Validation of back pain questionnaire in a popoulation of New Zealand adolescents

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ABSTRACT

This study aimed to examine the content, convergent and discriminant validity of the Adolescent Back Pain Questionnaire (ABPQ) which was developed to gather lifestyle choices information regarding New Zealand (NZ) teenagers' experience of low back pain (LBP). Twenty volunteers (mean age 16.41, SD 1.66 years) were recruited from a secondary school, private physiotherapy clinics and a local medical centre. Of these, fifteen participants (mean age 15.50, SD1.59 years) had been diagnosed and/or had presented to physiotherapy with LBP and the remaining five participants (mean age 15.84, SD 0.93 years) had no history of LBP. All participants completed both the on-line ABPQ and the Nordic Back Pain Questionnaire (NBPQ), applied in random order, followed by an individual face-to-face interview regarding their preferences and opinions about the questionnaires. The results showed that responses to the ABPQ demonstrated convergent and discriminant validity as a self-report measure across four domains of LBP namely: life-time LBP prevalence, pain intensity, care seeking, and aetiology of LBP. Further, the language and comprehension contained in the ABPQ was found to be acceptable to NZ adolescents and the ABPQ clearly discriminated between those with, and those without, LBP; thereby providing a basis for the use of the instrument when screening for this condition in the NZ adolescent population.

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INTRODUCTION

Low back pain (LBP) and its impact on peoples' daily lives and work is an expensive and ongoing health issue both internationally (Balague Dudler & Nordin, 2003; Dagenais, Caro, & Haldeman, 2008; Fairbank, 2015) and in New Zealand (Accident Compensation Corporation, 2012). LBP begins to appear prior to adolescence but the incidence of this condition increases throughout the teenage years with a sharp increase in life time prevalence from 12-15 years (Hill & Keating, 2009), and by late adolescence the prevalence rate mirrors that found in the adult population (Balague et al, 1995; Balague, Troussier & Salminen, 1999; Leboeuf-Yde et al, 2011; Swain et al, 2014). There is renewed interest in the prevalence and aetiology of adolescent LBP as it has been proposed that the key to understanding and preventing LBP in adulthood lies in identifying relevant factors in the earlier formative years (Jeffries, Milanese & Grimmer-Somers, 2007; O'Sullivan et al, 2012; Rees et al, 2011). Although much data has been gathered internationally on the incidence of LBP in adolescents and its effect on lifestyle and possible causes (Leboeuf-Yde et al, 2011), there is less information available on the incidence, aetiology and behaviour of LBP in the New Zealand secondary school population (Trevelyan & Legg 2010, 2011). Furthermore, there is a need for a robust questionnaire that incorporates information on LBP that is specific to adolescents in the context of the New Zealand healthcare system and lifestyle.

In New Zealand, physiotherapists play a key role in the management of patients across the spectrum of LBP presentations, including those within the adolescent population. Meaningful data that further enhances physiotherapists' knowledge of incidence, presentation patterns and functional impact of LBP is required to implement appropriate and timely therapeutic interventions. Additionally, implementation of preventative strategies, prior to the known time incidence of LBP, could reduce disability and improve physical participation in work and society throughout life. Consequently, the researchers considered existing questionnaires which could be readily used to gather data on LBP across a broad spectrum of New Zealand adolescents such as the Roland Morris Disability Questionnaire, the Oswestry Disability Questionnaire and the Hanover Functional Ability Questionnaire (Pellise et al, 2009; Roland & Fairbank, 2000; Watson et al, 2002). However, it was noted that a number of questionnaire options for assessing LBP were strongly focused on functional loss and disability and designed to gather data from individuals already diagnosed with LBP (Davidson & Keating, 2002).

The Standardised Nordic Questionnaire on Musculoskeletal Symptoms often referred to as the Nordic Back Pain Questionnaire (NBPQ) (Kuorinka et al, 1987), has been used extensively as the primary measurement instrument in studies investigating LBP (Bjorksten et al, 1999; Leboeuf-Yde et

al, 2011) and contains appropriate domains to investigate incidence and aetiology of LBP. However, the NBPQ is not specifically designed for an adolescent population and the wording contained in this questionnaire reflects an occupational as opposed to a school environment. To this end, a multi-dimensional questionnaire entitled the Adolescent Back Pain Questionnaire (ABPQ) was designed to study influences relevant to adolescent populations and their experience of LBP by incorporating questions within the context of the New Zealand lifestyle. The ABPQ (Appendix 1) was designed to serve as an accompaniment to other directly recorded physical measures such as body weight and height that were planned to be undertaken concurrently with the questionnaire.

A number of factors were taken into account when developing the ABPQ to ensure high quality data applicable to the New Zealand population. Ethnicity is a key social indicator and according to Jeffries et al (2007), the failure to collect this information when designing questionnaires on adolescent LBP is a common oversight. The ethnicity data in the ABPQ was categorised according to the recommendations by Statistics New Zealand (Statistics NZ, 2005). The generic definition of LBP itself is also problematic due to the fact that the low back is often linked with other regions such as the neck (Jeffries et al, 2007). In this study, in accord with the methods used by Pellise et al (2009) and Watson et al (2002), participants were required to meet two criteria in order to be classified as having LBP namely: 1). The presence of LBP in the shaded area on an accompanying body manikin and 2). A positive response to the question, *Have you ever experienced pain in the shaded area in the figure above in the last month that lasted one day or longer* (Appendix 1, Question 4). Six prevalence time frames (currently experiencing LBP, one month, six months, one year, three years and lifetime) were included so as to provide a detailed profile of the participants' LBP experiences and to enable comparisons with previous studies and their LBP data. Information on the participants' LBP treatment seeking history was incorporated (Appendix 1, Question 10) as an additional dimension of the LBP experience. A criticism of LBP questionnaires is that the specified functional activities are too broad and unspecific to capture patients' more nuanced activity limitations (Lygren et al, 2014). The nine functional activities included in the ABPQ (Appendix 1, Question 11) were taken from the modified Hanover Back Pain Disability Questionnaire (Jones & MacFarlane, 2009). Although these activities were originally designed for 11-14 year old school children, the options provided included a range of dynamic and static loading activities that were also applicable to the target age group in this study.

It is important to measure the validity of any instrument or measure used to collect data either for clinical or research purposes (Anastasi, 1986). The validity of a questionnaire reflects the extent to which the measurement tool accurately assesses the intended construct (Kimberlain & Winterstein, 2008). Therefore, a questionnaire used to establish the experience of LBP in adolescents must ask questions that clearly cover all aspects of that experience such as pain intensity, duration and effect and the questions need to be designed to accurately gather data that is sensitive to these constructs (Weresh et al, 1997). It is also necessary to establish that the questionnaire is suitable for the target population by ensuring the language is appropriate and easily understandable and that the format of the questionnaire allows answers to be fully completed and subsequently, analysed successfully (Weresh et al, 1997).

As both the NPBQ and the ABPQ cover the domains of LBP prevalence, intensity, frequency, duration, functional impact, care seeking and cause of LBP; the NPBQ was the questionnaire used to explore convergent validity of the ABPQ. Therefore the aim of this investigation was to explore the validity of the ABPQ and to examine the ability of the instrument to discriminate between New Zealand teenagers (aged 13 to 19 years) who have and have not experienced LBP.

METHOD

Design

A cross-sectional observational study design was carried out on a sample of New Zealand adolescents.

Ethical permission for the study was granted by the University of Otago Human Ethics Committee (Approval #12/043 24/1/2012) and after taking consultation with the Ngäi Tahu Research Consultation Committee, (University of Otago, 24/1/2012). All participants received a full information sheet and provided written informed consent before entering into the study. Further, for those participants aged less than 16 years, written informed consent was also gained from the parents/ legal guardians if this additional consent was deemed to be necessary.

Participants and Recruitment

Participants were recruited from those individuals attending private physiotherapy clinics, a local medical centre and pupils from the co-educational secondary schools within the Nelson region. Recruitment methods consisted of letters and follow-up phone calls to physiotherapists and general practitioners seeking volunteers. Posters, class announcements and personal contact with teachers were utilised as recruitment approaches for volunteers in the secondary schools.

All participants were required to be able to access the on-line questionnaire independently. The other inclusion criteria were set according to the participant's group allocation: those with (Group I) and without (Group II) LBP. Entry criteria for Group I were adolescents aged between 13-19 years, who had experienced LBP which was sufficient to warrant treatment from a health professional (doctor, physiotherapist or osteopath). For Group II, participants were required to be aged between 13-19 years, never have experienced LBP and not be undergoing treatment for any health problems at the time of the study. All of the latter participants were recruited solely from a local secondary school. Exclusion criteria for both Group I and Group II participants were those individuals who had a history of spinal surgery and those that were unable to write or read without assistance.

Procedures

The questionnaire was loaded into Survey Monkey (Survey Monkey Inc. USA), an online tool which enables customized design of surveys and questionnaires. The questionnaire consisted of two parts (A and B). Part A of the questionnaire was an adapted version of the NBPQ with minor wording changes

which were designed to reflect a school rather than a work environment and Part B consisted of 12 questions comprising the ABPQ including the experience of LBP (Appendix 1). Each participant completed the questionnaire in a dedicated computer and space set up for the purposes of the study. On completion of the on-line questionnaire, the content and utility of the ABPQ was discussed with each of the participants in a face-to-face structured interview comprising nine questions conducted by one of the investigators (HM) (Appendix 2). The questions in the face-to-face interview were designed to gather the participants' views on content and comprehensibility of language and wording. Questions were also included to identify any difficulties or areas of ambiguity associated with any of the questions. Participants were also asked to consider their preference for delivery mode when answering a questionnaire. Each of the participant's responses and comments were recorded directly onto an electronic spreadsheet during the interview.

Measures

The domains of LBP experience, life time prevalence of LBP, duration, frequency, intensity, functional loss, care seeking and the participants' views on the aetiology of their LBP problem were identified within the two questionnaires. The responses of five of the seven domains found to be common to both the ABPQ and the NBPQ (namely life-time LBP prevalence, intensity, care seeking, functional loss and aetiology of LBP) were used for the analysis. For the purposes of quantitative analysis the response options for each of the five domains were assigned numeric values and pooled when necessary as follows:

Life-time prevalence: "No pain ever" was scored 0 and "back pain during your lifetime": was scored 1.

Intensity: The Numeric Rating Scale (NRS) responses from 1-10 in the ABPQ were converted to the corresponding intensity ratings on the NBPQ where 0 = no pain, 1-3 = mild pain, 4-6 = moderate pain, 7-8 = severe pain, and 9-10 = very severe pain.

Care seeking: The responses in the ABPQ on care seeking were pooled: 0 = not seen, 1 = seen by GP, 2 = seen by school or medical centre nurse, 3 = seen by physiotherapist, osteopath or chiropractor, 4 = seen by GP and physiotherapist.

Functional loss: Scores derived from the ABPQ were assigned to impact either school, leisure activities or school and leisure activities respectively, where: 0 = no functional loss, 1 = loss of school activity, 2 = loss of leisure activity and 3 = loss of both school and leisure activities. This grouping enabled some comparison but was not a direct form of comparable scoring between the two question sets.

Cause of LBP: Scores; 0 = no cause, 1 = accident, 2 = sporting activity, 3 = activity at school, 4 = activity at home, 5 = other cause. These categories enable direct comparison. The sequence of Part A and B appearing in the on-line questionnaire was generated using an on-line randomization website (Randomness and Integrity Service Ltd).

Data Analysis

Convergent validity was assessed by determining the association between the responses to the ABPQ and the NBPQ questions, using Spearman's Rho correlation coefficients. Statistical significance was set at $p<0.05$.

Discriminant validity was assessed by percentage comparisons of the responses obtained from the ABPQ, examining those participants who reported "no LBP ever" and those that reported "LBP at least once" across the four domains of pain intensity (NRS), functional loss, causative factors (accident, sports activity, school or home activity) and care-seeking (physiotherapy, general practitioner, osteopath or other health practitioner).

Content validity: Responses from the participants' one-on-one interviews were assigned to one of the respective themes of the four content domains: question suitability, comprehension, appropriateness and preference, along with any additional comments they provided. A frequency count was taken of the number of responses for each domain. The additional free comments were analysed thematically for common threads of thoughts, feelings and opinions regarding the questionnaires.

RESULTS

Twenty people participated in the study; the data from one participant were excluded from analysis as it was incomplete. Nineteen volunteers (mean age 16.41, SD 1.66 years, range 14.0 -19.9 years) fully completed the on-line questionnaire between March and July 2012. Eighteen participants reported being of NZ European descent (94.74%) and one reported being both NZ Māori and NZ European descent (5.26%). Seven participants (37%) were male and 12 participants (63%) were female. Thirteen of the participants completed the questionnaire in a physiotherapy clinic and another six participants answered the questionnaire in their school office. The investigating physiotherapist (HM) conducted a one-to-one interview with each participant on completion of the questionnaire.

Table 1: Spearman's Rho correlation coefficients

Question domain	Spearman's Rho (r_s)	Significance level (p)
Pain intensity	.594	.007**
Care patterns	.973	.000**
Function loss	.351	.141
Aetiology	.741	.000**
Life time prevalence	.880	.000**

Note: ** Highly significant

Convergent validity

The correlation coefficients for ABPQ and NBPQ responses across five domains are detailed in Table 1. Strong significant correlations occurred between the ABPQ and NBPQ domains of life time prevalence of LBP (r_s= 0.880, p<0.001) causative factors of LBP (r_s=0.741, p<0.001) and care seeking behaviour for LBP (r_s = 0.973, p<0.001). A moderate correlation was also demonstrated for pain intensity levels (NRS) for the ABPQ and ranked equivalents in the NBPQ (r_s = 0.594, p = 0.007). A weak, non-significant correlation was found between the domain of functional loss between the two question sets (r_s =0.351, p = 0.141).

Discriminant validity

The percentage analysis of the ABPQ responses showed a clear distinction between those with and those without LBP with 100% of the participants without LBP reporting no functional loss, no care seeking and no life time prevalence of LBP (Table 2). The participants with no LBP did not report any care seeking, functional loss or events associated with the aetiology of LBP (Figures 1-3).

Table 2: Comparison of participants reporting low back pain and those reporting no back pain across three domains in the Adolescent Back Pain Questionnaire (ABPQ).

ABPQ domains	Low back pain (n=14)	No low back pain (n=5)
Care seeking	8	0
No care seeking	6	5
Functional loss	11	0
No functional loss	3	5
No aetiology	5	5
Accident	1	0
Sports	5	0
School activities	1	0
Lifting activity	3	0
Not sure	1	0
Posture	1	0

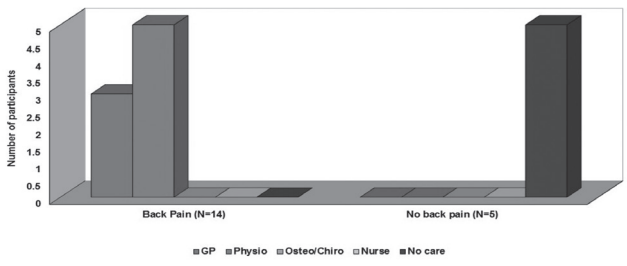

Figure 1: Health care seeking patterns for participants with (n=14) and without low back pain (n=5).

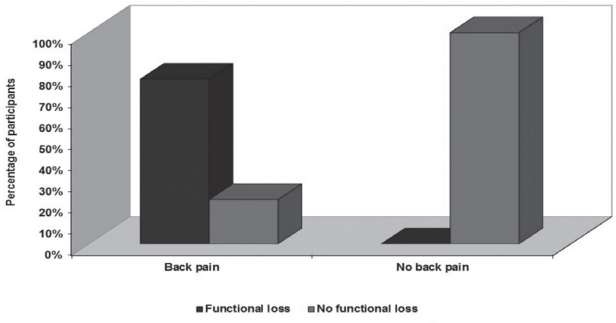

Figure 2: Functional loss expressed by participants with (n=14) and without low back pain (n=5).

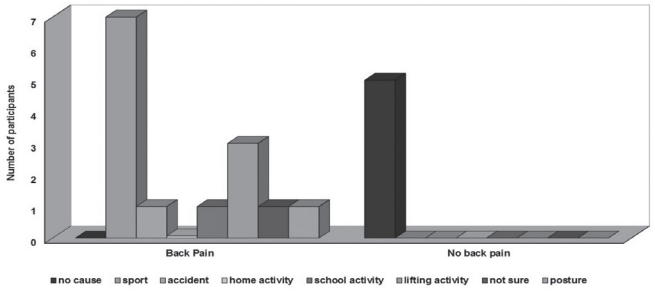

Figure 3: The number of participants reporting known cause of their low back pain.

Content validity

Suitability: In response to the interviewer's questions a clear majority of the participants found both the ABPQ and the NBPQ easy to understand, suitable for the target age group and did not require assistance to complete the questions.

Preference: Eight participants preferred the ABPQ, one participant preferred the NBPQ with ten of the participants expressing no preference. The use of the online delivery of the questionnaire was favoured by the majority of the participants. However six of the participants stated that either a paper or online delivery was satisfactory.

Comprehension: One participant required explanation of the meaning of "leisure" while completing the questionnaires and on interview suggested that "after school activities" could have been more appropriate wording. The same participant sought clarification from her mother on the time frame since pain onset.

Themes: Three participants identified the same pain prevalence question in the ABPQ as confusing. Participants were asked to indicate if they had ever experienced LBP for one day or more, or had experienced LBP for a day or more in the last month, six months, twelve months or, in the last three years (Appendix 1, Question 4). Two participants suggested changes to wording: The inclusion of "I don't know" option for cause of back pain and a suggestion for including a section on pain description. All participants were positive about the overall experience of participating in the survey.

DISCUSSION

This study sought to validate the ABPQ which had been tailored for New Zealand adolescents when screening for LBP presentations. The results showed that convergent validity was indicated with four of the five domains examined: life time prevalence, levels of back pain, causative factors, treatment choice and pain intensity levels (Table 1). The low correlation obtained for the fifth domain, functional loss, may be explained by the dichotomous nature of this variable (school or leisure) in the NBPQ, whereas in contrast, the ABPQ provided nine possible response options of graded activities. The results also indicated that the questions contained in the ABPQ clearly distinguished between those participants with and without a history of LBP when information was sought regarding seeking care for LBP, functional loss and aetiology of LBP (Figures 1-3). The finding that the participants expressed a preference for the ABPQ over that of the NBPQ may be explained by the unfamiliar terms and wording used in the NBPQ such as the term "back trouble" in this questionnaire in comparison with the more direct wording of "back pain" found in the ABPQ. Information gathered from the interviews following completion of the two questionnaires also indicated the participants had a clear preference for an on-line mode of delivery.

One of the limitations in the current study was the small number of participants in the 13 year old age bracket that were able to be recruited so that comprehension and understanding for adolescents in this age group was not able to be verified for the ABPQ. The recruitment of adolescents with back pain for this study who were actively undergoing treatment for LBP proved difficult due to the low numbers actually seeking treatment and is a further acknowledged limitation of the study. The New Zealand population is ethnically diverse with 30.7% of the population being either Māori, Pacific peoples or Asian (Statistics, New Zealand), and it is accepted that the study population was not representative of the demographic profile in New Zealand. The current study sampled a population in a semi-urban environment, and in a small geographical area, so that it is anticipated that results may vary in larger population groups and in different regions of New Zealand where the ethnicity and socio-economic factors are more variable. In terms of strengths, the opportunity to have one-on-one interviews with each participant immediately following the completion of the questionnaire assisted in gathering accurate responses and ensured that they were not diluted by time recall issues. Having a single interviewer for all the sessions was a further strength in the study design which served to minimise the potential for inter-reliability issues in the procedural aspects of the interviews.

Clinically, in a final iteration, there is potential for the APBQ to be used by physiotherapists as part of an overall patient information gathering process when assessing adolescents presenting with LBP. The results of the study also demonstrate to physiotherapists the value in reviewing the scope and language contained in widely utilized questionnaires to ensure their applicability for their target population of interest.

There are several recommendations for future research so as to strengthen the validity of this tool for clinical use. Based on a mean prevalence rate at 12 months of 0.33% (Calvo-Munzo, Gomez-Conesa & Sandez-Meca, 2013), it is estimated that a sample size of 237 participants is needed to establish a true difference (margin of error 5% with a statistical power of 90%) (Raosoft Sample size calculation Inc., 2004) in future iterations in the validation process of the questionnaire. Additionally, the low care seeking behaviour identified in this study may be related directly to the negligible impact on quality of life and/or function and leads to questions regarding what constitutes an episode of LBP. To further explore the discriminating ability of this questionnaire, participants with other disabilities and other painful non-LBP conditions could be included to ensure the tool did not record other generalised symptoms in LBP specific domains. An age/sex matched population sample of the subgroups with and without LBP would add weight to results and reduce potential bias. Definitions of LBP prevalence have been developed to reduce heterogeneity in frequency estimates in epidemiological studies of LBP and it is acknowledged that duration of LBP experience is the most difficult variable on which to gain consensus (Dionne et al, 2008). In the light of the comments made by several of the participants regarding pain prevalence in the current ABPQ it would also be worth revisiting this section to ascertain if minor adjustments could be made to improve clarity including that of incorporating "I don't know" options where appropriate. Incorporating the suggestions made by the participants into an updated version would ensure it is devoid of language and terms that might be unfamiliar or confusing to an adolescent population. Online questionnaires have the advantages of reduced personnel resources with the ability to contact a larger population and it has been shown there is an excellent correlation between online questionnaires and face-to-face interviews (Raat et al, 2007; Soetokino et al, 1997; Staes et al, 2000). Furthermore, the high internet usage in New Zealand (93.8% of the population) (http://www.internetworldstats.com/stats.htm) indicates there is a favourable climate for utilising the internet. Study into web-based accessibility of the ABPQ beyond that able to be carried out in the current study would serve to further improve the clinical utility of this tool for changing healthcare practices.

CONCLUSION

This study shows that the ABPQ demonstrates good convergent and discriminant validity, in addition to exhibiting acceptable

content validity and utility in the New Zealand school-age adolescent population. Participants indicated a preference for the ABPQ over the NBPQ in terms of content and language along with preference for an online mode of delivery. Physiotherapists can be confident that the use of the ABPQ in its current format will differentiate those adolescents presenting with and without LBP.

KEY POINTS

1. The construct validity of four out of five domains in the ABPQ was demonstrated when examined in relation to the widely used NBPQ.
2. As an instrument in its current format, the ABPQ clearly distinguishes between those adolescents with, and those without, LBP.
3. The language used and content contained in the ABPQ is appropriate for the target population of New Zealand adolescents, who also indicate a preference for an on-line delivery mode of this instrument.
4. Physiotherapists can be confident that the current version of the ABPQ will differentiate those adolescents presenting with and without LBP.

DISCLOSURES

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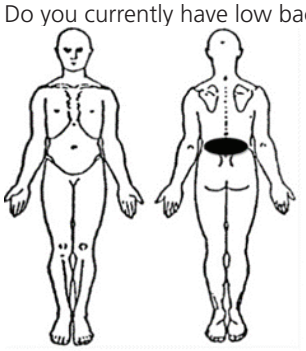
Appendix 1

Adolescent Back Pain Questionnaire

Questions		Answer options
1.	What is your date of birth?	dd/mm/yyyy
2.	Which ethnic group or ethnic groups do you belong to?	NZ/European Maori Samoan Cook Island Tongan Chinese Indian Other ethnicity eg Dutch Japanese Tokoleaun
3	Do you currently have low back pain?	Yes/No
		
4	A) In the past month, have you experienced any pain in the shaded area in the figure above that lasted one day or longer?	Yes/No
	B) In the past 6 months, have you experienced any pain in the shaded area in the figure above that lasted one day or longer?	Yes/No
	C) In the past 12 months, have you experienced any pain in the shaded area in the figure above that lasted one day or longer?	Yes/No
	D) In the past 3 years, have you experienced any pain in the shaded area in the figure above that lasted one day or longer?	Yes/No
	E) Have you ever experienced pain in the shaded area in the figure above that lasted one day or longer?	Yes/No
5	Are you undergoing any treatment for low back pain currently?	Yes/No
6	Thinking back over the past 12 months, how many days have you had low back pain that lasted one day or more?	
7	How bad was the pain at its worst during the past 12 months on a scale 0-10 where 0 represents no pain and 10 the worse pain you can imagine?	0-10
8	How long does your low back pain usually last?	
	a) less than 12 hours	Yes/No
	b)12-24 hours	Yes/No
	c)1-7days	Yes/No
	d) 7+ days	Yes/No
9	Does your low back pain ever spread down your legs?	Yes/No

10	Have you visited any of the following in the past 12 months for your low back pain?	
	a) Doctor	Yes/No
	b) Physiotherapist	Yes/No
	c) School nurse	Yes/No
	d) Not seen by anyone	Yes/No
	e) Other health professional	Yes/No
11	Does your low back pain make any of the following daily activities difficult?	
	a) reaching for a book from a high shelf	Yes/No
	b) carrying a school bag to school	Yes/No
	c) sitting on a school chair for a 45 minute lesson	Yes/No
	d) standing in a queue for 10 minutes	Yes/No
	e) sitting up in bed from a lying position	Yes/No
	f) bending down to put on socks	Yes/No
	g) getting up from an armchair at home	Yes/No
	h) running fast such as running to catch a bus	Yes/No
	i) sports activities at school	Yes/No
	j) none of these above activities bother me	Yes/No
12	What do you think caused your low back pain?	
	a) accident	Yes/No
	b) sporting activity	Yes/No
	c) lifting activity	Yes/No
	d) home activity	Yes/No
	e) school activity	Yes/No
	f) other	Yes/No

Appendix 2

Face-to face participant questions

1.	Were the questions understandable – did each of the questions make sense to you and enable you to provide answers quite easily?
2.	There were two separate questionnaires – one with a blue background and one with a green background. Thinking back on your experience in answering the questions – were the questionnaires both easy to understand or was one better than the other? If so can you give any examples of why you preferred one over the other?
3.	Did you answer the questions without having to ask for assistance?
4.	Do you think the questions are asked in a way that is appropriate for your age group?
5.	Did you think the wording and terms used in the questions are easily understood and, that you would expect your age group to understand?
6.	Do you think doing the questionnaire online was the best way to do this survey?
7.	Can you identify any questions or wording that could be improved or clarified?
8	Do you think we need to add any questions that were not included about the experience of low back pain in teenagers?
9.	Is there anything you would like to add about your experience here today?