Long-term effectiveness of a back education programme in elementary schoolchildren: an 8-year follow-up study

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Received: 1 February 2011 / Accepted: 21 May 2011 / Published online: 7 June 2011
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Abstract The purpose of this study was to investigate the long-term effectiveness of a spine care education programme conducted in 9- to 11-year-old schoolchildren. The study sample included 96 intervention subjects and 98 controls (9- to 11-year-olds at baseline). Intervention consisted of a 6-week school-based back education programme (predominantly biomechanically oriented) and was implemented by a physical therapist. Self-reported outcomes on back care knowledge, spinal care behaviour, self-efficacy towards favourable back care behaviour, prevalence of back and neck pain during the week and fear-avoidance beliefs were evaluated by the use of questionnaires. Post-tests were performed within 1 week after programme completion, after 1 year and after 8 years. Whereas the educational back care programme resulted in increased back care knowledge up to adulthood ($P < 0.001$), intervention did not change spinal care behaviour or self-efficacy. Pain prevalence figures increased less in the experimental group compared to the controls over the 8-year time span, yet statistical significance was not reached. Dropout analysis revealed spinal pain prevalence rates to be different in both groups throughout the study, including at baseline. Back education at young age did not reinforce fear-avoidance beliefs up to

adulthood. Predominantly biomechanical oriented back education in elementary schoolchildren is effective in improving the cognitive aspect of back care up to adulthood, yet not in changing actual behaviour or self-efficacy. The current study does not provide evidence that educational back care programmes have any impact on spinal pain in adulthood. The true long-term impact of school-based spinal health interventions on clinically relevant outcome measures merits further attention.

Keywords Education · Back pain · Child · Prevention and control

Introduction

Epidemiological data on low-back pain (LBP) at young age [1, 2], analysis of risk indicators for LBP both in adolescence and adulthood [3, 4], clinical findings [5, 6], imaging studies [7, 8] and immunohistochemical results [9] draw attention to early degenerative changes of the spine and to the concept of precocious prevention of LBP. Therefore, several back education programmes for children have been developed and evaluated within the scope of back pain prevention [10–29]. While several authors advocate the implementation of back education in elementary school systems [e.g. 11, 12, 23], the European Guidelines regarding the prevention of LBP [30] highlight that there is insufficient evidence to recommend for or against a generalized educational intervention for the prevention of LBP or its consequences in schoolchildren.

Generally, the concept of school-based spinal health interventions amounts to attaining a biomechanical healthy lifestyle by good understanding of basic back care-related principles, thereby reducing the burden of back pain.

The submitted manuscript does not contain information about medical device(s)/drug(s).

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Accordingly, the majority of previous research in the area of early back education centred on its effectiveness in terms of improving back care knowledge, achieving behavioural change and decreasing spinal pain prevalence rates [31, 32].

Focusing on the results of intervention studies including the evaluation of back care-related knowledge [11, 13, 14, 18–21, 23, 26–28], back education through the elementary school curriculum turns out to be an effective strategy in improving the cognitive aspect of back care till adolescence. However, the important distinction between improving a student's knowledge of body mechanics versus changing their behaviour towards a biomechanical healthy lifestyle has been discussed in literature [26, 33]. Correspondingly, mixed findings have been reported particularly in interventions aimed at achieving proper spinal care behaviour by means of early back education [11–17, 19–24, 27, 28]. However, the heterogeneity in processes used for evaluation as well as the diversity among interventions with regard to content, implementation time, didactic approach and/or follow-up time preclude a simple comparison and dictate cautiousness in interpreting study results.

Remarkably, while numerous studies consider behaviour to be a key outcome in the evaluation of educational back care programme's effectiveness, only few have elaborated upon the psychological determinants of attaining the pursued health behaviours [11]. Based on the theory of planned behaviour [34], knowledge, self-efficacy, social support and attitudes may be relevant within this context as they can be considered important predictors for health behaviour.

A critical point in the prevention discourse, however, might be the lack of evidence for the direct impact of school-based spinal health interventions on back pain prevalence later in life [32, 35]. Moreover, when evaluating the effectiveness of such strategies, possible adverse long-term effects have to be considered as well. Within this context, Burton et al. [36] warned against a reinforcement of fear-avoidance beliefs that could possibly arise from early back education due to increased awareness. Since high fear-avoidance beliefs and misconceptions about pain are shown to be widespread in adults and play a significant part in the development of long-term disability [37, 38], it is important that subjects who received early back care-related prevention strategies have no increased fear-avoidance beliefs. However, previous research carried out by Cardon et al. [11, 12, 14] and Geldhof et al. [18, 19] found educational intervention programmes not to have a detrimental effect on fear-avoidance beliefs up to 2 years after programme completion.

To the authors' knowledge, the impact of early back care promotion implemented in the elementary school

curriculum has never been evaluated up to adulthood. Hence, the aim of the current study was to investigate whether a 6-week back education programme, implemented by a physical therapist among elementary schoolchildren, is efficacious up to adulthood. For that purpose, key variables were studied in a pre-test/post-test design over 8 years using an experimental and control group, with randomization at school level. More specifically, the effectiveness of early back education in improving back care-related knowledge, spinal care behaviour and self-efficacy towards proper back care behaviour was evaluated, as was the impact of intervention on spinal pain prevalence figures and fear-avoidance beliefs.

Methods

Subjects

The sample assessed in the current study comprised young adults who were 9- to 11-year-old schoolchildren at baseline. Number, gender and average age of subjects are presented in Fig. 1, as also the passage of participants through the current study.

In 2000, 16 elementary schools in Flanders (Belgium) were selected by simple randomization. At baseline, schools were randomized into the intervention and the control group. None of the participating class groups had followed a back education programme at the study onset. The initial study sample consisted of 198 schoolchildren who were subjected to the educational back care programme, and 165 controls not subjected to the programme. At the 8-year follow-up, the experimental and control group included 96 and 98 young adults, respectively, indicating a response rate of 53.4%.

Procedure

Pre- and post-testing were performed within 1 week before and after intervention, respectively. Follow-up evaluations were organized 1 year and 8 years after the intervention was applied.

Participants were asked to complete a questionnaire. At pre-test, post-test and 1-year follow-up questionnaires were filled out at school under supervision of the class teacher. At the 8-year follow-up, all subjects were reached by mail to complete the questionnaires independently at home. They were invited to return the questionnaire in a presented stamped and addressed envelope. One month after mailing the questionnaires, the non-responders were contacted once by a personal phone call to stimulate them to complete and return the questionnaires; 161 adolescents returned their questionnaire in time and 33 additional questionnaires were

Fig. 1 Characteristics and flow of the study sample

obtained by e-mail after a phone call. The study protocol was approved by the Ethical Committee of the Ghent University Hospital.

Intervention

The back education programme, also implemented in previous studies [11–14, 18, 19], consisted of six 1-h sessions at 1-week intervals and was taught by a physical therapist. The programme was created making use of ten guidelines on “how to make your discs happy”: (1) always keep the natural curves of your back, (2) be active, join in sports, (3) place your book on a ring binder or inclined desk, (4) when you relax, lie down on your back with your legs raised, (5) bend your knees, not your back, (6) to lift, stand as close as possible to the object, (7) ask for help in lifting a heavy

object, (8) carry an object as close as possible to your body, (9) carry your book bag on your back, and (10) your book bag should not weigh more than one-tenth of your body weight. The programme was given to one class group at a time (maximum 26 pupils).

Evaluation

Back care knowledge, spinal care behaviour, self-efficacy towards proper back care behaviour, back and neck pain in the past week and fear-avoidance beliefs were evaluated by use of a questionnaire, which represented good test–retest stability [11] and had been implemented in previous research [11, 12, 14, 18, 19].

The back care knowledge test was a multiple-choice quiz including 18 items. General back care knowledge, i.e.

back care principles indirectly linked to the back education programme, was evaluated through eight questions, whereas specific back care knowledge (directly corresponding to the content of the back promotion programme) was assessed through the other ten items.

The use of back care principles in daily life (spinal care behaviour) was assessed through six questions regarding checking weight of the book bag, elevator use, posture while putting on shoes, doing exercises every day, and postural behaviour while lifting and carrying objects. These questions were rated on a five-point scale (from never to ever) with a higher score indicating a biomechanical favourable spinal care behaviour.

Self-efficacy towards proper back care behaviour was measured by asking how easy or difficult the following were: participation in physical activity and sports each day, attaining a natural curvature of the spine, minimal loading of the book bag and paying attention to ergonomical postures. Questions were rated on a four-point scale (from difficult to easy); the higher the score, the higher was the self-efficacy. At the 1- and 8-year follow-up, the questionnaire integrated an additional part for subjects of the intervention group asking how frequently they used the back care principles in their current daily live (5-point scale from never to always).

Furthermore, back and neck pain prevalence within the last week was enquired with week prevalence being defined as the occurrence of pain or discomfort, continuous or recurrent, at some point in the past week. The subjects were told that pain or discomfort due to fatigue related to a single exercise was not considered as a back or neck problem.

To end with, fear-avoidance beliefs were evaluated through six questions asking whether sitting, swimming, running, participating in physical education, cycling and lifting heavy objects are ‘dangerous’ when having a backache. Questions were rated on a five-point scale, with a low score representing low fear avoidance.

Data analysis

Data analysis was performed using SPSS 16.0. The level of significance was set at 5%. The evolution of the questionnaire outcomes was explored using repeated-measures multivariate analysis of variance with time as within-subjects factor (pre-test, post-test, 1-year follow-up and 8-year follow-up) and condition as between-subjects factor (intervention vs. control group). As the potential effect of gender on learning, health-related attitudes and behavioural changes were discussed in health promotion literature [39] and gender was included as a second between-subjects factor to evaluate three-way-interaction effects.

Results

The three-way interactions (gender $\times$ time $\times$ condition) showed no significance for back care knowledge ($F = 1.160$, ns), spinal care behaviour ($F = 0.166$, ns), self-efficacy ($F = 1.804$, ns) and fear-avoidance ($F = 2.442$, ns) composite scores, as well as for the general ($F = 1.647$, ns) or specific back care knowledge components ($F = 0.701$, ns), the separate items on spinal care behaviour, and self-efficacy and fear-avoidance beliefs except for the item ‘cycling’ within the category last mentioned ($F = 3.526$, $P = 0.016$). This means that all scores but fear-avoidance beliefs regarding ‘cycling’ changed similarly in boys and girls.

Table 1 presents the mean scores, interaction and main effects of condition and time on back care knowledge, spinal care behaviour, self-efficacy and fear-avoidance beliefs for the intervention and control groups at baseline, post-test, 1-year follow-up and 8-year follow-up. Data on week prevalence figures of back and neck pain over the 8-year time span studied are reported in Fig. 3.

Back care knowledge

Repeated-measures multivariate analysis of variance revealed a significant interaction effect (time $\times$ condition) with significant higher knowledge scores at the 8-year follow-up compared to the other test moments in both groups ($P \leq 0.044$). At baseline, knowledge scores were equal in the intervention group compared to the controls. At post-tests, however, knowledge scores were significantly higher in the intervention group in comparison with the control group on each moment of testing ($P \leq 0.011$) with the exception of specific back care knowledge at the 8-year follow-up ($P = 0.112$).

The composite back care knowledge score is presented in Fig. 2a.

Spinal care behaviour

For spinal care behaviour, no significant interaction effects (time $\times$ condition) were found either for the composite score ($F = 1.252$, ns) or for the separate items (Table 1).

Analysis of the total sum score of spinal care behaviour revealed a significant main effect of time ($F = 18.138$, $P < 0.001$) with a significant lower score at the 8-year follow-up compared to the other test moments ($P \leq 0.014$), indicating that subjects reported that they implemented biomechanical favourable spinal care behaviour less in young adulthood. The main effect of condition, however, was not significant (Fig. 2b).

At item level, a significant main effect of condition was found for ‘checking the weight of my book bag’

Table 1 Mean scores, interaction and main effects of condition and time on back care knowledge, spinal care behaviour, self-efficacy, and fear-avoidance beliefs for the intervention and control group at baseline and in the post-tests

Variable (score range)	Score (mean ± SD)				Interaction effect (F): Time × Condition	Time (F)	Condition (F)
	Pre-		Post-				
	Intervention	Control	Intervention	Control			
Back care knowledge (0–18)	10.0 ± 2.7	9.7 ± 2.1	12.5 ± 2.8	10.1 ± 2.4	12.7 ± 2.4	10.8 ± 2.8	13.0 ± 3.1
	4.5 ± 1.2	4.4 ± 1.2	5.7 ± 0.9	4.6 ± 1.2	5.4 ± 1.1	4.9 ± 1.3	5.8 ± 1.0
General back care knowledge (0–8)							
Specific back care knowledge (0–10)	5.4 ± 2.1	5.3 ± 1.8	6.9 ± 2.6	5.6 ± 1.9	7.3 ± 2.3	6.0 ± 2.3	7.2 ± 2.8
	20.7 ± 3.3	20.7 ± 3.0	22.9 ± 4.0	21.7 ± 3.3	22.9 ± 3.8	22.0 ± 3.2	20.5 ± 2.6
Spinal care behaviour (6–30)							
Checking weight of book bag	2.6 ± 1.2	2.2 ± 1.2	3.2 ± 1.1	2.5 ± 1.2	3.0 ± 1.0	2.4 ± 1.3	1.7 ± 0.9
Elevator use versus taking the stairs	3.5 ± 1.3	3.4 ± 1.3	3.2 ± 1.4	3.3 ± 1.3	3.6 ± 1.2	3.2 ± 1.2	3.1 ± 1.1
Knee position when putting on shoes	3.9 ± 1.2	4.2 ± 0.9	4.2 ± 1.2	4.3 ± 0.9	4.3 ± 1.0	4.4 ± 0.8	4.4 ± 0.8
Doing exercises every day	3.3 ± 1.2	3.4 ± 1.1	3.6 ± 1.2	3.2 ± 1.1	3.4 ± 1.2	3.1 ± 1.1	2.8 ± 1.2
Knee position when lifting	3.5 ± 1.2	3.5 ± 1.1	4.1 ± 1.4	4.1 ± 1.0	4.3 ± 1.1	4.3 ± 0.8	4.2 ± 0.9
Distance to body when load carrying	3.9 ± 1.2	4.1 ± 1.0	4.5 ± 1.1	4.3 ± 1.0	4.4 ± 1.2	4.5 ± 0.7	4.5 ± 0.7
Self-efficacy (4–16)	11.6 ± 1.7	11.8 ± 2.0	11.6 ± 2.0	11.8 ± 2.0	11.3 ± 2.2	11.4 ± 2.0	10.2 ± 1.9
Daily participation in physical activity	3.2 ± 0.6	3.3 ± 0.6	3.2 ± 0.7	3.3 ± 0.6	3.2 ± 0.7	3.2 ± 0.6	2.7 ± 1.0
Attaining a natural curve of the spine	2.6 ± 0.8	2.7 ± 0.8	2.8 ± 0.8	2.7 ± 0.8	2.5 ± 0.7	2.7 ± 0.8	2.3 ± 0.6
Minimal loading of the book bag	2.9 ± 0.9	3.0 ± 0.9	2.7 ± 0.9	2.8 ± 0.9	2.5 ± 1.0	2.8 ± 0.9	2.5 ± 1.0
Pay attention to ergonomic postures	3.0 ± 0.8	2.8 ± 0.8	2.9 ± 0.9	2.9 ± 0.7	3.0 ± 0.8	2.8 ± 0.8	2.7 ± 0.7
Fear-avoidance beliefs (5–25)	16.9 ± 3.6	16.4 ± 3.6	16.5 ± 4.5	16.1 ± 3.6	16.1 ± 3.7	15.7 ± 3.2	18.8 ± 2.9
Sitting	3.6 ± 1.2	3.6 ± 1.3	3.0 ± 1.4	3.6 ± 1.1	3.1 ± 1.3	3.4 ± 1.2	3.5 ± 1.0
Swimming	2.6 ± 1.4	2.6 ± 1.1	2.6 ± 1.5	2.4 ± 1.2	2.7 ± 1.4	2.4 ± 1.3	2.3 ± 1.0
Running	2.6 ± 1.2	2.5 ± 1.0	2.6 ± 1.4	2.5 ± 1.3	2.4 ± 1.1	2.4 ± 1.0	3.6 ± 1.0
Participation in physical education	2.9 ± 1.2	2.8 ± 1.1	2.9 ± 1.4	2.5 ± 1.2	2.6 ± 1.1	2.5 ± 1.1	3.3 ± 0.8
Cycling	2.9 ± 1.3	3.0 ± 1.3	2.9 ± 1.3	2.8 ± 1.3	2.8 ± 1.1	2.6 ± 1.1	3.0 ± 1.0
Lifting heavy objects	2.9 ± 1.5	2.5 ± 1.2	2.9 ± 1.4	2.5 ± 1.3	2.5 ± 1.3	2.3 ± 1.2	3.1 ± 1.2

SD = Standard deviation

Intervention group: $n = 96$; control group: $n = 98$ * $P < 0.05$; ** $P < 0.01$; *** $P < 0.001$

Fig. 2 Change of back care knowledge (a) and spinal care behaviour (b) over 8 years

Fig. 3 Week prevalence of self-reported back and neck pain at pre-test and at post-tests

($P < 0.001$) with significant higher reports of book bag weight checking in the experimental group compared to the controls at all test moments ($P \leq 0.014$) except for the 8-year follow-up evaluation. Furthermore, the main effect

of time was significant for all six items. Specifically, a positive evolution was found for three items: at 8-year follow-up, participants reported more to bend their knees while putting on their shoes and when lifting a heavy object, and more to carry a load close to their body, compared to the pre-test ($P \leq 0.002$) yet not to the post-test or 1-year follow-up. By contrast, for the items on checking book bag weight, doing exercises each day and taking the stairs instead of the elevator, a negative evolution over time was found with a significant lower score at the 8-year follow-up compared to all other test moments ($P \leq 0.016$) except for the post-test for the item ‘taking the stairs instead of the elevator’ ($P = 0.167$).

Self-efficacy

None of the interaction effects (time $\times$ condition) on self-efficacy showed significance, for the sum score ($F = 0.159$, ns) or for the separate items (Table 1). Whereas the main effect of condition was not significant, the main effect of time was ($P \leq 0.001$). At the 8-year follow-up, all self-efficacy scores except for the ‘minimal loading of the book bag’ item showed lower values compared to the previous test data ($P \leq 0.003$), indicating a negative evolution over time for both groups.

Back and neck pain prevalence

A comparison between responders and non-responders within the pre- and follow-up design revealed intervention subjects who answered the questionnaires at the 8-year follow-up to have significant higher pain prevalence rates at baseline compared to the non-responders ($P < 0.05$). By contrast, responders of the control group tended to have lower spinal pain prevalence figures at baseline compared to those who dropped out. These differences may bias the results; therefore, the data were corrected for prevalence at pre-test.

Generalized linear models revealed a significant interaction effect between time and condition ($P < 0.001$), with significant higher pain prevalence rates in the experimental group compared to the controls at all test moments (Fig. 3). Furthermore, pain prevalence at the 8-year follow-up was found to be significantly higher compared to the other test moments ($P < 0.001$).

Considering the group-specific course of spinal pain prevalence data over the 8-year time span, analysis showed that an increase in prevalence from pre-test to the 8-year follow-up was higher in the control group compared to the intervention group (from 19.4 to 41.8% (increase of 22.4%), and from 34.4 to 54.2% (increase of 19.8%), respectively), although significance was not reached.

Fig. 4 Change of fear-avoidance beliefs over 8 years

Fear-avoidance beliefs

For fear-avoidance beliefs, no significant interaction effect between time and condition was found, either for the composite score ($F = 0.144$, ns) or for the separate items (Table 1; Fig. 4). Whereas the main effect of condition was only significant for the item ‘lifting a heavy object’ ($F = 5.087$, $P = 0.025$) with significant higher fear-avoidance beliefs for this item in the intervention group compared to the control group, the main effect of time was significant for the fear-avoidance sum score ($F = 24.501$, $P < 0.001$) as well as for the items on running, participation in physical education, lifting heavy objects and sitting. Further analyses showed fear-avoidance beliefs to be significantly higher at the 8-year follow-up compared to the other moments ($P \leq 0.001$) for the variables for which a significant effect of time was found, except for the item ‘sitting’. For fear-avoidance beliefs with respect to ‘sitting’, significant lower fear-avoidance beliefs were found up to the 1-year follow-up evaluation compared to the baseline scores ($F = 6.372$, $P < 0.001$), indicating subjects then agreed less with the proposition one has to sit still when having backache. This difference, however, disappeared at the 8-year follow-up.

Discussion

In the present study, long-term effectiveness of a 6-week back education programme among 9- to 11-year-old schoolchildren was evaluated into young adulthood. Making use of questionnaires, subject’s self-reported outcomes regarding back care knowledge, spinal care

behaviour and self-efficacy were assessed over a period of 8 years, as were spinal pain week prevalence figures and fear-avoidance beliefs.

In line with our hypothesis, the findings of the present study demonstrate that persons who were subjected to the educational back care promotion programme scored significantly higher than the controls on the knowledge of back care principles up to 8 years after intervention. These results are in agreement with previous research that reported back education through the elementary school curriculum to be effective in improving the cognitive aspect of back care up to adolescence [11–14, 18, 19, 23, 26, 27] and suggested retention in adulthood.

As a right conception of biomechanical-favourable back care behaviour is assumed to form a necessary condition for, yet not to be synonymous with, the development of a conscious and lifetime healthy lifestyle conform good body mechanics [23, 26, 33], the impact of early back education on spinal care behaviour was investigated in the current study. When compared to their contemporaries in the control group, subjects who had received the school-based spinal health intervention did not score better on applying back care principles in daily life over the 8-year span studied, except at post-test performed within 1 week after programme completion. The current study results thus suggest spinal care behaviour in adulthood not to be affected by predominantly biomechanical-oriented back education programmes implemented during childhood, which is in accordance with previous controlled design studies providing inconclusive or statistically insignificant results from pre-test to post-test up to 1 year post-intervention [11, 22, 28]. On the other hand, intervention effects in integrating crucial, biomechanical favourable back care principles have been reported previously [12–17, 19–21, 23, 24, 27] up to 2 years after programme completion.

As numerous intervention studies consider spinal care behaviour conform a biomechanical-favourable lifestyle to be a key outcome in the evaluation of the programme’s effectiveness, an additional purpose of the current study was to investigate the impact of early back education on psychological determinants for attaining the pursued health behaviours. Specifically, self-efficacy was focused as it is known to affect both the initiation and continuation of health behaviour [40]. In agreement with the results of a 1-year follow-up study by Cardon et al. [11], the current study established that intervention subjects did not improve their self-efficacy towards proper back care behaviour. This lack of improvement in self-efficacy may suggest that the programme does not implement modelling, feedback, and reattribution sufficiently, since these factors are important to improve self-efficacy in health-related behaviour [40]. Alternatively, it may be due to poor self-judgement of behaviour in relation to back care.

Whereas the majority of intervention subjects reported the use of the learnt back care principles frequently in daily living at the 1-year follow-up evaluation, only a minority of the experimental participants (6.2%) stated to still apply the learnt principles assiduously or sporadically 8 years after programme completion. Therefore, including booster sessions in the programme may be advisable. Alternatively, class teachers could be involved in formulating specific guidelines as motivated teachers turned out to be efficacious in improving programme effectiveness by enhancing the implementation of learnt principles and providing prolonged feedback [13].

Despite its clear relevance, the influence of early back education on spinal pain reports later in life is poorly understood and inconsistently documented. Whereas in some intervention studies, programme implementation resulted in an overall reduction in back and neck pain prevalence up to 3 years after programme completion [10, 12, 15, 16], other papers found educational intervention not to have any effect on back pain reporting [14, 18, 19, 29]. The current study results tend to slightly favour the experimental condition over the control condition, as a stronger increase in spinal pain prevalence figures was observed in the control group compared to the intervention group (an increase of 22.4% vs. 19.8% over the 8-year time span, respectively). However, this slight, favourable trend among the intervention subjects must be interpreted with caution considering the fact that pain prevalence rates were different throughout the study in the two groups, including at baseline, due to the dropout characteristics. Furthermore, one could question whether self-reported back or neck pain is the right outcome measure of school-based back education programmes, as the reduction of future aspects or consequences of LBP (such as chronicity, the degree of disability, or seeking care for LBP) have been cited as a primary concern within the scope of prevention studies [30].

When discussing the effectiveness of back education through the elementary school curriculum, some light has to be shed on potential adverse effects of such strategies. In this respect, Burton et al. [36] argued that the risk existed that early attention to back care-related topics and pain resulted in increased fear-avoidance beliefs and reinforced an erroneous belief that there was something seriously wrong. However, the present 8-year follow-up study indicated that intervention subjects did not have higher fear-avoidance beliefs than controls, probably due to the active approach of not focusing on pain. The current findings are in line with prior study results [11, 12, 14, 18, 19] reporting educational intervention programmes not to have a detrimental effect on fear-avoidance beliefs up to 2 years after programme completion. As argued in the European Guidelines regarding the prevention of LBP [30], further study is necessary to explore whether misconceptions may be prevented by

carefully selected and presented health promotion programmes, with the merit of demedicalizing LBP.

Considering the limitations of the present study, the use of self-reported back care behaviour needs a critical approach. An objective evaluation of one's body mechanics, rather than a written test, would provide greater assurance whether preventive back care principles were incorporated into daily living. However, due to practical limitations, an objective assessment was unfeasible. The 46.6% dropout and the reality that responders at the 8-year follow-up may be not representative of the study sample at baseline with regard to spinal pain prevalence figures included a second limitation. Therefore, the findings of the current study regarding the long-term impact of early back education on pain prevalence need careful interpretation with regard to generalization. Considering a last limitation, the possible influence of confounding factors unrelated to the intervention was carefully controlled during the 8-year span studied. However, in the follow-up period, possible interfering factors related to the intervention programme were not controlled. Pragmatically, there is a chance that secondary schools provide back care-related topics, since in Flanders schools may autonomously determine their health policy. However, the fact that participants of both conditions attended multiple secondary schools makes the possible influence of interfering factors similar in both conditions. The black box condition during the follow-up period may even strengthen the current findings on long-term effects of early back education.

With a view to optimizing the existing school-based spinal health programmes, more research is needed on the long-term effectiveness of both biomechanically oriented education programmes and strategies promoting active management. However, the most feasible outcome measures should be determined first.

Acknowledgments The authors are grateful to Elisa Everaert and Veerle Steeman for data collection, and to all the principals, teachers and participants for their cooperation in this study. No funds were received in support of this study. No benefits in any form have been or will be received from a commercial party related directly or indirectly to the subject of this manuscript.

Conflict of interest statement None of the authors has any potential conflict of interest.

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