Relationship between cognitive factors and healthy spine-related behavior among pupils

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Abstract

Background Back pain is one of the most important public health problems. It is on rise among adolescent and pupils' population. The aim of this study was to assess the relationship between cognitive factors (skills, knowledge, self-efficacy, and expectation beliefs) and back care behavior among pupils.

Methods A cross sectional study was conducted on a random sample of students attending public elementary schools in Tehran, Iran from October 2018 to March 2019. They completed a questionnaire containing items on cognitive abilities and a checklist to assess their skills on back care behaviors. Stepwise multiple regression analysis was performed to find out the contribution of cognitive factors on outcome.

Results In all, 204 students were entered into the study. The results revealed that 95.3% of the variance in the back behavior was explained by self-efficacy ($\beta=0.586$, $t=12.08$, $P<0.001$), expectation beliefs ($\beta=0.232$, $t=5.08$, $P<0.001$), and skills ($\beta=0.181$, $t=4.46$, $P<0.001$).

Conclusion These results showed that the pupils who had more confident, skills, and expectation beliefs were more likely to do proper back behavior. In this regard, school-based back pain prevention interventions should be addressed using key cognitive factors that consider the potential change strategies.

Background

Back pain is one of the most important public health problems and nearly 540 million people suffer from it [1]. It is on the rise among adolescent and pupils' population and the prevalence varies between 11% and 52.1%, and is associated with back pain in adulthood [2–5]. Behavioral risk factors for back pain in children are, among others, prolonged improper backpack loading during the childhood years, carrying the bag in one side of body [1,5–7], physical inactivity [1,8], and improper posture during daily activity [7,9]. Thus it is argued that in order to prevent or reduce burden of back pain in pupils, theory-based back care educational programs for this population are of prime importance [10].

One such theory that might help to enrich these programs and make them effective is the Social Cognitive Theory (SCT). The Social Cognitive Theory was originated from the Social Learning Theory (SLT) and according to the theory three main psychological determinants that predict any behavior changes are: behavioral capability (knowledge and skills to perform a given behavior); Self-Efficacy (SE); and outcome expectation beliefs (behavioral beliefs) [11,12].

The applications of SCT in many health education/promotion programs are well documented [13–17]. For instance, a review of literature on Physical Activity (PA) and diet behavior among cancer survivors reported that SCT-based interventions demonstrated promising results [17]. Similarly, a review on the explanatory power of SCT to explain PA among adolescents showed that the model explained greater

proportion of variance for intention compared to behavior [16]. Hall et al. [14] developed and validated a SCT-based survey instrument that focused on knowledge, behavior, and SE for fifth grade students in order to assess the relationships between knowledge, behavior, and SE for healthy eating. They have demonstrated that SE and behaviors were positively correlated ($r = 0.40$, $P = 0.0001$); but knowledge was not associated with SE or behavior. However, we could not locate any studies that use this theory for back care education. Most existing studies on the topic are usually did not apply any theoretical models and only implemented interventions that thought could work to change or modify pupils' back care behaviors.

Spence et al. [18] and Sheldon et al. [19] for the first time presented a healthy back behavior education. They determined the effects of verbal presentation, demonstration, and guided discovery teaching methods on children's proper lifting techniques and at the end they could not show that any behavior change occurred. Cardon et al. [20] tested the practical performance and back care knowledge through the back care education programme, among fourth- and fifth-grade elementary schoolchildren. The results showed that behavioral changes need further evaluation to optimize back care prevention programmes for elementary schoolchildren. Recently, Dullien et al. [1] conducted a cluster randomized controlled study and have examined if teacher-led intervention programmes could improve back-care knowledge and back-friendly behaviour. The results showed back care knowledge and parts of back-friendly behaviour could be significantly improved. As reported by Geldhof et al. [21], the intensive back posture education through the elementary school curriculum is effective till adolescence. It was shown that school-based back education programme did not change spinal care behaviour or self-efficacy [22]. Santos et al. [23], argued that no statistically significant difference was found between post-test and follow-up in relation to theoretical knowledge and posture during activities of daily living. A key limitation of these investigations is that they do not address cognitive factors causing back behavior and this issue has been scarcely investigated from the theoretical point of view.

However, to the best of our knowledge, as mentioned earlier this theory has not been used in any back pain prevention programs in elementary schools and we are not aware of a quantitative study that explores cognitive factors causing back behavior. Therefore, we were interested to investigate the extent to which the SCT could explain back care behavior among schoolchildren. It was hoped the findings from this study could help to design and implement an appropriate intervention for pupil populations attending elementary schools.

Methods

Design

This study used a cross-sectional design among 5th-grade students attending elementary schools in Tehran, Iran from October 2018 to March 2019. The independent variables were the constructs of the SCT (self-efficacy, knowledge, skills, and outcome expectation beliefs). The dependent variable was the back behavior (Fig.1).

The study sample

The study sample was consisted of female students aged 11 years. They were selected from two (out of 8) randomly selected elementary schools in North-West of Tehran, Iran. The district has a population of variety socio-economic background. In order to explore the predictive factor, the study of Dullien article [1] was referred to determine the required sample size. According to Dullien to conduct a study with power of 80%, and standard deviation of 14.5 for performance score with a minimum precision of 2 at 5% significance level, a sample of 202 pupils would be required. However, since in school-based studied, selection almost is impossible, thus the whole classes were selected and 204 fifth grade students were recruited. We obtained permission from school principals and all parents completed written informed consent.

Measures

1. Information on pupils' parents job and level of education and a question about the presence of back pain during last week among pupils (Yes, No).
2. To measure main independent variables the Cardon et al. questionnaire was used [20]. The questionnaire contained 43 items including the following sections:

(i). Back care knowledge consisting of 10 multiple-choice items on general back care knowledge. For each item respondents could choose a correct answer from a list of statements. The correct answers received 1 point and if they have responded wrongly they get zero score for that item. The score on this construct ranged from zero to 10 where the higher scores indicated higher knowledge.

(ii). Back care skills, which contained a checklist for practical assessment of skills, for back care principles. The checklist consisted of 23 items tapping into seven tasks (sitting at a table; picking up the crate; carry the crate; set the crate down on the table; pick up a pencil; move the crate; and book bag use). Each item is rated on a 5-point scale ranging from 1 (very poor) to 5 (excellent) giving score ranging from 23 to 115 where higher scores indicated better fulfillment of tasks.

(iii). Self-efficacy contained 4 questions asking that how easy or difficult the following were: participation in daily physical activity and sports, attaining a natural curvature of the spine, minimal loading of the book bag and paying attention to ergonomical postures. Each item is rated on a five-point scale (from difficult to easy) giving score ranging from 4 to 20 where the higher scores indicated higher self-efficacy.

(iv). Outcome expectation beliefs (behavioral beliefs) contained 6 items asking whether sitting, swimming, running, participating in physical education, cycling and lifting heavy objects are 'dangerous' when having a backache. Each item is rated on a five-point scale (strongly disagree to strongly agree) giving score ranging from 6 to 30 where higher score indicated stronger beliefs.

3. Back care behavior as outcome measure contained six questions regarding daily activities on checking weight of the book bag; carrying the bag with 2 straps; knee position when putting on shoes; doing exercises every day; and postural behavior while lifting and carrying objects. Each question is rated on a five-point scale (never = 1 to ever = 5) giving a score ranging from 6 to 30 where higher scores indicated better preventive behavior.

Data collection

Before data collection, we explained the aim of this study to the principal, class teacher, and pupils of the two schools. After indicating the permission from them, we distributed the questionnaire. There were two independent research assistants to help in this study, and rated students' skills based on checklist. Since the analysis of the relationship between the variables is worthy of attention, in fact, we are looking to identify that the relationships between variables that are extracted from the theory are confirmed by the data collected from the sample.

Data analysis

Descriptive statistics were used to explore the data. In addition, we used stepwise multiple regression analysis in order to assess the relationship between back care behavior (outcome variable) and independent variables including knowledge, skills, SE and expectation beliefs. The level of significance was set at $p < .05$. The data were analyzed using the SPSS V_{24} software to test the correlation between study variables.

Results

Participants

In all, 204 pupils aged 11 years participated in the study. Of these, 22.5% (n = 46) reported back pain during last week. The common characteristics of the students are presented in Table 1.

In general, the students' scores on knowledge were reasonable (mean = 4.71). The means and standard deviations of independent and dependent variables are demonstrated in Table 2.

The results obtained from stepwise multiple regression analysis to predict the back care behavior are showed in Table 3. The analysis revealed that 95.3% of the variance in the back care behavior was explained by skills (β = 0.181, P<0.001), expectation beliefs (β = 0.232, P<0.001) and self-efficacy (β = 0.586, P<0.001). Fig. 2 shows the plot of regression standardized residual.

Discussion

This study was carried out in order to predict healthy spine-related behavior among pupils using the SCT in elementary schoolchildren. The results revealed that SE, skills and expectation beliefs were important mediators of Back-care Behavior (BB). Of these, SE was the strongest predictors for BB. Studies have shown that SE affects both the initiation and continuance of BB [22,25]. The relationship between SE and behavior are well documented in previous studies where it has been reported that interventions should be improve students' SE towards proper BB. Indeed, it has been suggested that back pain prevention programs should implement modelling, feedback, and reattribution sufficiently, since these factors are important to improve SE in health-related behavior [22,25].

A positive value for the expectation beliefs' coefficient ($\beta = 0.232$, $P<0.001$) gives the sense that the stronger beliefs about dangers of back pain, will result in improved behaviors. Similarly, Gross et al. reported that one of the most basic assumptions about human behavior is the fact that what people' believe guides what they do [25]. Therefore, in order to enhance proper back behavior, we need to reinforce the proper beliefs and active approach towards dangers of pain and limitations that might exceed. In fact, belief change is much easier at a younger age; so appropriate actions should be considered in educational programs in order to correct any misunderstandings and misbelieves at this stage. As such the findings from the current study indicates promoting expectation beliefs could be an appropriate strategy for back care interventions.

We found a significant and positive relationship between skills and BB ($P<0.001$) that has been not indicated previously. This however, indicates that with improving students' skills, we might be able to promote their proper back behavior. As suggested in educational initiatives we need to target children's skills toward BB, during key constructive years when maladaptive beliefs, habits, and attitudes about the condition are being shaped [25].

The knowledge of back principals did not show any significant association with BB. Studies have shown that although knowledge might improve after back care interventions, the association between knowledge and proper back behavior was not established. For instance, Dullien et al. reported that back care knowledge and parts of BB significantly improved from pre- to post-test but increase in the intervention group' knowledge did not significantly affect their behavior [1]. Santos et al. also reported that there was no statistically significant difference between the post-test and follow-up concerning the back care knowledge and posture during activities of daily living although the performance of students was higher in the post-test and follow-up, when compared with the pretest [23]. Perhaps this is because people usually do not act on what they know and the fact that education alone is unlikely to promote positive and persisting behavioral change without coincident strategies [25].

Limitations

There were some limitations with this study. First, we used a cross-sectional design and data were collected through self-reported measures and raters' assessments; thus, the findings designs cannot provide evidence for cause-effect relationships. Longitudinal data and experimental studies are needed to

confirm the results observed in this study. Secondly, although we explored main cognitive factors of behavior, we acknowledge that there were other factors based on the SCT (environmental determinants of behavior) that were not adequately addressed. Finally, one should notice that we only collected data from girls' who were attending public elementary school; therefore, this limits the generalizability of the results to the entire population of pupils.

Conclusion

This study was the first to SCT to predict healthy spine-related behavior among pupils. The findings suggest that the SCT-based back care education programs should focus more on expectation beliefs, self-efficacy and skills when designing interventional programs for pupils. Indeed, assessing the utility of main cognitive determinants of SCT deserves further investigation.

Abbreviations

CFA: Confirmatory factor analysis

SCT: Social cognitive theory

SEM: Structural Equation Model

SE: Self efficacy

Declarations

Acknowledgments

Funding

Availability of data

The datasets used and analyzed during the current study are available from the corresponding author on reasonable request.

Authors' contribution

ZAC was the main investigator, collected and analyzed the data, and wrote the first draft. SST supervised the study and contributed to all aspect the study. AM was study advisor and contributed to analysis, interpretation and writing process. All authors read and approved the final manuscript.

Ethics approval and consent to participate

The study was registered by the ethics committee of Tarbiat Modares University under the code IR.TMU.REC.1396.727 and was in accordance with the Helsinki Declaration. We invited all of parents; informed them about research design, aim, objectives, as well as voluntariness, confidentiality and their rights. They then agreed to participate in the study by completing and returning the questionnaire. The parents completed the written consent form.

Consent for publication

Not applicable.

Competing interests

The authors declare that they have no competing interests.

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Tables

Table 1. The sample characteristics (n = 204)

		n (%)
Father's job		
	Employed	181 (88.8)
	Unemployed	4 (2.0)
	Retired	11 (5.4)
Mother's job		
	Employed	40 (19.6)
	Housewife	160 (78.4)
Father's level of education		
	Illiterate/primary	3 (9.9)
	Secondary	87 (42.6)
	Higher	69 (33.8)
Mother's level of education		
	Illiterate/primary	34 (16.7)
	Secondary	94 (46.1)
	Higher	55 (27.0)
Presence of back pain		
	Yes	46 (22.5)
	No	154 (75.5)

Table 2. Descriptive statistics for the study variables (n= 204).

	Mean	SD	Score range
Knowledge	4.71	1.40	0-10
Skills	65.84	16.16	23-115
Self-efficacy	13.89	4.44	4-20
Expectation belief	20.48	6.44	6-30
Back care behavior	20.94	6.65	6-30

Table 3. Parameter estimates based on stepwise regression analysis to predict back care behavior (n= 204).

Variables	B	SE_B	β	t	95% CI for B	P value
Self-efficacy	0.878	0.073	0.586	12.077	0.735-1.022	<0.001
Expectation belief	0.239	0.047	0.232	5.084	0.146-0.332	<0.001
Skills	0.075	0.017	0.181	4.463	0.042-0.108	<0.001

$F (3, 200) = 1332.519$, P< 0.001, R^2 (Adjusted R^2) = 0.976 (0.953)

Dependent variable is back care behavior change; **B** = unstandardized coefficient; **SE_B**= standard error of the coefficient; **CI** = Confidence Interval; **β** = standardized coefficient

Figures

BB = Back Behavior

BP = Back Pain

Figure 1
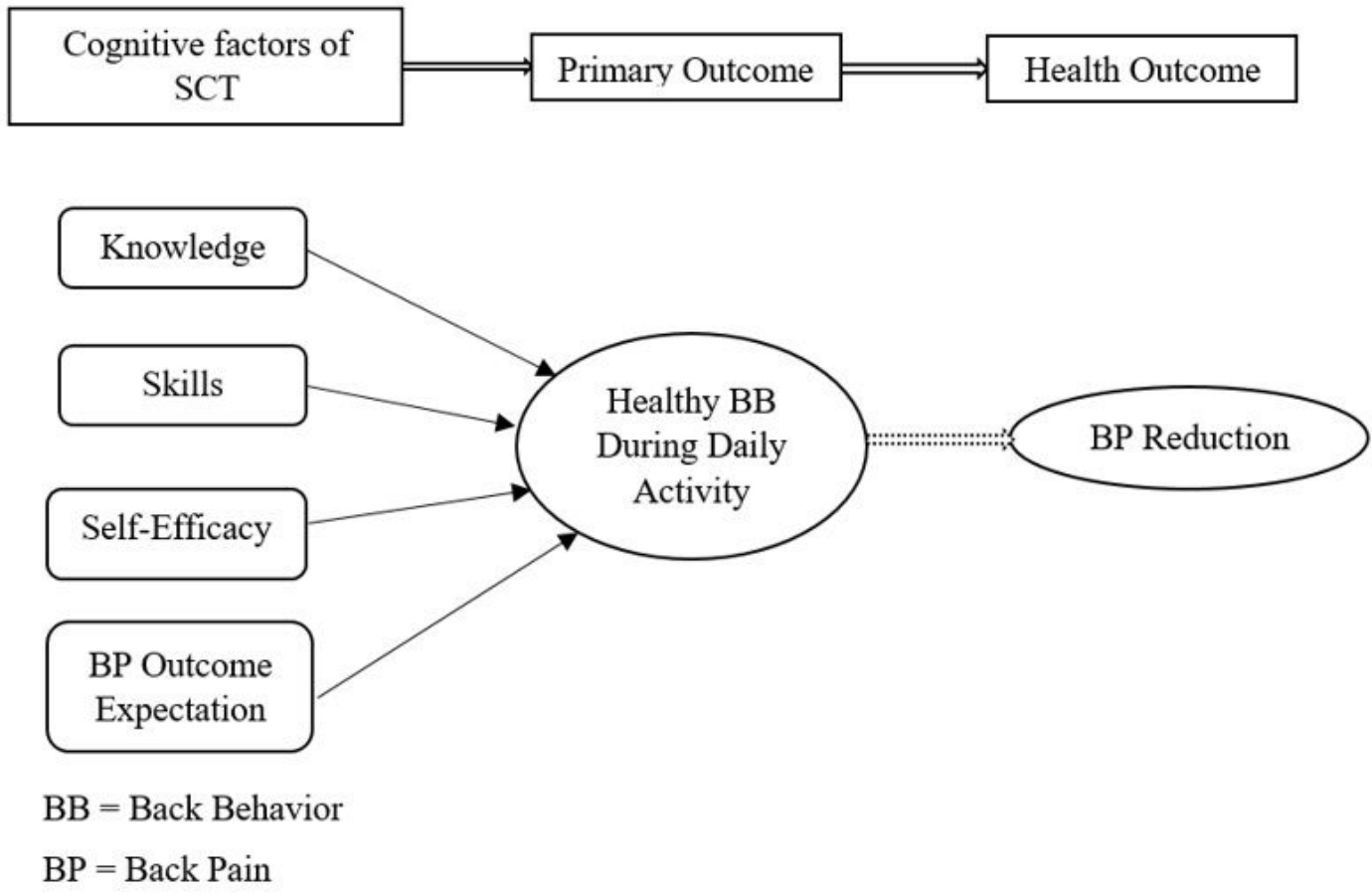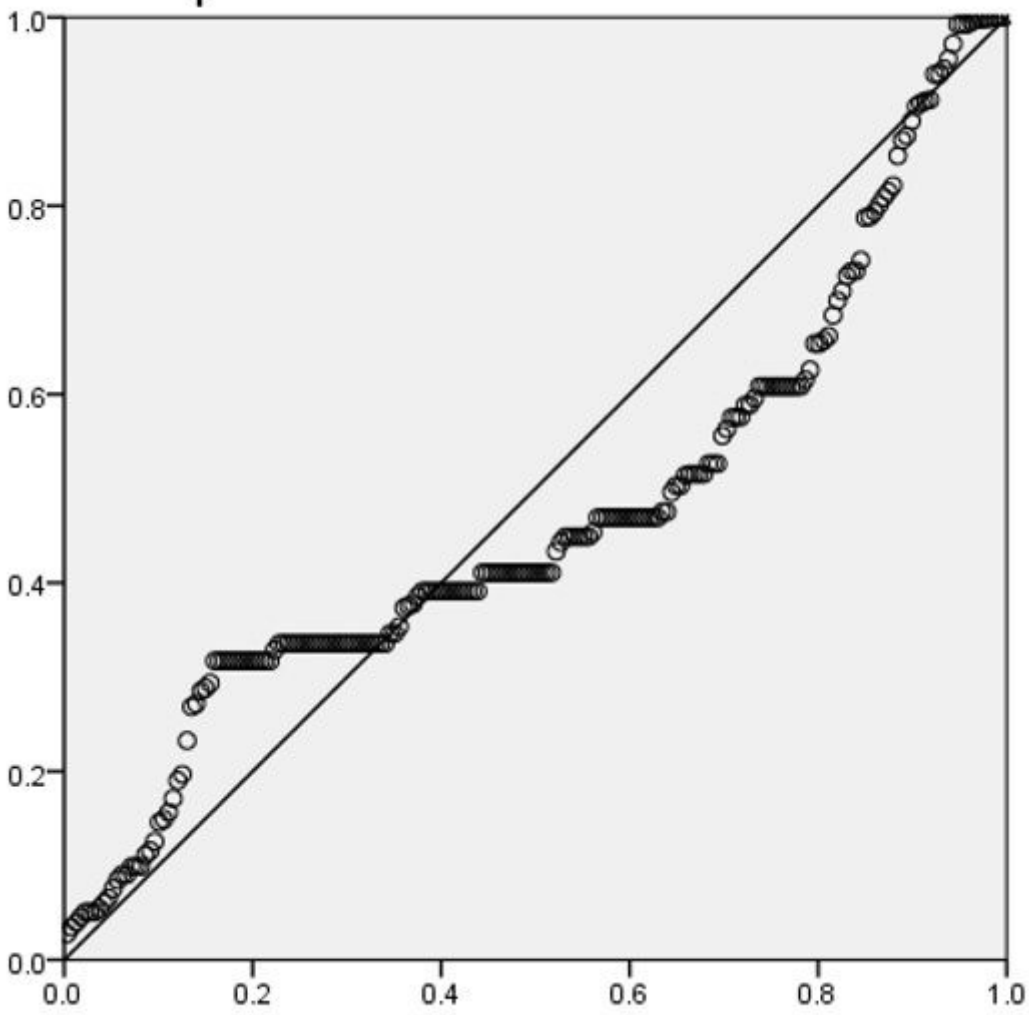
Conceptual framework of the study

Figure 2

Normal P-P plot of regression standardized residual (dependent variable: back care behavior)