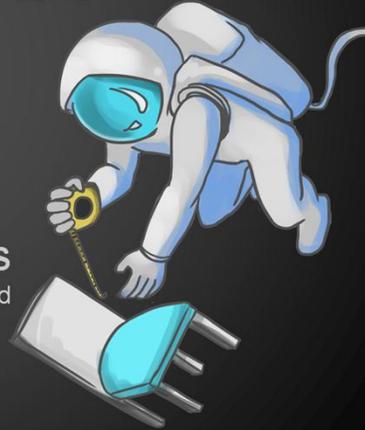


# DEA 4700: Final Presentation SPINEBUDDY

Ergonauts  
Taking your product to infinity and beyond



Ergonomic evaluations everywhere

## Background: Relevance of SpineBuddy

According to the American Chiropractic Assoc.:

- Back pain one of the most common reasons for missed work
- 2nd most common reason for visits to doctor's office
- Americans spend at least \$50 BILLION each year on back pain
- Experts estimate as many as 80% of the pop. will experience a back problem in their lifetimes.

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 to this growing problem is definitely needed. We found SpineBuddy interesting because of its claims to be a solution to this expensive problem.

## Background: Literature on Therapies

- Suggest: exercise & stretching to manage chronic back pain, avoiding prolonged bed rest, and maintaining good posture
- In study conducted by Shealy & Borgmeyer in '97: non-surgical spinal decompression resulted in improvement in 92% of 219 patients
- Jacobson et al: concluded that medium firm mattresses reduced clinically diagnosed back & shoulder pain, and spine stiffness

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:

1) Bert H. Jacobson, Tia Wallace, Hugh Gemmell, Subjective rating of perceived back pain, stiffness and sleep quality following introduction of medium-firm bedding systems, Journal of Chiropractic Medicine, Volume 5, Issue 4, Winter 2006, Pages 128-134, ISSN 1556-3707, 10.1016/S0899-3467(07)60145-1.

(<http://www.sciencedirect.com/science/article/pii/S0899346707601451>)

2) C. Norman Shealy, MD, PhD, and Vera Borgmeyer, RN, MA. Decompression, Reduction, and Stabilization of the Lumbar Spine: A Cost-Effective Treatment for Lumbosacral Pain. American Journal of Pain Management Vol. 7 No. 2 April 1997

## **Project Goals**

- Ergonomic Evaluation
- Objectives

### SpineBuddy Claims:

- Decompress Vertebrae
- Relieve Pressure on Discs
- Loosen Tight Muscles

What are we trying to prove?

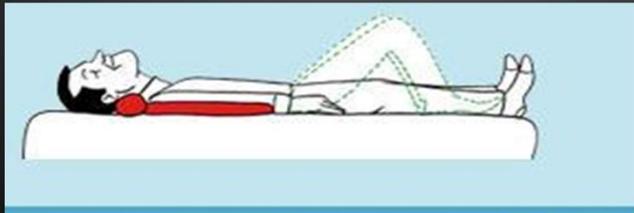
## Methodology

### 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

	48		32		16
	47		31		15
	46		30		14
very high pressure/severe discomfort	45		29		13
			28		12
	44		27		11
	43		26		10
	42	medium pressure/discomfort	25		9
41			8		
	40		24		7
	39		23		6
	38		22	Very low pressure/slight discomfort	5
	37		21		
	36		20		3
high pressure/severe discomfort	35		19		2
	34		18		1
	33		17	No presure / no discomfort	0

The above scale was adopted from literature:

Wenqi Shen, Kenneth C. Parsons, Validity and reliability of rating scales for seated pressure discomfort, International Journal of Industrial Ergonomics, Volume 20, Issue 6, December 1997, Pages 441-461.

## **Methodology: Measuring Spine**

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

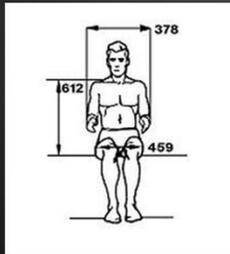
## Methodology

### 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

## Spinebuddy - One Size Fits All?

- Spinebuddy length: Approximately 23"
- This is less than the 5th percentile of American male's midshoulder height (Female data was not available)



		5th Percentile	50th Percentile	95th Percentile
612	Midshoulder height, sitting	23.9"	25.7"	27.5"

Source: Anthropometric Dimensional Data <http://msis.jsc.nasa.gov>

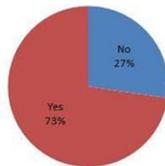
Source: Anthropometric Dimensional Data: <http://msis.jsc.nasa.gov>

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.

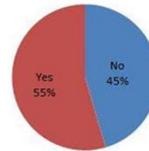
# Results

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

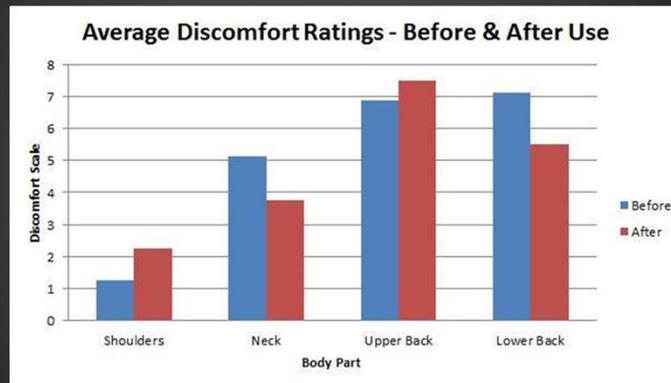
Did you experience pain during product use?



Did you experience pain after using the product?



## Results - Discomfort Scale (Short Term)

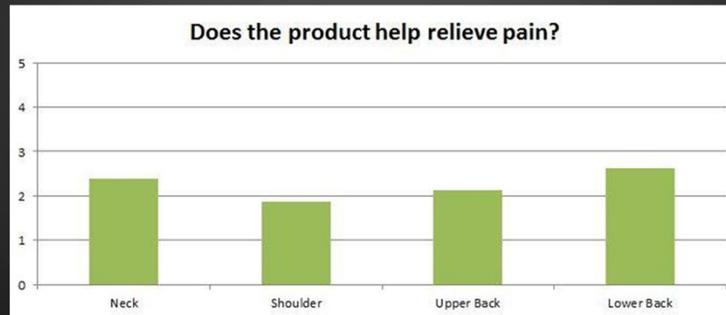


The above data is a combination of all short-term participants. It should be noted that many of these participants entered in scores of 0 for these body parts (claimed that they experienced no pain before/after), which brought down the average to the single-digit range, even though the scale has a minimum of 0 and a maximum of 48.

## Results - Short Term

This product relieves....

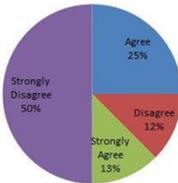
	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
My _____ pain.	1	2	3	4	5



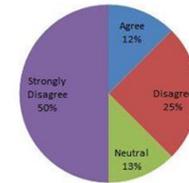
The questionnaire we used included the above question, and asked the participants to rate the effectiveness of relieving pain in each body part from 1 (strongly disagree that the product relieves pain) and 5 (strongly agree that the product relieves pain). The results show that on average, people disagreed that the product relieves pain across the board.

## Results - Short Term

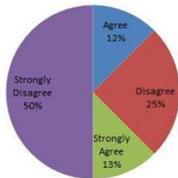
Relieved Neck Pain



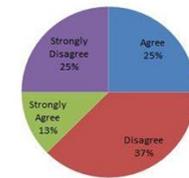
Relieved Shoulder Pain



Relieved Upper Back Pain



Relieved Lower Back Pain



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.\_

## Results: Short-Term Use

- Wilcoxon signed rank tests
- Null hypothesis:
  - unequal medians of spine length
  - unequal medians of discomfort scores before/after use of Spinebuddy
  - unequal medians of discomfort scores before/during use of Spinebuddy

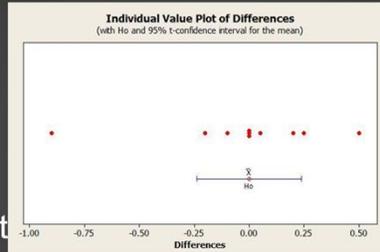
Wilcoxon signed rank test assumes that:

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.

## Results: Short-Term Use (continued)

- No significant difference in spine length, before & after (p=0.92)



- No significant difference between before/after use (shoulders: p=0.37, neck: p=0.79, upper back: p=0.85, lower back: p= 0.79)
- No significant difference in discomfort before/during USE (shoulders: p=0.18, neck: p=0.31, upper back: p=0.42, lower back: p= 0.68)

The statistical analysis result shows that there is no significant difference between spine length or discomfort levels before/after use and before/during use.

## Results: Long-Term Use

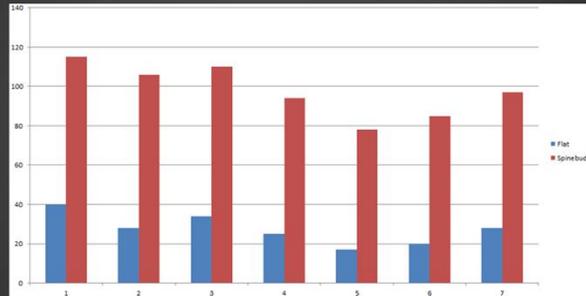
- 3 participants; all female
- Used spinebuddy for 15-minutes for 3 consecutive days
- No significant difference in discomfort between before/after use  
(shoulders:  $p=0.18$ , neck:  $p=0.86$ , upper back:  $p=0.15$ , thigh: 1.00)
- Observed increase of discomfort at lower back  
(lower back:  $p=0.03$ , one tailed test)
- No noticeable changes in discomfort rating across time

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

- Average pressure (mmHg)



- Flat pressure < Spinebuddy pressure
  - 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

## **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

Reiteration of the results, analysis, and discussion from our research and two studies (long-term and short-term)

## 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 compositions.

**Thank you! Questions?**

## **Appendix 1. Statistical Outputs**

Outputs will be sent separately in word document.