Objective
The objective of this study was to assess the effectiveness of a defined clinical protocol comprised of whole body vibration (WBV) and its impact on chronic back pain by determining whether it improves outcome measures of chronic back pain.

Background
Whole body vibration therapy is delivered via a vibration platform with the participant in a standing, sitting, or lying position, either with or without concurrent exercise. The vibrations travel through the participant’s body and cause muscle contraction, thereby strengthening activated muscles. Strengthening core stability and back muscles can reduce or eliminate back pain. Previous studies have documented improvements in back pain after therapy with only WBV, as well as that involving WBV plus exercise. 1,2 Although the exact mechanisms are not fully understood, this technique is believed to elicit neurovascular changes through activation of muscle and joint proprioceptors, receptors that relay information about joint angle, muscle length, and muscle tension. One such receptor, the muscle spindle, activates the tonic vibration reflex during WBV. 3 This causes unconscious, repeated muscle contractions, warranting the label of “exercise.” Frequency, amplitude, acceleration, and duration can be adjusted to achieve individualized rehabilitation, although the most effective manipulation of these factors has yet to be determined. Frequency is the number of oscillations per second; vertical displacement is the amplitude. Most studies have applied a frequency from 0.45 Hz and amplitude has ranged from 0.12 mm. Acceleration, which typically ranges from 0.0–18g, is the product of frequency and amplitude. Duration is the length of treatment time. Studies have reported durations from 1–6 minutes or more. 1(p691),2(p1830) Duration is the length of treatment time. Studies have reported durations from 1–6 minutes or more. 1(p691),2(p1830) Duration is the length of treatment time. Studies have reported durations from 1–6 minutes or more. 1(p691),2(p1830)

Methods
Previously collected data from clients treated at ReVita Rehab (Spokane Valley, WA), a clinic which administers WBV and exercise therapy, were compared. Clinicians removed patient identifiers and provided data for analyses. Data were collected before and after therapy by means of the Visual Analogue Scale (VAS), a psychometric forced-choice rating scale for assessing pain, the Oswestry Disability Index (ODI), a questionnaire for determining functional disability and quality of life, and a postural analysis completed by a clinician. The postural analysis was done with PneuMAP™ (Pneumex, Inc., Sandpoint, ID), a grid which allows quantification of postural lean.

Sequential Protocol Used by ReVita Rehab: (accompanying figures below):
Unless otherwise stated, all equipment was designed at and manufactured by Pneumex, Inc. (Sandpoint, ID). All WBV ranged from 15–25 Hz based on patient tolerance; duration of WBV began at 10 min and increased to 15 min according to clinician discretion. 1. The patient lies supine on a vibration table called VibroTrac™, which delivers 3D WBV. Straps connect traction bars to a harness worn by the patient. Hydraulic movement of the bars causes gentle longitudinal stretch. During WBV, dynamic exercises to isolate and strengthen specific back and shoulder muscles are performed. 2. Still wearing the harness, the patient is attached to a treadmill with an overhead suspension bar which reduces weight borne by the patient. This allows for walking rehabilitation while avoiding pain and risks associated with falling. 3. Next, the patient sits in the PneuBack Chair™, which partially unweights the patient. This positions him or her with a corrected posture. 4. The patient performs dynamic exercises while still seated in the PneuBack Chair™. This allows exercise of isolated muscle groups chosen based on results of the PneuMAP™ posture analysis. 5. The 240 Stretch Trainer™ (Precor, Inc., Woodinville, WA), which sits on the Pro-Vibe 3D WBV platform, delivers passive stretch plus 3D WBV to the patient. 6. Last, the patient performs dynamic strengthening exercises while standing on the VibePlate®, a 1D WBV instrument (VibePlate.com, Denver, CO).

Analyses:
Posture analysis, ODI, and VAS data were entered and statistically analyzed using Microsoft Excel and paired t-tests to compare baseline and post-treatment scores. Statistical differences with a value of p<0.05 were considered significant.

Results

<table>
<thead>
<tr>
<th>Outcome Measures</th>
<th>N=55</th>
<th>ODI Index</th>
<th>N=55</th>
<th>Visual Analogue Scale</th>
<th>N=41</th>
</tr>
</thead>
<tbody>
<tr>
<td>Posture Analysis*</td>
<td>24%</td>
<td>22%</td>
<td>12%</td>
<td>10%</td>
<td>54%</td>
</tr>
</tbody>
</table>

*As determined by the PneuMAP™ lean measurement

Figure 1. Mean improvement in outcome measures. As shown in Figure 1, marked improvements were found in all outcome measures (each significant at the 0.005 level or less). Changes in ODI (disability and quality of life) were significant at the p<0.0005 level, and changes in the VAS (pain) were significant at the p<0.0001 level. For the posture analysis, changes were significant at the p<0.005 level.

Figure 2. Distribution of patients across improvement categories in the ODI and the VAS. The ODI is measured as a percentage out of 50; 100% indicates the worst possible score. The VAS is numbered 0-10, with 10 indicating the worst possible pain.

Figure 2 denotes the distribution of patients across improvement categories of the ODI and the VAS. The great majority of patients improved by at least 50% in these two outcome measures.

Conclusions
From these results, we conclude that this protocol which involves whole body vibration and exercise rehabilitation results in marked improvements in pain, posture, and functional disability and quality of life in adults with chronic back pain.

Several limitations of this proof-of-practice study exist, including lack of a control group and a placebo group. The rehabilitation protocol did not isolate therapeutic variables, and parameters varied between patients, so it is not clear which aspects of the therapy may have caused the improvements. From this study it is not possible to make conclusions regarding the effectiveness of whole body vibration compared to other methods. Future research should examine physiological mechanisms responsible for pain and functional improvements elicited by whole body vibration and possible long- term effects. Importantly, for whole body vibration, terminology needs to be standardized and optimal therapeutic parameters determined.

References