Ergonomic evaluations everywhere
Here are just some quick facts from the American Chiropractic Assoc. Website. As you all can see back pain is a serious issue in America. It presents serious financial burdens and impedes our productivity. A solution is for this growing problem is definitely needed. We found SpineBuddy interesting because of its claims to be a solution to this expensive problem.
Unfortunately there isn’t much literature on the topic of back pain and non-invasive treatments. Most of the literature is dated and only loosely related to SpineBuddy.

1) Webmd and many other reputable websites suggest the following to help with back pain. Of them the most notable is exercise to strengthen one’s core muscles and improving flexibility to reduce tension and tightness. SpineBuddy

2) Research by Shealy and Borgmeyer in ’97 (Am. Jor. of Pain Manag.) showed that decompression has been proven effective as a treatment for herniated and degenerative disc disease, relieves intradiscal pressure, 86% of patients immediate resolution of symptoms, 84% pain free 90 days post treatment

3) closest finding related to SpineBuddy. The firm laying down SpineBuddy seemed to fit in the category of a type of firm bedding.

Citations:

Project Goals

- Ergonomic Evaluation
- Objectives

SpineBuddy Claims:
  - Decompress Vertebrae
  - Relieve Pressure on Discs
  - Loosen Tight Muscles

What are we trying to prove?
Methodology

Short-term Study
--8 subjects
--Questionnaire
--15 minute use

Long-term Study
--3 days
--3 subjects
--Similar questionnaire
--15 minutes each day
Methodology: Questionnaire
--Demographic:
   --Gender, Age, Occupation, Physical Activities
   --Back Pain before use of product
   --Does background affect success?
--Experimental
   --Spine Length Before and After Use
   --Pain while using product?
   --Pain after using product?
   --Does product stop/cause pain?
Methodology: Pain Intensity Scale

--Questions
   --Is Pain present?
--Location of Pain?
   --Neck, Shoulder, Upper/Lower Back, Hip
   --Other--specific location in back region
   --R or L
--Intensity of Pain: Scales
The above scale was adopted from literature:

Methodology: Measuring Spine

--Person sitting
  --back against wall
  --on flat floor
--Use tape measure, measure from floor to base of neck (bump, C7)
Methodology

Pressure

• Comparisons of pressure patterns with/without use of Spinebuddy.
• Pressure map and average pressure were recorded
• Tactile Pressure mapping system was used
• Seven participants' data was collected
The distribution of female midshoulder height data was not available. However, even with just the male data, we can see that the 23" Spinebuddy cannot adequately fit most population.
Results

• 8 Short-term participants; 5 females, 3 males
• 3 Long-term participants; all females

Did you experience pain during product use?

- Yes: 20%
- No: 27%

Did you experience pain after using the product?

- Yes: 55%
- No: 45%
The above data is a combination of all short-term participants. It should be noted that many of these participants entered in scores of 0 for these body parts (claimed that they experienced no pain before/after), which brought down the average to the single-digit range, even though the scale has a minimum of 0 and a maximum of 48.
The questionnaire we used included the above question, and asked the participants to rate the effectiveness of relieving pain in each body part from 1 (strongly disagree that the product relieves pain) and 5 (strongly agree that the product relieves pain). The results show that on average, people disagreed that the product relieves pain across the board.
Even when the subjective responses were considered by each body part, we can see that the majority of the people disagree that the product relieves pain.
Wilcoxon signed rank test assumes that:
1. Data is paired and comes from the same population.
2. Each pair is chosen randomly and independent.
3. The data is at least ordinal.

We used the Wilcoxon signed rank test to statistically verify whether there is a difference in spine length before and after using Spinebuddy, whether people subjectively rate the discomfort level differently before and after use, and whether people subjectively rate the discomfort level differently before and during use.
The statistical analysis result shows that there is no significant difference between spine length or discomfort levels before/after use and before/during use.
Similar to the short-term participants, long-term participants also did not find that using Spinebuddy increased their discomfort level for any of the body parts after using the product for 3 consecutive days.
Results: Pressure Mat
Results: Pressure Mat

• Average pressure (mmHg)

• Flat pressure < Spinebuddy pressure
  o Paired Wilcoxon signed rank test (p=0.01)
Discussion

Discomfort

• Questionnaire did not show statistical significance before and after the use of Spinebuddy
• There did exist pressure increase during the use of Spinebuddy
• Discomfort level did not significantly change before and after use of Spinebuddy
• For both short term, long term
Reiteration of the results, analysis, and discussion from our research and two studies (long-term and short-term)

**Conclusion**

Based on our findings, Spine Buddy:
- Did not lengthen the spine
- Caused discomfort during usage
- Resulted in either no improvement in discomfort or an increased level of discomfort in back after long term use
Future Testing

- More participants
- Long-Term: more days
- Better Pressure Measurement
- More accurate spine length measurement
- Placebo Effect/Framing

More participants
Joe mentioned that SpineBuddy was targeted towards "everybody"; because the userbase is so large, we would suggest future participants mirror this large population in terms of demographic diversity. For the two studies we carried out, all participants were Cornell undergraduate and graduate students, and thus all come from a very narrow array of academic background. They are also from a very limited age group.

Long-Term: More Days
Because of our time constraints, we were only able to run the "long-term" study for three days. However, ideally, we would love to have run a long-term study that would run at least a month, with variables such as whether or not the participants had back pain before the study, and with controls (participants who are asked to lie down on the floor without SpineBuddy). In doing this, we may get a more representative picture of how SpineBuddy may help alleviate or even prevent pain in the long run, if someone were to continue using it.

Better Pressure Measurements
The pressure sense we used was quite excellent. However, for our purposes, the mat was not long enough, and did not provide a full mapping of the entire spinal area we were interested in looking into. Because of its shape, the mat caught either only the upper back or the lower back on participants. Also, because there was no specific starting point to where the participants laid down, we could not guarantee a line-up of body parts even between same-person compositions (e.g. in two images of the same participant, one lying down without SpineBuddy and one with, we cannot assume the same coordinate of numbers represents the pressure reading for the exact same part of the body).

In the future, it would be imperative to have a way of measuring pressure such that we can get information on the entire back as well as accurately know which part of the body is mapped where in order to make direct number comparisons on with and without SpineBuddy composites.
Thank you! Questions?
Appendix 1. Statistical Outputs

Outputs will be sent separately in word document.