldman et al, 2001; Jones et al, 2005) whereas others reported contradictory results (Harreby et al, 1999).

Recurrent NSLBP, in the present study, was associated with poor flexibility of the hamstring muscles based on the CSR test. This was indicated by a significantly higher mean CSR score for the asymptomatic controls without recurrent NSLBP ($M = 0.56$, $SD = 2.70$) compared to those with recurrent NSLBP ($M = -1.91$, $SD = 3.47$). As a matter of fact, about 70% ($n=22$) of the school-children with recurrent NSLBP had short hamstrings. These findings are suggestive of a possible influence of tight hamstrings on the development of LBP in adolescents. It is also possible that recurrent episodes of LBP could have had an effect on the hamstring flexibility resulting in reduced CSR scores. Risk factors such as inactivity have been reported to be associated with tight hamstrings (Feldman et al, 2001). Similar results were found among 502 Canadian high school-students (mean age, 13.8 years) by Feldman et al (2001) with an odds ratio of 1.04 (CI: 1.04 -1.06) for LBP for students with tight hamstrings. However, the results of Feldman et al (2001) should be interpreted with caution because of the relatively low response rate of 62%. The participants lost to follow-up after the first evaluation differed in age, mass and height with the included subjects. Nevertheless, muscle flexibility in adolescents has been known to be reduced especially between the ages of 15 and 18 years (Jordaan et al, 2005). This has been attributed to the accelerated growth spurt (Feldman et al, 2001) and the concomitant impact on the soft-tissues such as stiffness (Jordaan et al, 2005). Similarly, Sjolie (2004) reported poor hamstrings flexibility among school-children with recurrent NSLBP based on AKET test in a cross-sectional study involving 88 adolescents between the ages of 14 and 16 years adjusted for BMI. Weight status had no influence on the flexibility performance of the adolescents in this study, a finding which concurs with other studies (Castro-Pinero et al, 2013)

8.6 Health-Related Quality of Life and adolescent recurrent NSLBP

The objective was to compare the general health of the adolescents with recurrent NSLBP and those without. To the researchers, no study has analysed the relationship between HRQoL and recurrent NSLBP using the EQ-5D-Y among adolescents using a case-control design. Overall, the majority of the participants in the present case-control study perceived their general health to be high (IQR 95-100) on the VAS of the EQ-5D-Y. In addition, the VAS scores on general health were not influenced by the presence or absence of recurrent NSLBP. There were no significant differences in proportion between adolescents with recurrent NSLBP and those without in the following domains: mobility, self-care, usual activities and pain or discomfort. These results from the case-control study suggest that adolescents in schools have excellent HRQoL and the effect of recurrent NSLBP per se on adolescent HRQoL could be low. An explanation for this might be that adolescent LBP, although sometimes recurrent in nature, is benign and inconsequential to health. On the other hand, better coping strategies for adolescents with recurrent NSLBP may offer an alternate explanation. These findings parallel those reported by Pellise et al (2009) who evaluated the prevalence of LBP and its effect on HRQoL among 1 470 Spanish and Swiss school-children with mean age of 15.05 (SD=1.17 years). Although a cross-sectional design was used and adolescent HRQoL was evaluated using a different instrument, KIDSCREEN-52, the authors concluded that LBP has little effect on health-related quality of life. The KIDSCREEN-52 has been reported to have acceptable levels of internal consistency reliability in literature; Cronbach α value range from 0.73 to 0.89 for all KIDSCREEN dimensions (Tzavara et al, 2012; Pellise et al, 2009). However, the authors found that adolescents with LBP associated with several other pain sites in the body reported poorer HRQoL scores. This means that unless adolescent LBP is a symptom of a multidimensional health problem, it should not be a cause for concern. Similarly, Belague et al (2011) assessed the association between NSLBP and HRQoL among 1 407 school-children (mean age, 15.05 years) using a shorter version of the KIDSCREEN questionnaire, the KIDSCREEN-10, and found that LBP affected HRQoL marginally. Only adolescents reporting LBP with whole body pain reported significant quality of life impairments. These results support Pellise et al (2009) conclusions and together with the findings of this study reveal that recurrent NSLBP during adolescence is not severe enough to have detrimental effects on physical mobility, self-care activities and on the performance of daily usual activities. However, in the pain domain, no statistically significant difference was found between the school-children with recurrent NSLBP and those without. A possible explanation for this could be that the EQ-5D-Y evaluates “current” overall health based on individual perceptions and not “previous” health. The symptomatic cases were recruited on the basis of having a history of recurrent NSLBP but symptom-free on the day of the survey. This study

indicated that, of the 32 symptomatic cases, 22 reported having “no pain or discomfort” and only 10 indicated for “some pain or discomfort”. In comparison, five of the 32 asymptomatic controls indicated for “some pain or discomfort” and 27 reported “no pain”. These results are suggestive of possible pain or discomfort that could have been from other anatomical areas of the body. This highlights a possible strength of the EQ-5D-Y questionnaire in evaluating HRQoL among adolescents as it reveals other potential sources of pain. However, these findings also expose a significant shortcoming of the EQ-5D-Y in assessing HRQoL among adolescents with conditions characterised by recurrences and relapses.

Of importance, this study found a significant difference in proportion between the symptomatic cases and asymptomatic controls in the EQ-5D-Y domain of feeling worried, sad or unhappy. Of the 32 adolescents with recurrent NSLBP, 20 reported being a “bit worried” compared to only nine adolescents without LBP. This finding suggests that recurrent NSLBP in adolescents may be associated with subtle feelings of worry or unhappiness. Although interpretation of these findings is cautious because of the nature of the study and the size of the sample used, it is possible to hypothesise that recurrent NSLBP experienced by adolescents may result in psychological problems of worry, sadness or unhappiness. However, it is also possible that psychological factors could be perpetuating recurrences of LBP episodes in adolescents. Prospective and cross-sectional evidence exist that links LBP and psychological factors in adolescents (Jones et al, 2003; Watson et al, 2003; Jones and Macfarlane, 2009; Trevelyan and Legg, 2010). In a cross-sectional study involving 245 school-children between the ages of 11 and 14 years in New Zealand, Trevelyan and Legg (2010) investigated risk factors associated with back pain and found that emotional symptoms (worrying, unhappiness, nervousness and fear) were significantly associated with the report of back pain; a finding also shared by Gunzburg et al (1999), who reported the incidence of LBP to be significantly correlated with feelings of unhappiness in a cross-sectional study involving 392 school-children.

The results of this study is in contrast with those of O’Sullivan et al (2012) who concluded that adolescent chronic LBP at 17 years has a negative impact across a number of important domains on the SF-36 HRQoL questionnaire, particularly on the physical and mental HRQoL. Similar to the EQ-5D-Y questionnaire, the SF-36 has been validated in both adults and adolescents (Jörngården, Wettergen & Von Essen, 2006; Qu, Guo, Liu, Zhang & Sun, 2009). Although the subjects were more or less of the same age, the difference between this study’s results and those of O’Sullivan et al (2012) could be justified by a number of factors. Population and methodological differences could partly explain these differences. This study had a relatively small sample size compared to a cross-sectional sample size of 1 283 Australian adolescents used by O’Sullivan et al (2012). A multinational study conducted by

Ravens-Sieberer et al (2010) in Germany, Spain, Sweden, Italy and South Africa, to evaluate the reliability and validity of the EQ-5D-Y in children and adolescents found that the ability of the instrument to detect moderate impairments of HRQOL may be limited. Therefore, it could be that the EQ-5D-Y is less sensitive to detect differences in HRQoL in older adolescents in a relatively small sample compared to the SF-36 instrument.

CHAPTER 9: CONCLUSIONS & RECOMMENDATIONS

8.7 Prevalence of NSLBP in adolescents

This study provided evidence that non-specific LBP is prevalent in the younger age-groups, affecting a number of Zimbabwean adolescents in schools. It is a problem among all the age-groups of adolescents with the prevalence increasing with age. These findings illustrate an untapped health-care problem for the future. In the literature, adolescent NSLBP has been reported to be an important precursor for the development of chronic LBP in adults (Hestbaek et al, 2006). From a public health perspective, this study reveals the pervasiveness of LBP among adolescents but exposes a gap in understanding the transition process into adult LBP.

In a small proportion of adolescents, this study showed that NSLBP run a recurrent course, characterised by periods of exacerbations and symptom-free episodes. However, in the majority of adolescents, episodes of recurrent NSLBP are relatively mild and of short duration, presenting with some functional consequences and it is unlikely to lead to severe disability and medical treatment in the majority of adolescents. The impact of recurrent NSLBP on the health-related quality of life was minimal, although sufferers may experience subtle feelings of being sad or worried. Most of the parents of school-children with recurrent NSLBP are unaware of the LBP status of their children. The above-mentioned possibly underscore the trivial nature of recurrent NSLBP in adolescents.

Historically, LBP has been reported to be an adult condition that is associated with work-related factors (Limon et al, 2004; Yun et al, 2012). However, this study has indicated that non-specific symptoms of LBP start in early adolescence. The mean age of onset of non-specific LBP was 14.4 years, peaking earlier in females than in males. The reasons for this are not clear. However, this has been related to puberty-related factors or gender differences in pain reporting (Shehab and Al-Jarallah, 2005). The fact that school-going adolescents are being affected before work-life begins is a disturbing finding that requires attention. These findings highlight the need for LBP awareness or prevention strategies during, or even before the adolescence period. Although LBP commences early in females, the influence of gender seemed to be less specific. Both males and females were equally affected for lifetime and recurrent NSLBP. However, female gender was a significant risk factor for point LBP. Circumstantial reasons for these findings are not clear, but the results on point prevalence may indicate biological or gender differences in pain perception or pain reporting between females and males which may need to be investigated further.

8.8 Individual risk factors for adolescent recurrent NSLBP

A cross-sectional and case control design was used to identify risk factors of LBP.

Therefore, the actual causes of adolescent recurrent NSLBP cannot be deduced from the outcomes of this study. To fulfil this objective the study would have required a different research design. However, a number of factors were associated significantly with the report of adolescent recurrent NSLBP.

One of the most important outcomes from this study was the relationship between sport participation and recurrent NSLBP in adolescents. School-children who either did not participate in sports completely or participated for less than two hours per week were likely to report recurrent NSLBP. This implies that decreased physical activity in school-children may be related to increased occurrence of LBP. Although this relationship could be bidirectional, this cross-sectional evidence may provide a basis for recommending sports activity among school-children to reduce the prevalence of LBP. Additionally, school-children who sat four to six hours every day sedentary on leisure or entertainment activities reported recurrent NSLBP compared to those spent less. This adds to the importance of promoting physical activity in adolescents during school hours and after school at home. Another prominent finding was the significant association between recurrent NSLBP and hamstring flexibility. Adolescents with tight hamstrings were more likely to report recurrent NSLBP. Although it is not possible to conclude that tight hamstrings caused recurrent NSLBP, this relationship depicts the need to incorporate specific exercise programmes in schools aimed at maintaining muscle flexibility. This calls for re-resurrection of physical education programmes in the school curriculum.

Interestingly, this study did not observe cross-sectional evidence of a relationship between relative school bag weight and recurrent NSLBP. It seems that Zimbabwean school-children carry school-bags that are safe for their spinal health (less than 10% of body weight). However, an important factor to consider that emerged from this study was the significant relationship between the duration of carrying the school-bag and the reporting of recurrent NSLBP. The prevalence of recurrent NSLBP increased linearly with time. This should be of paramount importance to parents and teachers to restrict prolonged carrying of school-bags in school-children.

8.9 Recommendations for future research

Studies on adolescent LBP are still emerging, and in Zimbabwe more still needs to be done to understand the condition more before the work-life of the adolescent begins. Traditionally, the adolescence period has been considered as a healthy period of life not characterised by the complaints of conditions such as LBP. However, this study has indicated that LBP is a

prevalent symptom characterised by recurrent episodes in adolescents. Fortunately, recurrent NSLBP among adolescents seems to be benign and is associated with modifiable individual risk factors such as tight hamstrings and lack of physical activity (sports). Taking into account the results of the study, the following recommendations are made:

- Non-specific LBP is relatively common among adolescents in schools and is recurrent in some instances. However, there is a need to develop a greater understanding of the problem and ascertain the factors that precipitate recurrences of LBP episodes in adolescents. This will create a scientific base for effective health-promotion and interventional programmes in schools. Therefore, longitudinal cohort studies may be the next step to identify possible causative factors of recurrent NSLBP in adolescents and to appreciate the temporal effects of risk factors. However based on the present results, it suffices to recommend immediate spinal health promotional and strategies in secondary schools by health professionals to increase awareness of the condition in adolescents and to empower affected adolescents to self-manage based on advice and information.
- Adolescent recurrent NSLBP has been reported in the literature to lead to adult LBP. In addition, this study indicated that the prevalence of recurrent NSLBP increased with age. This justifies the need for long-term follow up studies to this present cross-sectional study to monitor the transition of LBP from adolescence into adulthood. Although the present study indicated that much of recurrent NSLBP symptomology is benign and inconsequential to health among adolescents. However, it is unknown if this could be said for the impact of recurrent NSLBP among adults in Zimbabwe. Therefore, there is a need for similar studies among adults to assess the impact of recurrent or chronic LBP in terms of HRQoL, functional consequences, hospitalisation and costs.
- This study highlighted the presence of non-specific LBP complaints among adolescents living and schooling in the urban areas. Before implementation of health-promotion activities targeting school-children in Zimbabwe, it would be important to replicate this study in a different setting such as rural schools or the private urban secondary schools. This will provide a comprehensive picture of the magnitude of the problem of LBP on a larger scale and the relative importance of risk factors.
- This study emphasised the identification of individual correlates for recurrent NSLBP. Future studies on adolescent LBP should embrace the bio-psychosocial nature of the condition and investigate, using a multidisciplinary approach, all the possible factors that could be responsible for LBP and the recurrent episodes. School-children with

recurrent NSLBP reported having subtle psychological problems than those without. In future studies, the role of psychological factors in the report of recurrent NSLBP need to be clarified in adolescents. In addition, it suffices to recommend the introduction of school psychological services to assist school-children deal with associated psychological issues.

- Given that a small subgroup of adolescents will report recurrent NSLBP, this beckons for health-promotion activities and LBP interventional programmes in schools to reduce the prevalence and severity of LBP. There is need to involve parents, school authorities, teachers and health-professionals in these programmes. Regular meetings could be scheduled in schools involving all stakeholders to discuss students' health concerns. The areas of focus should be multifaceted and should include: awareness of LBP, coping strategies, posture, school-environment, school-bag related factors, beneficial exercises and emphasise on lifestyle modification.
- There is a high need for randomised controlled trials that evaluate the role of educational and exercise interventions in curbing LBP among adolescents. In the meantime, it suffices to recommend to school-authorities to ensure that school-children participate in sport or physical activity for at least four hours per week. Future studies comparing the prevalence of recurrent NSLBP between sport group and non-sport groups in the adolescents are needed. This will enable researchers to fully understand the influence of sport in the development of recurrent NSLBP.
- This study indicated that time spent sedentary was associated with recurrent NSLBP in adolescents. However, this was based on self-report. In future, studies that do not rely on self-reported data but make use of objective measurements of sedentary time such as accelerometers would be necessary. This would provide more objective data to corroborate the subjective reporting on sedentary activity. In the meantime, it suffices to recommend to the parents to ensure that school-children do not spend more than four hours per day sedentary on entertainment activities such as watching television and video games.
- Although the relative school-bag weight was not associated with the report of adolescent recurrent NSLBP, more studies are needed in the future to determine the guidelines for acceptable loads to be carried by Zimbabwean adolescents in schools. Prolonged carrying of school-bag was shown to be associated with recurrent NSLBP. This calls for awareness in the schools about the possible dangers of carrying school-bags for prolonged period of time and as solution the possible introduction of lockers in schools.

- The study identified female gender as an important risk factor for point NSLBP. However, the explanations for this association are not clear in the literature. The role of puberty and accompanying hormonal changes has been speculated. There is need to understand more on the effect of pubertal hormones and the aetiology of LBP during adolescence possibly through randomised controlled trials. In addition, there is also a need to incorporate pre-adolescents without a menstrual history (school-children in the primary schools) in LBP research involving younger ages. This would enable researchers to understand the possible effect of menstruation on the development or reporting of LBP.

8.10 Critical assessment of the study

The study was the first of this nature to investigate for LBP among adolescents in Zimbabwe and the associated individual risk factors. However, it is premature to accept and generalise these findings until such a study has been repeated. Nevertheless, given the scarcity of studies in adolescents in Zimbabwe on LBP, this study provides a springboard for the future studies. The use of these study findings in the future depend on the strength of the study which could be attributed to the following:

- This study uniquely investigated the prevalence of recurrent NSLBP across all the age categories of adolescents in their primary societal arena: schools. In addition, this study had an added advantage of that adolescent responses on recurrent NSLBP were confirmed by a questioning parents regarding their child's recurrent NSLBP status. Most importantly, the study findings were consistent with findings from other cross-sectional studies in the literature.
- This study was conducted in two continuous phases. Using a large cross-sectional sample (n=532), the first phase of the study identified adolescents with reports of severe recurrent NSLBP. Subsequently, these adolescents were matched in 1:1 case-control study during the second phase to assess the influence of specific risk factors. This methodology illustrates an attempt to identify the most vulnerable adolescents to LBP and assess the factors associated with the report of the condition. In addition, the case-control highlights an attempt to neutralise the confounding influence of the demographic factors such as age and gender on the report of recurrent NSLBP.
- The response rate from both the school-children and parents was satisfactory. Therefore, non-participation bias had no effect on the observed findings. The recruitment of secondary schools and subjects was random.

- The LBP study questionnaire was subjected to content validity and reliability testing prior to the main study. The questionnaire was found to be comprehensible and reproducible. The Medical Health Questionnaire, which solicited the past medical history of school-children, was adopted and modified from a validated version previously used by Fannuchi et al (2009) for South African adolescents. In the study, two methods of assessment were used to identify LBP: a direct question and a pre-shaded manikin. In addition, the definition of non-specific LBP used in this study is internationally recognised. Furthermore, the study was based on a Delphi definition of recurrent NSLBP. Most studies have relied on arbitrary or pragmatic definitions not supported by scientific arguments. The HRQoL was assessed using a validated tool, the EQ-5D-Y. However, the questionnaire has not been tested for validity and reliability among Zimbabwean adolescents.
- The study had a relatively large sample size comparable to cross-sectional samples of other studies in the literature. The sample size was calculated based on an absolute prevalence rate of recurrent NSLBP among adolescents in a regional country of Mozambique. Although the second phase of the study utilised a small sample, the study had a control group, without any previous history of non-specific LBP, matched for age, gender and school-class.

However, during the interpretation of the study results the following limitations of the study needs to be considered:

- The main limitation of this study was the cross-sectional nature of the data collected. A cross-sectional sample of secondary school students were used to estimate the prevalence of non-specific LBP and to identify associated risk factors. An inherent weakness of such studies is the reliance of self-reported data gathered at a specific point in time. It is only possible to create a hypothesis of association between LBP and identified risk factors. However, the temporal nature of the risk factors cannot be established. Although a longitudinal study may have provided this detail, such an approach would have required more time and resources. In addition, a cause-effect relationship is not possible to deduce.
- Another limitation of the study were that the data was based on self-reports. It is possible for subjects not to remember the exact nature and characteristics of the LBP. Reliance on subjective morbidity for retrospective data creates a possibility of recollection bias. This may result in imprecise prevalence figures and skewed results. Therefore, the results of this study need to be interpreted with caution. However, since pain has been described as a subjective phenomenon, subjective recall has

been regarded as the only valid way to assess pain (Jones et al, 2004). Nevertheless, in attempt to counteract recall bias, reliability testing was conducted. The main outcome measure of recurrent NSLBP had showed moderate kappa reliability (0.51).

- Another limitation is the degree of generalisability of the study findings to other countries. This is because of methodological and definitional differences. This study employed a cross-sectional and a case-control design concurrently. To the authors' knowledge, no studies on adolescent LBP has utilised mixed designs. In addition, the adopted definition of recurrent NSLBP has not been used previously in studies investigating adolescent recurrent NSLBP.
- The study sample was not representative of all the adolescents in schools in Harare, Zimbabwe. Only three secondary schools were randomly selected from government administered schools. Therefore, these findings are generalisable to adolescents in government directed schools in the urban areas of Harare. In addition, the sample size for the second phase of the study was relatively small (n=64). This could have minimised the ability to detect significant differences.
- A limited number of risk factors (individual) for recurrent NSLBP were studied. This study could have missed on the potential interaction of many factors in the development of recurrent NSLBP among adolescents.

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APPENDIX A: LOW BACK PAIN QUESTIONNAIRE

Demographic data

Code number.....

Date of Birth/...../.....

Gender

Male ☐

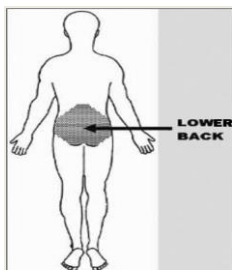
Female ☐

What Form are you in?

Where do you stay?

Section A: Information on Low Back Pain

1. Have you ever experienced pain or discomfort in the lower part of your back which lasted for one day (24hrs) or longer in your life (**not associated with menstruation in females**), in the area indicated in the figure below?



Do you have pain in your lower back (in the area shown on the diagram)?

The shaded area represents the lower part of the back

Yes

☐

No

☐

2. How old were you when you first experienced that pain in the lower part of your back?years old.

The next questions will all be based on your experience of low back pain in the past 12 months. Please answer based ONLY on the last 12 months.

3. For the last 12 months, did you **EVER** have pain in the lower part of your back, in the area indicated in the Figure above?

Never

☐

Once

☐

Frequently

☐

NB: If you answered, frequently, Please continue with questions below. If you did not indicate frequently, please go to question number 8.

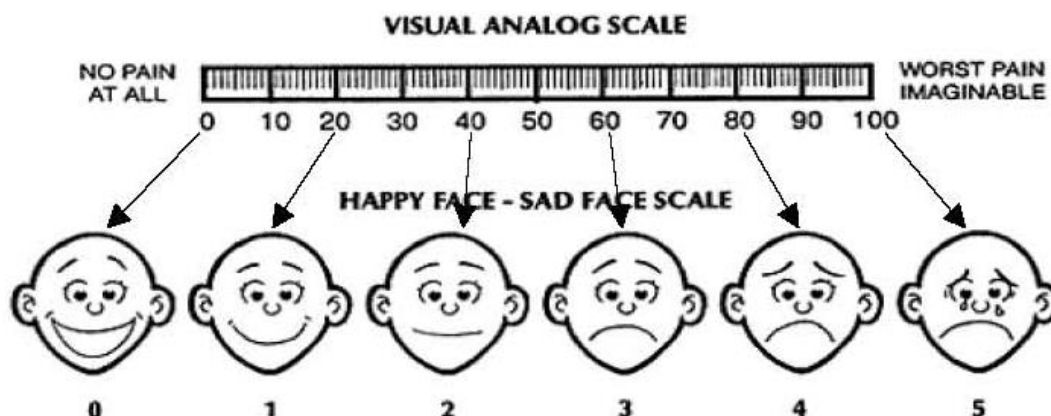
4. How **OFTEN** would you say that you have experienced pain episodes in your lower part of your back, on average, during the last 12 months?

Twice ☐ Thrice ☐ More than Thrice ☐

5. How long (in days) does your lower back pain episode **usually** last, in the past 12 months?

1-7 ☐ 8-14 ☐ 15-21 ☐ 22-29 ☐ ≥ 1 month ☐

6. How severe or serious, **on average**, is the pain that you frequently feel in the lower part of your back on a scale of 0 to 10? 0 means no pain and 10 means worst pain ever felt in your life. (Please mark with an X on the figure below, adopted from Ibrahim, 2000).



7. Do you experience any pain in your buttock; thigh, calf and foot that appear to be associated with the pain you frequently feel in your lower back?

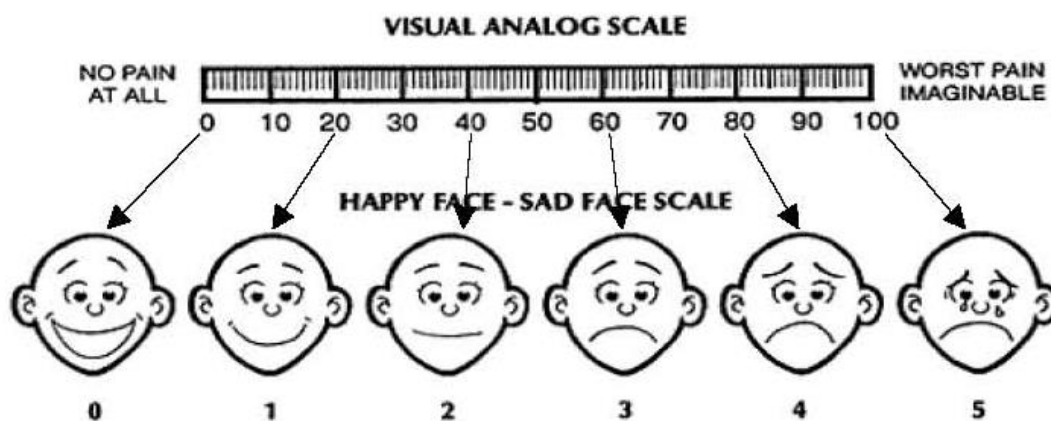
Yes ☐ No ☐

8. Do you have the pain in the lower part of your back **NOW**?

Yes ☐ No ☐

NB: If you answered, YES to the question above, Please answer the following question. If you did not, please, skip to number 10.

9. How severe or serious is the pain you feel **NOW** in the lower part of your back, on average, using a score of 0 to 10? 0 indicates no pain or discomfort and 10 indicate the worst pain or discomfort you ever felt in your life (**Please mark with an X on the figure below, adopted from Ibrahim, 2000**).



10. Have you ever sought treatment for low back pain or information from any medical personnel or traditional healers regarding the pain that you frequently feel?

Yes ☐

No ☐

11. Has your pain in the lower back ever interfered with any of the following activities?
Please indicate with (✓) your response.

Sitting on a school-chair for a 30 minutes	Yes/ No
Reaching up to get a book from a high shelf	Yes/No
Standing over a long time at school/home	Yes/No
Walking over a long distance	Yes/ No
Participating in sports/exercise at school/home	Yes/No
Bending down to put socks on	Yes/No
Carrying your school bag to school	Yes/No
Sitting up in bed from lying position	Yes/No
Running fast for class or catching a bus/car	Yes/No

12. Have you **EVER** missed school for at least one day (school absenteeism) because of your low back pain?

Yes ☐

No ☐

Section B: Schoolbag information. Please tick (✓) where appropriate.

13. Do you carry a school bag to school?

Yes ☐

No ☐

14. How would you **PERCEIVE** the weight of your school bag that you carry to school?

Heavy ☐

Average weight ☐

Not Heavy ☐

15. On average, how long (minutes) do you normally spend carrying your schoolbag **TO** and **FROM** school?

< 5min ☐ 5 – 10min ☐ 11 – 20min ☐ 21 – 30min ☐ >30min ☐

16. How do you **normally** carry your school-bag to and from school?

Right/ Left Shoulder ☐

Over both Shoulders ☐

Right/Left Hand ☐

Section C: Sports participation.

17. Do you play any sport or exercise regularly? (Either at school or at home)

Yes ☐

No ☐

18. If **YES**, Please list the sport(s) or exercise(s) activities that you play at school or home

a)..... b).....

19. How many **HOURS** a week in total, do you play sport/exercise at school or at home?

<2hrs ☐ 2-<4hrs ☐ 4-<6hrs ☐ 6-<10hrs ☐ ≥10 hrs ☐

20. About how long (hrs), on average, do you spend sitting per day, including weekends, watching television, playing video games or using laptop/computer, listening to music?

<2 hrs ☐ 2-<4hrs ☐ 4-<6hrs ☐ 6-<10hrs ☐ ≥10hrs ☐

Section D: Smoking status

21. Have you **EVER** smoked cigarettes in your life?

Yes ☐

No ☐

22. Did you at least smoke **ONE** cigarette in the past week?

Yes ☐

No ☐

Thank you for your participation in this research project

University of Cape Town

APPENDIX A1: MIBVUNZO YEMUSANA

Ruzivo pamusoro pako

code number.....

Une makore mangani

Rudzi

Musikana

☐

Mukomana

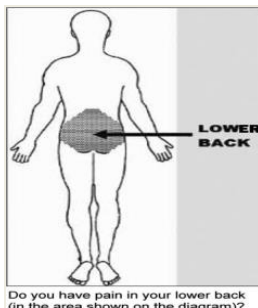
☐

Urikuita Fomu yechingani?

Unogara kupi?

Chipato A: Ruzivo pamusoro pamarwadzo emusana

- 1 Wati wambosangana namarwadzo emusana zvenguva yakareba semaawa makumi maviri ne mana kana kupfuura, panzvimbo yakaratidzwa pamufananidzo uripazasi?



Hongu

☐

Kwete

☐

- 2 Wakatanga kurwadziwa nemusana une makore mangani?

Pindura mubvunzo inotevera inoda kuziva nezvedambudziko remusana mugore rapfura iri. Ndapota pindura wakatarisa mwedzi gumi ne mbiri dzapfura idzi.

- 3 Wanga uchinzwwa marwadzo emusana uyu zvakanyanya sei panguva yemwedzi gumi nembiri yadarika iyi?

Kwete

☐

Kamwechete

☐

Anouya Achienda

☐

Kana wapindura uchiti Anouya Achienda pindura mubvunzo inotevera. Kana wapindura imwewo enda unopindura mubvunzo wechi 8.

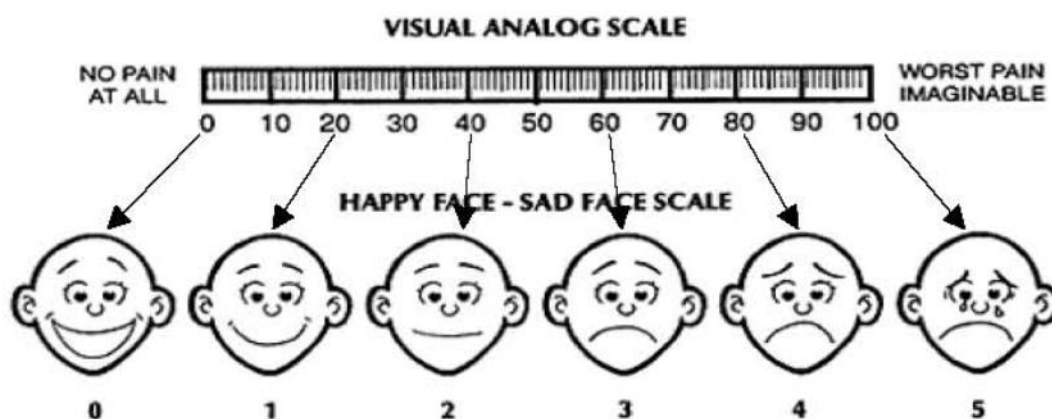
- 4 Ungaziva kuti kubva pamwedzi gumi nembiri yadarika iyi marwadzo emusana anouya achienda wakaanzwa kangani?

Kaviri Katatu Kakawanda

- 5 Marwadzo aunonzwa pamusana wako aya anowanzo kurwadza zvenguva yakareba sei tichitarisa pamwedzi gumi nembiri yapfuura?

1-7 8-14 15-21 22-29 ≥1month

- 6 Ungapima nezvibodzwa zvingani pamarwadzo emusana anouya achidzokera uchipima nezvibodzwa zviripakati pezere negumi? Ndapota isa vara rekukanzura (X) panhamba dziri pazasi zvichinyatsotsanangura zvizere manzwiwo aunoita marwadzo.



- 7 Marwadzo aunonzwa nechekuzasi kwemusana anorwadza kusvika kumakumbo netsoka here?

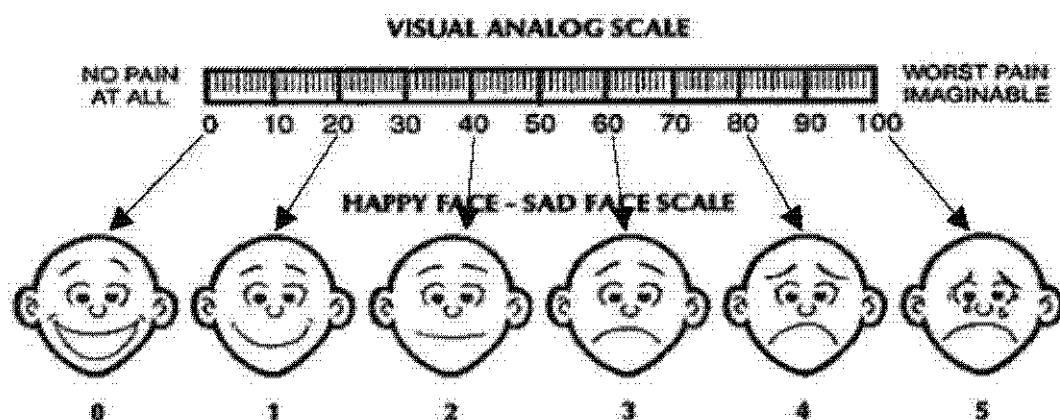
Hongu Kwete

- 8 Urikunuzwa marwadzo nechepazasi pemusana wako izvezvi here?

Hongu Kwete

Kana wapindura hongu pamubvunzo uripamusoro, pindura mubvunzo asi kana wapa mhinduro yekuti kwete drika unopindura mubvunzo 10.

- 9 Ungapa zvibodzwa zvingani kubva muzvibodzwa zvekubva pazero kusvika gumi pamarwadzo aurikunzwa izvezvi? Ndapota isa vara rekukanzura (X) panhamba dziri pazasi ingatsanangura zvizere marwadzo auri kunzwa.



- 10 Wati wamborapwa kunana chiremba kana vanoongoroora nezvemutezo maererano nemarwadzo emusana wako muguva yemwedzi gumi ne mbiri yadarika?

Hongu

☐

Kwete

☐

- 11 Marwadzo emusana wako aya ati ambokutadzisa kuita zvinhu zvakatarwa izvo?

Kugara pacheya kwema minetsi 30

Hongu/ Kwete

Kusverera pasherufu iri pamusoro

Hongu/kwete

Kumira kwenguva refu kumba nekuchikoro

Hongu/Kwete

Kufamba nzendo refu

Hongu/ Kwete

Kutamba mitambo kuchikoro

Hongu/Kwete

Kukotama kuda kugadzirisa masokisi

Hongu/Kwete

Kutakura beghi kuchikoro

Hongu/Kwete

Kugara uchibva mukurara

Hongu/Kwete

Kumhanyira bhazi kana mukirasi

Hongu/kwete

- 12 Wakamborovha here kuchikoro zvichikonzerwa nemusana unenge wanyaya kurwadzwa?

Hongu

☐

Kwete

☐

Chipato B: Mashoko ebhegi rekuchikoro.

13 Unotakura bhegi here pakuenda kuchikoro? Ndapota isa mhinduro yako mubhokisisi rakakodzera?

Hongu ☐

Kwete ☐

14 Ungapima sei kurema kwebhegi rako raunotakura kuchikoro?

Rinorema ☐

Riripakati nepakati ☐

Rakareruka ☐

15 Unopedza nguva yakareba sei wakatakura bag rako kuenda kuchikoro zvese nekudzoka kumba

< 5min ☐ 5–10min ☐ 11–20min ☐ 21–30min ☐ >30min ☐

16 Unowanzo takura bhegi rako wakaita sei paunenge uchienda kuchikoro nekudzoka kazhinji kacho?

Bendekete Rwerudyi/Rubosve ☐

Kumusana ☐

Mumaoko Angu ☐

Chikamu chetatu: Mitambo

17 Unotambawo mitambo here kuchikoro kana kumba panguva yako yaunenge usina zvekuita?

Hongu ☐

Kwete ☐

18 Kana mhinduro iri hongu, unoitamba ipi kuchikoro kana kumba panguva yaunenge usina zvekuita?

a)..... b).....

19 Unotora nguva yakareba sei pasvondo, kuita mitambo inosimbisa mutezo kumba kana kuchikoro?

0-2 hrs ☐ 2-4 hrs ☐ 4-6 hrs ☐ 6-10 hrs ☐ ≥10hrs ☐

20 Unotora nguva yakareba sei wakagara uchiona terevhizheni kana kutamba mitambo yepa terevhizheni kana kushandisa kombiuta pazuva

0-2 hrs ☐ 2-4 hrs ☐ 4-6 hrs ☐ 6-10 hrs ☐ ≥10hrs ☐

Chikamu cheChina: Ongororo yekuputa fodya

21 Wakamboputa fodya here?

Hongu ☐

Kwete ☐

22 Wamboputa kana midzanga mumwe pasvondo rapfura?

Hongu ☐

Kwete ☐

Waita basa nenguva yako

University of Cape Town

APPENDIX B: MEDICAL HEALTH QUESTIONNAIRE

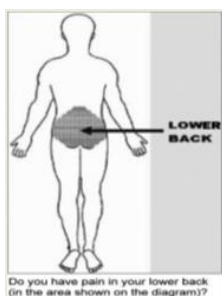
Instruction: Please indicate with a tick (✓) in the appropriate box.

- 1 In the past 12 months, has your child ever complained to you or any other family member of pain or discomfort in the lower part of his/her back (see Figure below), which lasted a day or longer, not related to their menstrual cycle in females?

Yes

☐

No

☐

The shaded area represents the lower part of the back.

- 2 Is there anyone in the family (including yourself) that you know of who complains of pain in their lower part of the back and takes medication or used to take medication for that?

Yes

☐

No

☐

If Yes, what is the relationship to the child.....

- 3 Has your child sustained any injury to his/her back either at home or at school that you are aware of?

Yes

☐

No

☐

- 4 Has your child been diagnosed by a doctor or physiotherapists with any condition that affect his/her back?

Yes

☐

No

☐

If Yes, Please list the condition.....

- 5 Is your child currently following a specialised treatment programme with a medical doctor for pain he/she feels in the lower part of his/her back?

Yes

☐

No

☐

- 6 Is your child currently following a rehabilitation programme after an operation on his/her bones, ligaments, muscles and tendons of his/her limbs and trunk?

Yes

☐

No

☐

If Yes, please would you list.....

- 7 Does your child find it difficult or impossible to stand up on his/her own without using an assistive device for example a crutch?

Yes

☐

No

☐

- 8 Has your child been diagnosed with a neurological condition which affects the tone in his/her muscles?

Yes

☐

No

☐

If yes, please list:

- 9 Does your child have a visible problem with his/her back (scoliosis) that requires him/her to wear a brace or to go for an operation?

Yes

☐

No

☐

- 10 Has your child been diagnosed with a spinal tumour or unequal leg length at any time since birth?

Yes

☐

No

☐

APPENDIX B1: HWARO REBVUNZO REHUTANO

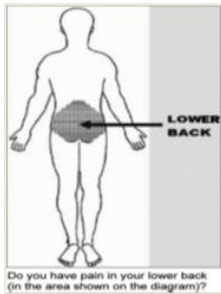
Zvekuita

Isa mhinduro makakodzera uchiisa vara rekutendera mukabhokisi pazasi.

- 1 Mwana wenyu akambokuudzai here nezvedambudziko rake remusana kana kuti makambomunzwa achishushikana nedambudziko remusana zvisiri zvekuteera kwake?

Hongu ☐

Kwete ☐



- 2 Pane here mumhuri menyu nedambudziko rekurwara nemusana kusanganisira imimi?

Hongu ☐

Kwete ☐

Taurai kuti hukama hwacho hwakamira sei nemwana...

- 3 Mwana wenyu uyu akambokuvvara here musana kumba kana kuchikoro zvamunoziva?

Hongu ☐

Kwete ☐

- 4 Mwana wenyu akamboonekwa nana chiremba kuti ane dambudziko remusana here?

Hongu ☐

Kwete ☐

Kana zvakadaro mungandizivise here dambudziko racho.....

- 5 Parizvino mwana wenyu ane hurongwa hwakakosha hwekudzidziswa nachiremba hwaari kuteera here maererano namarwadzo emusana?

Hongu ☐

Kwete ☐

- 6 Parizvino mwana wenyu anezvaari kurapwa here maererano nekutyoka mabonzo ekumusana, makumbo kana maoko?

Hongu ☐

Kwete ☐

Kana zvakadaro tsanangurai kuti arikiutwei.....

- 7 Mwana wenyu anoomerwa here kana kutadza kusimuka ega asina kushandisa zvinhu zvinomubatsira kusimuka semadomha?

Hongu ☐

Kwete ☐

- 8 Mwana wenyu ati amboonekwa aine dambudziko retsinga dzake zvinova zvinozovhiringidza mashandiro enyama dzake dzemuviri?

Hongu ☐

Kwete ☐

Kana zvirizvo tsanangurai zvizere.....

- 9 Mwana wenyu angave nekuremara kwemusana kungada kuti apfeke koseti kana kuda kuitwa oparesheni?

Hongu ☐

Kwete ☐

- 10 Mwana wenyu akamborapwa here kana kuti ane dambudziko regomarara remusana kana kusaenzana kwemakumbo pamuviri wake kubva huberekerwo hwake?

Hongu ☐

Kwete ☐

APPENDIX C: CONTENT VALIDITY LETTER

Research Title: Prevalence and Individual Risk Factors Associated with Recurrent Non-specific Low Back Pain Among Secondary School Adolescents in Harare, Zimbabwe.

My name is Matthew Chiwaridzo. I am an MSc Physiotherapy student at the University of Cape Town, pursuing a research project evaluating the presence of non-specific low back pain symptoms and the associated individual risk factors among adolescents in schools. Adolescent LBP has been found to be increasing during the past 20 years globally and has been linked to chronic LBP in adults. However, research into adolescent low back pain is limited in Zimbabwe. This has created a need for me to investigate the magnitude of the problem among adolescents in schools and assess the influence of individual risk factors associated with the condition. My supervisor is Mrs Niri Naidoo from the University of Cape Town, Faculty of Health Sciences (**email:niri.naidoo@myuct.ac.za**).

I am currently developing my questionnaires to assist with data collection. I am kindly asking you to serve as a content expert because of your experience in research and your rich knowledge into the phenomena of low back pain. In total, five experts will be used to judge the relevance of the items in the instruments. Accompanying this letter is the criteria for measuring content validity which was proposed by Waltz and Bausell (1983). You are asked to rate each question on the instrument for relevance, clarity, simplicity and ambiguity on a four-point scale. You are also requested to give recommendations and suggestions and to add or omit items to facilitate the refinement of the questionnaires.

Your participation in the validation of the instruments is mostly appreciated as a preliminary step to create a reliable questionnaire for screening low back pain in adolescents. You are free to make comments and suggestions to add or amend questions. You are also free to contact me for any issues that need clarity. My contact details are as follows. Email address: matthewchiwaridzo@yahoo.co.uk, **Cell phone number:** +263 773 603 069. **Address:** College of Health Sciences, Department of Rehabilitation, New Building, Ground Floor, Room 41.

Yours faithfully

Matthew Chiwaridzo

MSc Physiotherapy Student

APPENDIX D: LETTER TO MINISTRY OF EDUCATION

*all communications should be addressed to
"The Secretary for Education Sport and Culture"
Telephone: 734051/59 and 734071
Telegraphic address : "EDUCATION"
Fax: 794505/705289/734075*



Ref: C/426/3
Ministry of Education, Sport,
Arts and Culture
P.O Box CY 121
Causeway
Zimbabwe

MATTHEW CHIWARIDZO
No. 8 LILMURIK
COURT, AVONDALE
HARARE

RE: PERMISSION TO CARRY OUT RESEARCH

Reference is made to your application to carry out research in the Ministry of Education, Sport and Culture institutions on the title:

Prevalence and Individual Risk factors
Associated with Non-Specific
Recurrent Low Back Pain in Secondary
School Adolescents in Harare urban areas

Permission is hereby granted. However, you are required to liaise with the Provincial Education Director responsible for the schools you want to involve in your research.

You are also required to provide a copy of your final report to the Ministry since it is instrumental in the development of education in Zimbabwe.

I. Gweme

FOR: SECRETARY FOR EDUCATION, SPORT AND CULTURE



APPENDIX E: LETTER FROM HARARE EDUCATION OFFICE

All communications should be addressed to
"THE PROVINCIAL EDUCATION DIRECTOR"

Telephone : 792671-9
Fax : 796125/792548
E-mail :
moeschre@yahoo.com



ZIMBABWE

REF: G/42/1
Ministry of Education,
Sport and Culture
Harare Provincial Education Office
P. O. Box CY 1343
Causeway
Zimbabwe

30.01.2012

Matthew Chiwaricho
of University of
Cape Town

RE : PERMISSION TO CARRY OUT RESEARCH IN SOME SELECTED SCHOOLS

To carry out research on the prevalence and individual risk factors associated with non-specific recurrent low back pain in secondary schools adolescents in the

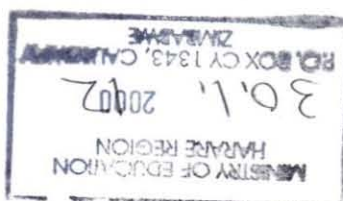
Reference is made to your letter dated 15.12.2011

Please be advised that the Provincial Education Director grants you authority to carry out your research on the above topic. You are required to supply Provincial Office with a copy of your research findings.

M. M. M. M. M.

For Provincial Education Director

Harare Metropolitan Province



APPENDIX F: LETTER TO SCHOOL HEAD

The Headmaster/mistress

MOUNT PLEASANT SCHOOL

P.O Box MP 90

MOUNT PLEASANT HARARE



Harare

Dear Sir/Madam

RE: APPLICATION FOR PERMISSION TO CONDUCT A RESEARCH STUDY

My name is Matthew Chiwaridzo. I am Zimbabwean post-graduate student, currently pursuing a Master's Degree in Physiotherapy at the University of Cape Town (U.C.T) in South Africa. As part of my studies, I am expected to conduct a research project. I have chosen to explore on the **"Prevalence and individual risk factors associated with non-specific, recurrent low back pain in adolescents (10-19 years) in Harare urban secondary school learners"**. I hereby request permission to carry out the above mentioned study at your school. Ethical approval for the study has been granted by the University of Cape Town and from Harare Province Ministry of Education offices.

It is anticipated that the results will be helpful in quantifying the magnitude of LBP in adolescents and identify possible risk factors which may assist in planning for effective health promotion strategies in schools for students. The researcher undertakes to share the outcomes of this research study with the Ministry and your school. Participation in this study will be anonymous and voluntary for students and the information gathered will be treated with utmost respect and confidentiality. I would be grateful if you would allow me to carry out the study at your institution.

I am looking forward to your favorable response.

Yours faithfully

Matthew Chiwaridzo Tel: 0773 603 069



APPENDIX F2: LETTER TO SCHOOL HEAD

The Headmaster/mistress

DZIVARESEKWA 2 HIGH

P.O Box DZ 50.....

DZIVARESEKWA.....

Harare

Dear Sir/Madam



RE: APPLICATION FOR PERMISSION TO CONDUCT A RESEARCH STUDY

My name is Matthew Chiwaridzo. I am Zimbabwean post-graduate student, currently pursuing a Master's Degree in Physiotherapy at the University of Cape Town (U.C.T) in South Africa. As part of my studies, I am expected to conduct a research project. I have chosen to explore on the **"Prevalence and individual risk factors associated with non-specific, recurrent low back pain in adolescents (10-19 years) in Harare urban secondary school learners"**. I hereby request permission to carry out the above mentioned study at your school. Ethical approval for the study has been granted by the University of Cape Town and from Harare Province Ministry of Education offices.

It is anticipated that the results will be helpful in quantifying the magnitude of LBP in adolescents and identify possible risk factors which may assist in planning for effective health promotion strategies in schools for students. The researcher undertakes to share the outcomes of this research study with the Ministry and your school. Participation in this study will be anonymous and voluntary for students and the information gathered will be treated with utmost respect and confidentiality. I would be grateful if you would allow me to carry out the study at your institution.

I am looking forward to your favorable response.

Yours faithfully

Matthew Chiwaridzo Tel: 0773 603 069

APPENDIX F3: LETTER TO SCHOOL HEAD

The Headmaster/mistress

D2 High 1

P.O Box D290

Harare

Harare

Dear Sir/Madam

RE: APPLICATION FOR PERMISSION TO CONDUCT A RESEARCH STUDY

My name is Matthew Chiwaridzo. I am Zimbabwean post-graduate student, currently pursuing a Master's Degree in Physiotherapy at the University of Cape Town (U.C.T) in South Africa. As part of my studies, I am expected to conduct a research project. I have chosen to explore on the "Prevalence and individual risk factors associated with non-specific, recurrent low back pain in adolescents (10-19 years) in Harare urban secondary school learners". I hereby request permission to carry out the above mentioned study at your school. Ethical approval for the study has been granted by the University of Cape Town and from Harare Province Ministry of Education offices.

It is anticipated that the results will be helpful in quantifying the magnitude of LBP in adolescents and identify possible risk factors which may assist in planning for effective health promotion strategies in schools for students. The researcher undertakes to share the outcomes of this research study with the Ministry and your school. Participation in this study will be anonymous and voluntary for students and the information gathered will be treated with utmost respect and confidentiality. I would be grateful if you would allow me to carry out the study at your institution.

I am looking forward to your favorable response.




Yours faithfully



Matthew Chiwaridzo Tel: 0773 603 069



APPENDIX G: STUDY TIMETABLE

Activity/Task	Dates
1. Research Proposal Development <ul style="list-style-type: none"> • Topic identification • Questionnaire design • Ethical Approval from HREC • Institutional Approval from the Ministry of Education Offices (Harare, Zimbabwe) 	September 2011  April 2012
2. Ethical and Institutional approval <ul style="list-style-type: none"> • Approval from the Medical Research Council of Zimbabwe • Approval from school principals of the selected secondary schools • Content validation of the study questionnaires • Pilot study (test-retest reliability) 	May 2012  June 2012
3. Fieldwork for the Main study <ul style="list-style-type: none"> • General visits to the participating schools for background information • Parental/legal guardian Approval • Student Approval • Phase 1 data collection in all the three selected secondary schools • Preliminary results • Data entry into Microsoft Excel • Data Editing/Cleaning • Phase 2 Instruments Purchase • Phase 2 Pilot Study • Phase 2 Data collection in the three secondary schools • Data entry into Microsoft Excel • Verification and Data Management 	June 2012  December 2012
4. Results Analysis <ul style="list-style-type: none"> • In-depth analysis of study results from Phase 1 and 2 • Write-up of the Results Section for Phase 1 and Phase 2 • Discussion of the Phase 1 results • Discussion of the Phase 2 results • Final write-up of the whole thesis 	January 2013  August 2013

APPENDIX H: PARENTAL INFORMATION LETTER

Dear Parents/Guardian

My name is Matthew Chiwaridzo. I am a Physiotherapist, graduated in 2007 from University of Zimbabwe. I am currently pursuing my Master's Degree in Physiotherapy at the University of Cape Town. As part of the Master's degree programme, I am conducting a research project entitled: **“Prevalence and Individual Risk factors Associated with Non-specific Low Back Pain in Secondary School Adolescents in Harare, Zimbabwe.”** The overall aim is to determine the prevalence of non-specific low back pain and establish any association with factors such as body mass index, level of physical activity, muscle flexibility, smoking status, health-related quality of life and sedentary time. I would like to invite your child to participate in my research study.

Previous studies internationally and regionally have found a high prevalence rate of low back pain in adolescents during their school years similar to adult prevalence. Adolescents with low back pain at a younger age are more likely to report the symptoms later in their adulthood. Therefore, this creates a need to quantify the magnitude of low back pain in adolescents and establish risk factors associated with the condition. This information will help us in formulating preventative strategies in schools.

The study obtained formal approval from Human Research Ethical Committee in South Africa; Medical Research Council of Zimbabwe; the Ministry of Education, Sports, Arts and Culture and from the school principal of your child's school. Three secondary schools will participate in the study and all of them have been randomly chosen. In every school, one class in each form (One-Six) was chosen, and your child is in one of the chosen classes. The study will be conducted in two-linked phases. Your child may not participate in all the phases of the research. There are no risks involved in this study in both phases. Phase 1 entails completing a questionnaire on low back pain status. This will take approximately 10 ± 15 minutes and will be done during appropriate time so as not to interrupt their school lessons. The second Phase will involve taking measurements such as bodyweight, height and muscle flexibility tests.

The entire study will take three months and expected to start in the second school term. No personal names will be used during the entire study or in publication of results. All information gathered will be kept strictly confidential. Your child's participation in this study is entirely voluntary. Your child is free to withdraw from this study at any time. No reason is required and no adverse consequences will follow his/her withdrawal. Your child's school is not directly involved in this study, and they will have no access to your child's personal results. However, once the study is completed, we will inform the school and the Ministry of

Education of the outcome. If, however, your child is found to have low back pain which warrants further examination, you will be notified and your child will be referred to a Primary Health Facility for treatment.

I would greatly appreciate your support by signing an attached consent from thereby allowing your child to participate in this study. Please complete also the section on your child's medical history. If your child has a specific low back pain he/she will not be required to take part in the study as the diagnosis is already confirmed. Please feel free to contact me if there is any information, regarding this study, that you do not clearly understand, or if you require any further information. I will be available at your child school on the 15th of June at 10.00 am to answer any question.

Thank you very much for your support.

Matthew Chiwaridzo

Tel +263 773 603 069

Email: matthewchiwaridzo@yahoo.co.uk

Supervisor: Mrs Niri Naidoo

University of Cape Town

Faculty of Health Sciences

Division of Physiotherapy

Email: niri.aidoo@myuct.ac.za

Ethics contact details

Faculty of Health Sciences

Human Research Ethics Committee

Room E52-24 Groote Schuur Hospital

Old Main Building

Observatory 7925

Tel [021] 4066492

Email: sumayah.ariefdien@uct.ac.za

APPENDIX H1: MASHOKO KUVABEREKI

Vanodiwa Vabereki/Muchengeti

Zita rangu ndinonzi Matthew Chiwaridzo. Ndiri mudzidzi wefundo yepamusoro, parizvino ndirikudzidza kuva nechitupa chepamusoo cheMaster's degree maererano nezvemitezo ndichiitira ndiri pachikoro cheUniversity ye Cape Town. Sehurongwa hwezvidzidzo zvangu, ndirikutarisrwa kuti ndiite tsvakiridzo yezvidzidzo zvangu. Tsvakiridzo iyi inenge ichiongorora nezve: **“Huwandu nezvikonzero zvinounza marwadzo emusana muzera revana vadiki varipakakati pemakore gumi ne gumi ne pfumbamwe vari muzvikoro zvesekondari zviri muharare”**. Tsvakiridzo iyi irikuda kuburitsa nekuziva uwandu hwevana vezera varipakati pemakore gumi kusvika pamakore gumi nepfumbamwe vangave vaine dambudziko remusana muzvikoro uye nekutarisa kuti pane zvinokonzeresa marwadzo aya here zvakafanana ne huremu hwemuviri, mwero wekumira, kuitwa kwe mitambo inosimbisa muviri, kushandiswa kunoitwa musana, ongororo yekuputa fodya kana zvimwe zvakarerekera kumhando yeutano nehupenyu hunoraramwa. Ndinokokawo mwana wenyu kuti akwikwidzewo mutsvakiridzo iyi, uye ndinova nekutenda makamubvumudzawo.

Muzvidzidzo zvekumashure, pasi rese nedunhu rino zvakaonekwa kuti dambudziko remusana chirwere chizere muzera rechidiki panguva yavo yekuenda kuchikoro kusvika muzera rekukura kwavo. Munyika yedu ino hamusati mamboitwa tsvakiridzo yakaererana nemarwadzo emusana muzera rechidiki. Vana vezera remakore gumi kusvika pagumi nepfumbamwe vanodzimbikana nemusana vanozo nyanyakuzonzwa marwadzo akawedzera nemusana mukukura kwavo. Sekudaro zvakaongororwa kuti pave ne tsvakiridzo yekuti dambudziko remarwadzo emusana rinosvika papi, uye nezvingave zvinokonzera marwadzo aya nekutarisa zvazvinozokonzera kumberi tine danho rekuti zvidzivirirwe kubvira muzvikoro.

Kuti ndiite tsvakiridzo iyi ndakawana bvumo iri murinyorwa kubva kubato rezvedzidzo reku University ye Cape Town uye ne bato retsvakiridzo reMedical Research Council remuno mu Zimbabwe. Kune zvikoro zvinoita zvina zvesekondari zvandichashandisa kuita tsvagiridzo iyi Pachikoro chega-chega kirasi imwe chete mufomu yoga (1-6) yakasarudzwa, uye mwana wenyu ndemumwe wevana varikukirasi yakasarudzwa. Hakuna zvinotyisa zvinokwanisika kuitika zvingasanganikwa nemwana wenyu. Tsvakiridzo iyi ichaitwa munguva mbiri. Nguva yekutanga inotarisisira kuti mwana wenyu apindure hwaro yemibvunzo pamusoro pemarwadzo emusana. Izvi zvinotora nguva isingadarike maminetsi gumi uye zvinoitwa panguva yavanoita bureki ravo kuitira kuti ndisava vhiringidza zvidzidzo zvavo zvechikoro

Nguva yepiri ichasanganisira kuyera uremu wemutumbi wemunhu, kureba kwake nehuremu kwebhegi rake rekuchikoro. Tsvakiridzo iyi inotarisirwa kutora mwedzi mitatu uye ichitarisirwa kutanga mutemu yechipiri yevana vechikoro. Vana vese vanenge vatendera kukwikwidza mutsvakiridzo vanogoverwa nhamba zvichienderana nezvikwata zvavo. Mashoko ese achaunganidzwa achachengetwa muchivande. Kukwikwidza kwemwana wenyu mutsvakiridzo iyi anotarisirwa kuita nemoyo wake pasina kumanikidzwa. Mwana wenyu anakodzera yekusiya tsvakiridzo iyi panguva yaanoda, hapana chikonzero chingadiwa zvichienderana nekusiya kwake. Chikoro chemwana wenyu hachisi mukati metsvakiridzo iyi uye havana mawaniro ezvakavandika zvichabuda pamusoro pemwana wenyu. Nekudaro kana tsvakiridzo iyi yapera tichazivisa mukuru wechikoro zvichabuda pamwe negurukokota rezvedzidzo neve Harare Provincial Offices sezvo vakazvitarisira. Nekudaro kana mwana wenyu awanikwa aine marwadzo emusana inoda kuongororwa zvakanyanya muchaziviswa uye mwana wenyu achaendeswa kukiriniki iri pedyo naye

Ndingatende zvikuru nekurudziro yenyu pamwe nekutendera muchiisa zita renyu pa gwaro wekubvuma uye nekubvumira mwana wenyu kuti akwikwidzewo mutsvakiridzo iyi. Kana muchida kuti mwana weyu akwikwidze ndapota zadzikisai nekunyora pagwaro rekubvuma. Ndapota zadzikisai zvakare panhorondo yehutano hwemwana wenyu. Kana mwana wenyu aine dambudziko remarwadzo emusana rakanyanya kana humwewo hurwere haatenderwi kukwikwidza mutsvakiridzo sezvo vaine chirwere chinoto zivikanwa kare. Ndapota ivai makasununguka kundibata kana murairidzi wangu kana muine mashoko amusina kunyatso nzwisisa munogona kubatawo Professor Marc Blockman (Chair of the research committee). Ndichange ndiri pachikoro chemwana wenyu nemusi wa15 June nenguva dza 10 am kana muine mibvunzo yakanangada neni.

Ndinotenda zvikuru nekurudziro yenyu

Matthew Chiwaridzo

Ethics contact details

Tel +263 773 603 069

Faculty of Health Sciences

Email: matthewchiwaridzo@yahoo.co.uk

Human Research Ethics Committee

Supervisor: Mrs Niri Naidoo

Room E52-24 Groote Schuur Hospital

University of Cape Town

Old Main Building

Faculty of Health Sciences

Observatory 7925

Division of Physiotherapy

Tel [021] 4066492

Email:niri.aidoo@myuct.ac.za

Email: sumayah.ariefdien@uct.ac.za

APPENDIX I: INFORMED CONSENT FORM

- I hereby confirm that I have been informed by the researcher, Matthew Chiwaridzo, on the purpose and nature of the research project entitled: **“Prevalence and Individual Risk factors Associated with Non-specific Low Back Pain in Secondary School Adolescents in Harare, Zimbabwe.”**
- I have received and read the attached information sheet regarding the above study.
- I was given an opportunity to contact the researcher and ask questions.
- I have received enough information and understand all that the study entails.
- I am aware that all the results and information collected, including personal details of my child, will be strictly confidential and will remain anonymous in all reports relating to the study.
- I understand that my child may withdraw from the study at any stage and that there will be no adverse consequences following his/her withdrawal.
- I have understood everything that has been explained to me regarding the above study and I consent to my child participating in this study.
- I know that by signing below indicates that I have permitted my child to participate in the study.

Signature:

Date and Place:

Witness:

Date and Place:

APPENDIX I 1: GWARO REKUBVUMA

- Ndiripo pakutendera kuti ndakaziviswa nemuongorori Matthew Chiwaridzo pachinangwa nemamiriro etsvakiridzo inoti: **“Huwandu nezvikonzero zvinounza marwadzo emusana muzera revana vadiki varipakakati pemakore gumi ne gumi ne pfumbamwe vari muzvikoro zvesekendari zviri muharare”**.
- Ndakatambira pamwe nekuveerenga magwaro anoenderana netsvakiridzo iri pamusoro.
- Ndakapihwa mukana wekubata nemuongorori pamwe nekumubvunza mubvunzo.
- Ndatambira ndikanzwisisa zvichadiwa mutsvakiridzo iyi.
- Ndine ruzivo kuti magwaro ezvichabuda ezvakavandika pamusoro pemwana wangu zvichange zviri muchivande uye zvinoramba zviri pakuzivikanwa pama gwaro ese achazonyorwa pakupera kwe tsvakiridzo.
- Ndanzwisisa kuti mwana wangu anokwanisa kusiya kukwikwidza uku chero pachidanho chipi zvacho uye kuti hapana mhosva yaanenge apara, zvichienderana nekusiya kwaanenge aita.
- Ndanzwisisa zvese zvatsanangurwa kwandiri maererano netsvakiridzo uripamusoro uye ndotendera kuti mwana wangu ave anokwikwidza mutsvakiridzo iyi.

Siginecha: **Zuva neNzvimbo:**

Mupupuri: **Zuva neNzvimbo:**

APPENDIX J: STUDENTS INFORMATION SHEET

Dear Student

My name is Matthew Chiwaridzo. I am a physiotherapist, and I am currently studying for my Master's Degree in Physiotherapy at the University of Cape Town. As part of my degree programme, I am conducting a research entitled: **“Prevalence and Individual Risk factors Associated with Non-specific Low Back Pain in Secondary School Adolescents in Harare, Zimbabwe.”** I would like you to participate in this research study. Before agreeing to participate, it is important that you read and understand this letter. It will explain the purpose of the study and what will be involved. I will also explain to you verbally for your better understanding.

Previous studies, internationally and regionally, have found a high prevalence rate of low back pain in adolescents during their school years similar to adult prevalence. Adolescents with low back pain at a young age are more likely to report the symptoms later in their adulthood. Therefore, a need has been identified to quantify the magnitude of low back pain in our adolescents and establish risk factors associated with the condition with the hope of minimizing the condition and formulating preventative strategies in schools that curb low back pain. Written approval has been obtained from the Ministry of Education, headmaster of your school and your parent has signed an informed consent allowing you to participate. Three secondary schools will participate in the study and all of them have been randomly chosen. In every school, one class in each form (One-Six) was chosen, and you happen to be in one of the chosen classes together with the rest of your classmates.

The study will be conducted in two-linked phases. You may not participate in all the phases of the research. Phase One entails filling in a questionnaire that will take 10-15 minutes to complete during your break time or any other time scheduled by school authorities. In Phase Two, measurements will be taken such as your weight, height, school-bag weight and muscle flexibility in an attempt to ascertain if there is a correlation between them and low back pain. The entire study will take three months and expected to start in the second term of studies. No names will be used. No other personal information will be publicly divulged. Your participation in this study is entirely voluntary; you are free to withdraw from this study at any time. No reason is required and no adverse consequences will follow your withdrawal. Please feel free to ask me any questions if there is any information, regarding this study that you do not clearly understand.

This study obtained formal ethical approval from Human Research Ethical Committee in South Africa and Medical Research Council of Zimbabwe. There are no risks involved in this study and your participation is entirely voluntary. My contact details and those of my

supervisor are provided underneath. Feel free to contact me if you have any questions regarding the research project. Your participation is very crucial to the success of this project.

Thank you so much for your time.

Yours faithfully

Matthew Chiwaridzo

UCT MSc Physiotherapy student

Tel: +263 773 603 069

Supervisor: Mrs Niri. Naidoo Email: niri.naidoo@myuct.ac.za

Physiotherapy Lecturer

Division of Physiotherapy

Faculty of Health Sciences

University of Cape Town

University of Cape Town

APPENDIX J 1: MASHOKO KUMUDZIDZI

Anodiwa mudzidzi

Zita rangu ndinonzi Matthew Chiwaridzo. Ndiri mudzidzi wefundo yepamusoro parizvino ndirikufundira kuva nechitupa chepamusoo cheMaster's Degree maererano nezvemutezo ndichiitira ndiri pachikoro chedzidzo yepamusoro cheUniversity yeCape Town. Sehurongwa hwezvidzidzo zvangu ndirikutarisrwa kuita tsvakiridzo yezvidzidzo zvangu. Tsvakiridzo iyi inenge ichiongorora nezve **“Huwandu nezvikonzero zvinounza marwadzo emusana muzera revana varipakati makore gumi negumi ne pfumbamwe vari muzvikoro zvesekendari zviri muharare.”** Tsvakiridzo iyi irikuda kuburitsa nekuziva uwandu hwevana vezera remakore gumi kusvika pamakore gumi ne pfumbamwe vane dambudziko remusana muzvikoro uye nekutarisa kuti pane zvinokonzeresa marwadzo here zvakafanana nehuremu hwemuviri, mwero wekumira, kuitwa kwe mitambo inosimbisa muviri, kushandiswa kunoitwa musana, ongororo yekuputa fodya kana zvimwe zvakarerekera kumhando yeutano nehupenyu hunoraramwa. Usati watendera kukwikwidza, zvakakosha kuti uverenge nekunzwisisa tsamba iyi icha tsanangura chikonzero pamwe nezvinodiwa

Muzvidzidzo zvekumashure, pasi rese nedunhu rino zvakaonekwa kuti chirwere chizere muzera rechidiki panguva yavo yekuenda kuchikoro kusvika muzera rekukura kwavo. Munyika yedu ino hamusati mamboitwa tsvakiridzo yakaererana nemarwadzo emusana muzera rechidiki. Vana vezera remakore gumi kusvika pagumi nepfumbamwe vanodzimbikana nemusana vanoza nyanyakuzonzwa marwadzo akawedzera nemusana mukukura kwavo. Sekudaro zvakaongororwa kuti pave ne tsvakiridzo yekuti dambudziko remarwadzo emusana rinosvika papi uye nezvingave zvinokonzera marwadzo aya nekutarisa zvazvinozokonzera kumberi tiri mudanho rekuti zvidzivirirwe kubvira muzvikoro. Kuti tiite tsvakiridzo iyi ndakawana bvumo iri murinyorwa kubva kubato rezvedzidzo reku University ye Cape Town uye ne bato retsvakiridzo re Medical Research Council remuno mu Zimbabwe.

Mubereki wako kana vanokuchengeta vatendera nekunyora zita ravo pasi petsamba yavo yandavapa kuti iwewe ukwikwidze mutsvagidzidzo iyi. Kune zvikoro zvinoita zvina zvandichashandisa kuita tsvagidzidzo iyi. Pachikoro kirasi imwe chete mufomu 1-6 yakasarudzwa, uye iwe uri mumwe wevana varimukirasi yakasarudzwa pamwe nevaunofunda navo. Tsvakiridzo iyi ichaitwa munguva mbiri dzakasiyana. Nguva yekutanga inotarisirira kuti upindure mahwaro emibvunzo anatora maminitisi gumi izvi zvichaitwa panguva yenyu yamunenge muri pabureki kuitira kuti tisavhiringidze zvidzidzo zvako zvechikoro. Nguva yepiri ichasanganisira kukuyera huremu hwemutumbi wako, kureba

kwako nehuremu kwebhegi rako rekuchikoro pamwe kushandisa shandisa mutezo wako kuona kuti hapana here pane marwadzo anango rwadzisa musana kana kwete

Hapana zvakaipa zvinoitwa kwauri zvinosanganisirwa mutsvakiridzo iyi. Tsvakiridzo iyi inotarisirwa kutora mwedzi mitatu uye ichitarisirwa kutanga mutemu yechipiri yechikoro. Hapana mazita achashandiswa. Hapana zvakavandika zvichapambidzirwa kuruzhinji. Kukwikwidza kwako mutsvakiridzo iyi ndekemoyo wako nechido chako pasina kumanikidzwa. Hapana chikonzero chingadiwa kana wafunga kusiya.

Ndinotenda zvikuru nekurudziro yenyu

Matthew Chiwaridzo

UCT MSc Physiotherapy student

Tel: +263 773 603 069

Supervisor: Mrs Niri. Naidoo Email:niri.naidoo@myuct.ac.za

Physiotherapy Lecturer

Division of Physiotherapy

Faculty of Health Sciences

University of Cape Town

APPENDIX K: PHASE 1 STUDENT ASSENT FORM

- I hereby confirm that I have been informed by the researcher, Matthew Chiwaridzo, of the purpose and nature of the above study entitled: **“Prevalence and Individual Risk factors Associated with Non-specific Low Back Pain in Secondary School Adolescents in Harare, Zimbabwe.”**
- I have received and read the attached information sheet regarding the above study.
- I was given an opportunity to contact the researcher and ask questions.
- I have received enough information and understand all that the study entails.
- I am aware that all the results and information collected, including personal details, will be strictly confidential and will remain anonymous in all reports relating to the study.
- I understand that I may withdraw from the study at any stage and that there will be no adverse consequences following my withdrawal.
- I have understood everything that has been explained to me regarding the above study and I assent to participate in this study.

Signature: **Date and Place:**

Witness: **Date and Place:**

APPENDIX K 1: GWARO REKUBVUMA

- Ndiripo pakutendera kuti ndakaziviswa nemuongorori Matthew Chiwaridzo pachinangwa nemamiriro etsvakiridzo inoti: **“Huwandu nezvikonzero zvinounza marwadzo emusana muzera revana varipakati makore gumi negumi ne pfumbamwe vari muzvikoro zvesekendari zviri muharare.”**
- Ndakatambira pamwe nekuveerenga magwaro anoenderana netsvakiridzo iri pamusoro.
- Ndakapihwa mukana wekubata nemuongorori pamwe nekumubvunza mubvunzo.
- Ndatambira ndikanzwisisa zvichadiwa mutsvakiridzo iyi.
- Ndine ruzivo kuti magwaro ezvichabuda ezvakavandika pamusoro pemwana wangu zvichange zviri muchivande uye zvinoramba zviri pakuzivikanwa pama gwaro ese achazonyorwa pakupera kwetsvakiridzo.
- Ndanzwisisa kuti ndinokwanisa kusiya kukwikwidza uku cero pachidanho chipi zvacho uye kuti hapana mhosva yandinenge ndapara zvichienderana nekusiya kwandinenge ndaita.

Siginecha: Zuva neNzvimbo:

Mupupuri: Zuva neNzvimbo:

APPENDIX L: EQ-5D-Y QUESTIONNAIRE

Describing your Health Today

Instructions: Under each heading, mark one box that describes your health TODAY

Mobility (walking about)

- I have no problems walking about ☐
- I have some problems walking about ☐
- I have a lot of problems walking about ☐

Looking after myself

- I have no problems washing or dressing myself ☐
- I have some problems washing or dressing myself ☐
- I have a lot of problems washing or dressing myself ☐

Doing usual activities (*for example, going to school, hobbies, sports, playing, doing things with family and friends*)

- I have no problem doing my usual activities ☐
- I have some problem doing my usual activities ☐
- I have a lot of problems doing my usual activities ☐

Having pain or discomfort

- I have no pain or discomfort ☐
- I have some pain or discomfort ☐
- I have a lot of pain or discomfort ☐

Feeling worried, sad or unhappy

- I am not worried, sad or unhappy ☐
- I am a bit worried sad or unhappy ☐
- I am very much worried sad or unhappy ☐

How good is your health TODAY

- We would like to know how good or bad your health is TODAY.
- This line is numbered from 0 to 100.
- 100 mean the best health you can imagine.
- 0 mean the worst health you can imagine.
- Please mark an X on the line that shows how good or bad your health is TODAY.

Best
Imaginable

100

90

80

70

60

50

40

30

20

10

0

Worst

Imaginable

University of Cape Town

APPENDIX M: PHASE 2 LETTER FOR PILOT STUDY

University of Zimbabwe
College of Health Sciences
Department of Rehabilitation
P.O Box A178
Avondale
Harare

Date 15/ October/ 2012

Dear Madam

RE: Permission to utilise the part three physiotherapy in an inter-tester reliability pilot study for weight and height measurements.

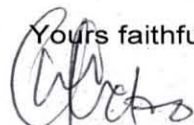
I do hereby request for permission to utilise the part 3 physiotherapy students in my pilot study for the Phase 2 of my research project during their lunch break.

The pilot study entails measuring students weight using an electronic body weight scale and their standing height using a standardised procedure, and compare the rate of concordance of the physical measurements between two raters. The measurements will be conducted in the gymnasium during lunch time.

My name is Matthew Chiwaridzo, I am physiotherapist currently pursuing post-graduate studies at the University of Cape Town. I am conducting a research on the prevalence of recurrent non-specific low back pain in adolescents in secondary schools and the associated individual risk factors. My ethical clearance reference number is **HREC REF:189/2012**

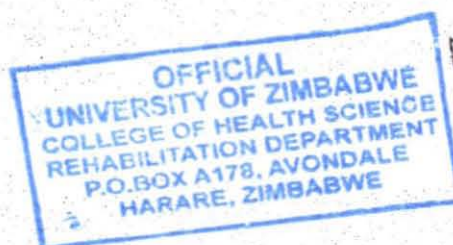
I am looking forward to your favourable response

Yours faithfully



Mr Matthew Chiwaridzo

MSc Physiotherapy Student



Approved

APPENDIX N: PHASE 2 INFORMATION LETTER

Dear Student

My name is Matthew Chiwaridzo. I am conducting a study entitled **“Prevalence and Individual Risk factors Associated with Non-specific Low Back Pain in Secondary School Adolescents in Harare, Zimbabwe”** as part of my Master’s Degree programme at the University of Cape Town. Based on the study eligibility criteria, you have been selected to participate in this study. I would be grateful if you participate in this study.

This is a follow-up study to the first phase of the study which you participated in by completing a questionnaire. This second phase aims to correlate the report of recurrent low back pain to physical factors such as body mass index and muscle flexibility. In addition, the study aims to compare the health-related quality of life between adolescents who reported recurrent low back pain and those who did not. Therefore, this phase entails conduction of the following measurements: height, body weight, and hamstring muscle length. Your body weight will also be measured whilst carrying your school-bag to assess your “standing posture”. The measurements will be conducted in the mornings on dates agreed with the school authorities. Thereafter, you will be requested to complete a questionnaire, EQ-5D-Y. It is anticipated that data collection will take approximately 15 minutes. There is no physical harm that will occur to you during the data collection.

Participation in this study is strictly by volition. You are under no obligation to participate in the study and you can withdraw without any consequences or need for justification. Your privacy will be maintained during the study as no personal names will be used and no information will be publicly divulged. In addition, the measurements will be conducted in an empty classroom by the researcher for each individual. You are free to ask questions at any time regarding the study.

Yours faithfully

Matthew Chiwaridzo

UCT MSc Physiotherapy student

Tel: +263 773 603 069

Supervisor: Mrs Niri. Naidoo Email:niri.naidoo@myuct.ac.za

UCT Physiotherapy Lecturer

APPENDIX N 1: MASHOKO KUMUDZIZI

Zita rangu ndinonzi Matthew Chiwaridzo. Ndiri mudzidzi wefundo yepamusoro parizvino ndirikufundira kuva nechitupa chepamusoo cheMaster's Degree ndichiita nezve: **“Huwandu nezvikonzero zvinounza marwadzo emusana muzera revana varipakati makore gumi negumi ne pfumbamwe vari muzvikoro zvesekendari zviri muharare.”** Ndingafare wakapa bvumo yekutendera kupinda mutsvagiridzo iyi.

Tsvakiridzo iyi irikuda kuburitsa nekuziva nezve hukama uripo pakati pedambudziko remusana nehuremu hwemuviri, mwero wekumira, kureba kwenyama dzemuviri. Pedzozve, muchabvunza kuburikiidza ne gwaro re EQ-5D-Y kuti tione hutano huripo pakati pevana vechikoro vane dambudziko remusana nevasina. Mukutarisa huremu hwenyu, muchatariswa makabereka mabhegi enyu amunotakuara kuchikoro. Unekodzero yekusiya tsvakiridzo iyi panguva yaanoda, hapana chikonzero chingadiwa zvichienderana nekusiya kwake.

Chikoro chako kana shamwari dzako hadzimbozive zvinenge zvabuda mutsvagiridzo iyi. Hapana zvakaipa zvinoitwa kwauri zvinosanganisirwa mutsvakiridzo iyi. Hapana mazita achashandiswa. Hapana zvakavandika zvichapambidzirwa kuruzhinji. Kukwikwidza kwako mutsvakiridzo iyi ndekemoyo wako nechido chako pasina kumanikidzwa. Hapana chikonzero chingadiwa kana wafunga kusiya. Tsvakiridzo iyi inotarisirwa kutora nguva pfupi ichaitwa makuseni.

APPENDIX O: PHASE 2 ASSENT FORM

- I hereby confirm that I have been informed by the researcher, Matthew Chiwaridzo, on the purpose and nature of the above study entitled: **“Prevalence and Individual Risk factors Associated with Non-specific Low Back Pain in Secondary School Adolescents in Harare, Zimbabwe.”**
- I have received and read the attached information sheet regarding the second phase of the study.
- I was given an opportunity to ask the researcher any pertinent questions.
- I have received enough information and understand all that the study entails.
- I am aware that all the results and information collected will be strictly confidential and will remain anonymous in all reports relating to the study.
- I understand that I may withdraw from the study at any stage and that there will be no adverse consequences following his/her withdrawal.
- I have understood everything that has been explained to me regarding the above study and I consent to participate in this study.

Signature: **Date and Place:**

Witness: **Date and Place:**

APPENDXI 01: GWARO REKUBVUMA

- Ndiripo pakutendera kuti ndakaziviswa nemuongorori Matthew Chiwaridzo pachinangwa nemamiriro etsvakiridzo inoti: **“Huwandu nezvikonzero zvinounza marwadzo emusana muzera revana varipakati makore gumi negumi ne pfumbamwe vari muzvikoro zvesekendari zviri muharare.”**
- Ndakatambira pamwe nekuveerenga magwaro anoenderana netsvakiridzo iri pamusoro.
- Ndakapihwa mukana wekubata nemuongorori pamwe nekumubvunza mubvunzo.
- Ndatambira ndikanzwisisa zvichadiwa mutsvakiridzo iyi.
- Ndine ruzivo kuti magwaro ezvichabuda ezvakavandika pamusoro pemwana wangu zvichange zviri muchivande uye zvinoramba zviri pakuzivikanwa pama gwaro ese achazonyorwa pakupera kwetsvakiridzo.
- Ndanzwisisa kuti ndinokwanisa kusiya kukwikwidza uku cero pachidanho chipi zvacho uye kuti hapana mhosva yandinenge ndapara zvichienderana nekusiya kwandinenge ndaita.

Siginecha: Zuva neNzvimbo:

Mupupuri: Zuva neNzvimbo:

APPENDIX P: PHASE 2 DATA SHEET

[illegible]

APPENDIX Q: RESEARCHER DATA SHEET

[illegible]

APPENDIX R: ETHICAL APPROVAL



UNIVERSITY OF CAPE TOWN

Faculty of Health Sciences
Human Research Ethics Committee
Room E52-24 Groote Schuur Hospital Old Main Building
Observatory 7925
Ms S Ariefdien - Tel: [021]4066492 • Fax: [021]4066411
email: sumayah.ariefdien@uct.ac.za

23 April 2012

HREC REF: 189/2012

Mr M Chiwaridzo,
Physiotherapy
Health & Rehab
F-45
OMB

CC: Ms N Naidoo
Health & Rehab
F46 Old Main Building

Dear Mr Chiwaridzo,

PROJECT TITLE: PREVALENCE AND INDIVIDUAL RISK FACTORS ASSOCIATED WITH NON-SPECIFIC RECURRENT LOW BACK PAIN IN ADOLESCENT (10-19 YEARS) IN HARARE URBAN SECONDARY SCHOOL LEARNERS

Thank you for submitting your new study to the Faculty of Health Sciences Human Research Ethics Committee

It is a pleasure to inform you that the Ethics Committee has formally approved the above-mentioned study.

Approval is granted until 28 April 2013

Please submit an annual progress report (FHS016) if the research continues beyond the expiry date. Please submit a brief summary of findings if you complete the study within the approval period so that we can close our file (FHS010).

Please note that the ongoing ethical conduct of the study remains the responsibility of the principal investigator.

Please quote the HREC REF in all your correspondence.

Yours sincerely

PROFESSOR MARC BLOCKMAN
CHAIRPERSON, FHS HUMAN RESEARCH ETHICS

Federal Wide Assurance Number: FWA00001637.
Institutional Review Board (IRB) number: IRB00001938

This serves to confirm that the University of Cape Town Human Research Ethics Committee complies to the Ethics Standards for Clinical Research with a new drug in patients, based on the Medical Research Council (MRC-SA), Food and Drug Administration (FDA-USA), International Convention on Harmonisation Good Clinical Practice (ICH GCP) and Declaration of Helsinki guidelines.

The Human Research Ethics Committee granting this approval is in compliance with the ICH Harmonised Tripartite Guidelines E8: Note for Guidance on Good Clinical Practice (CPMP/ICH/135/95) and FDA Code Federal Regulation Part 50, 56 and 312.

APPENDIX S: MRCZ ETHICAL APPROVAL

Telephone: 791792/791193/792747
Telefax: (263) - 4 - 790715
E-mail: mrc.zimbabwe@yahoo.com
Website: www.mrcz.org.zw



Medical Research Council of Zimbabwe
Josiah Tongogara / Mazoe Street
P. O. Box CY 573
Causeway
Harare

MRCZ APPROVAL LETTER

Ref: MRCZ/B/356

03 July, 2012

Matthew Chiwaridzo
University of Cape Town
School of Health and Rehab Sciences

RE:- Prevalence and individual risk factors associated with non-specific, recurrent LRP in secondary school Adolescents

Thank you for the above titled proposal that you submitted to the Medical Research Council of Zimbabwe (MRCZ) for review. Please be advised that the Medical Research Council of Zimbabwe has **reviewed** and **approved** your application to conduct the above titled study. This is based on the following

- Study Protocol
- Parent Information letter and Parent Informed consent letter (English and Shona)
- Student information letter and Student assent letter (English and Shona)
- LBP study Questionnaire
- Medical Health Questionnaire

- APPROVAL NUMBER** : MRCZ/B/356
The above details should be used on all correspondences, consent forms and documents as appropriate.
- APPROVAL DATE** : 03 July, 2012
- EXPIRATION DATE** : 02 July, 2013
- TYPE OF MEETING** : Expedited review

After this date, this project may only continue upon renewal. For purposes of renewal, a progress report on a standard form obtainable from the MRCZ Offices should be submitted one month before the expiration date for continuing review.

- SERIOUS ADVERSE EVENT REPORTING:** All serious problems having to do with subject safety must be reported to the Institutional Ethical Review Committee (IERC) as well as the MRCZ within 3 working days using standard forms obtainable from the MRCZ Offices.
- MODIFICATIONS:** Prior MRCZ and IERC approval using standard forms obtainable from the MRCZ Offices is required before implementing any changes in the Protocol (including changes in the consent documents).
- TERMINATION OF STUDY:** On termination of a study, a report has to be submitted to the MRCZ using standard forms obtainable from the MRCZ Offices.
- QUESTIONS:** Please contact the MRCZ on Telephone No. (04) 791792, 791193 or by e-mail on mrcz@mrczimshared.co.zw.
- Other**
Please be reminded to send in copies of your research results for our records as well as for Health Research Database.
You're also encouraged to submit electronic copies of your publications in peer-reviewed journals that may emanate from this study.

Yours Faithfully

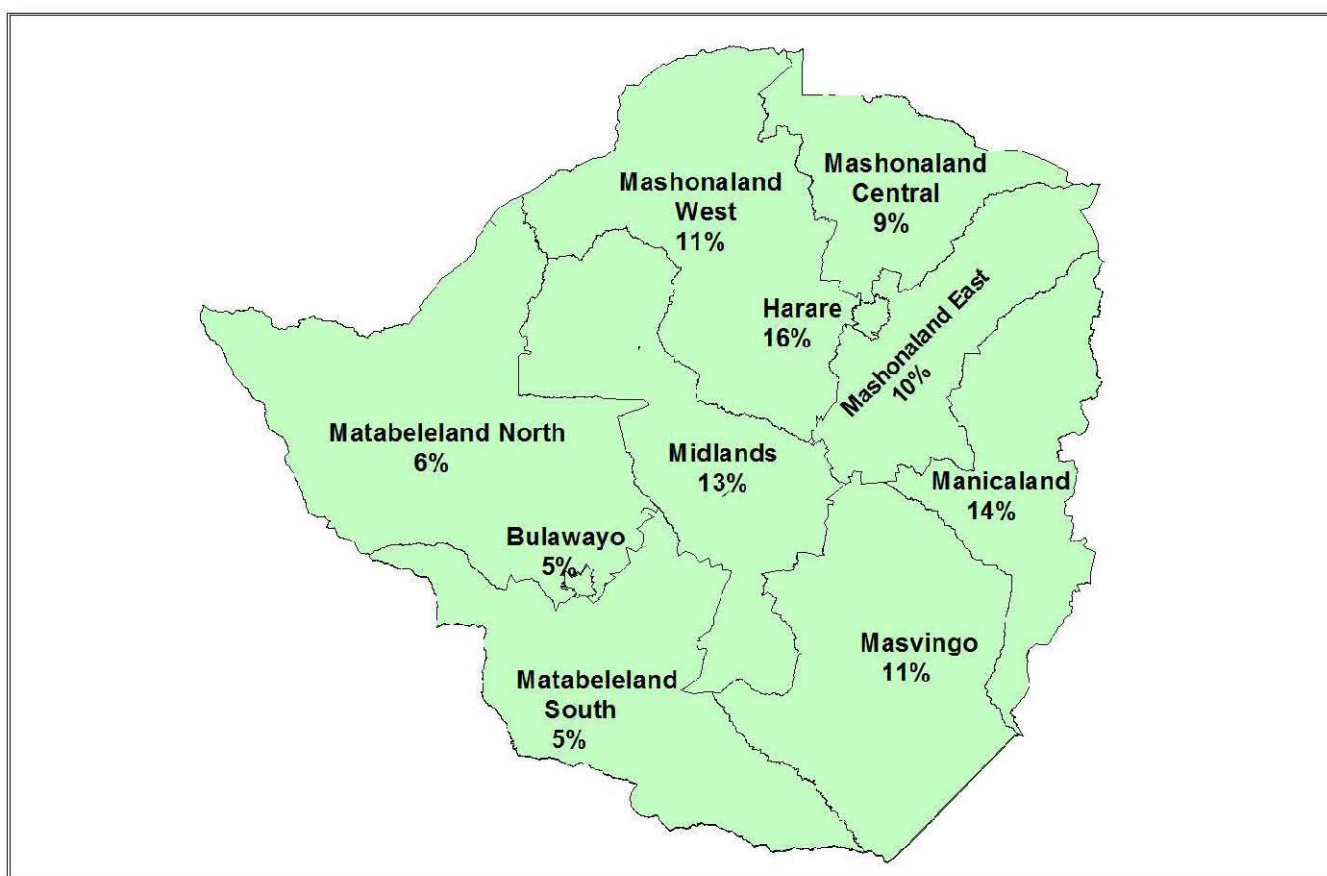
MRCZ SECRETARIAT
FOR CHAIRPERSON
MEDICAL RESEARCH COUNCIL OF ZIMBABWE



PROMOTING THE ETHICAL CONDUCT OF HEALTH RESEARCH

APPENDIX T: MAP OF ZIMBABWE

source: ZimStat (2012)



APPENDIX U: BMI-for-age GIRLS (5-19 years)

BMI-for-age GIRLS

5 to 19 years (percentiles)



2007 WHO Reference

APPENDIX V: BMI-for-age BOYS (5-19) years

