Novel Simulation of Controlled and Uncontrolled Blood Pressure Device

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One in three American adults (67 million people) suffer from high blood pressure, and approximately half of patients with hypertension have uncontrolled blood pressure leading to costs of about $46 billion annually for health care services, medications, and loss of productivity at work.[1] Adherence to antihypertensives is generally poor, contributing to the number of patients not managing their high blood pressure.[2] Educating patients about high blood pressure and the role that medications and lifestyle changes play is critical to improving patient understanding and management of high blood pressure.

Aims

- Educate people on the dangers of high blood pressure and to stress the importance of medication adherence and living a healthy lifestyle
- Use an interactive device to help demonstrate the effects of high blood pressure on the heart
- Assess the effectiveness of a blood pressure teaching device on educating individuals on high blood pressure and its impact on health.

Materials and Methods

Participants

- Recruited at health screening events through the American Pharmacists Association Academy of Student Pharmacists (APhA-ASP)

Study Procedure

- Participants were randomized to high blood pressure education with or without the device.
- Both groups received education verbally and visually about basic blood pressure readings, risk factors, complications and options to improve health outcomes.
- A seven item survey was utilized to assess knowledge of and attitudes regarding hypertension management prior to and after education.

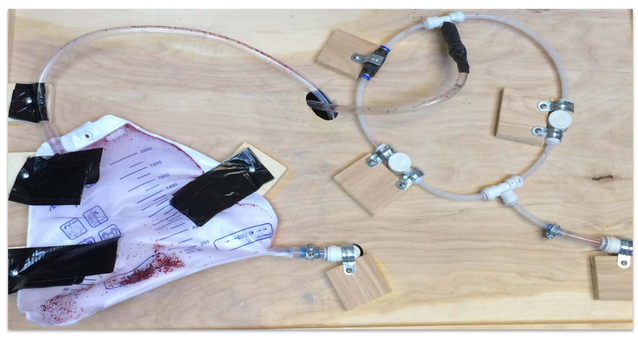
Statistical Analysis

- Pre and post scores for each item were compared for each of the groups using Wilcoxon Signed Ranks Test.
- Mann Whitney U test was performed on the difference scores of each item to compare the control and treatment.

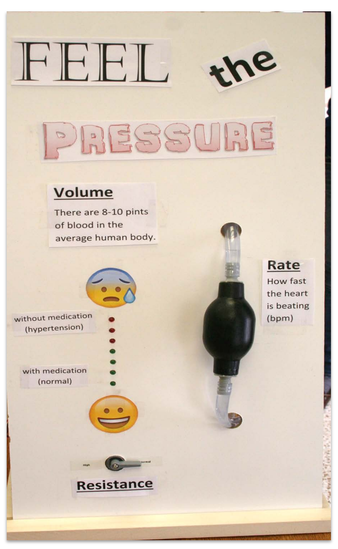
Device Engineering

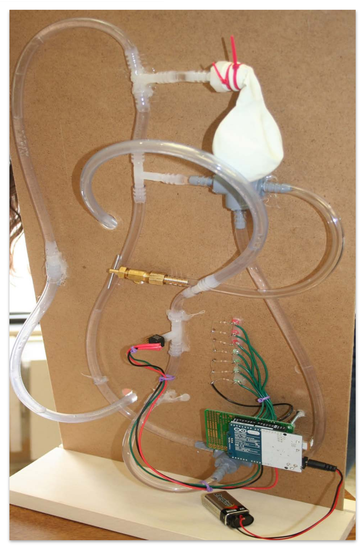
First and Second Generations



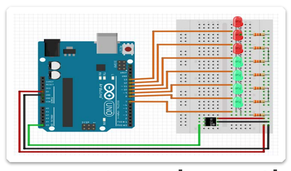


Third Generation





- Pump is smaller and easier to move
- Electronic pressure senor programmed with Arduino to display pressure with LEDs
- Smaller, more compact



Future Generations:

- Additional digital measurements, show the real-world pressure difference
- Improve aesthetics, add a heart shaped pump
- Professional and attractive interface

Results

Figure 1

Wilcoxon Signed Ranks Test (P-values, statistical significance P<0.05)			
	I understand what high blood pressure is	I understand how medications work to lower BP	I understand how high BP can lead to long term problems with my heart
Control	.059	.157	.144
Device	.010	.047	.038
**Comparing pre- and post-assessment questions for the control and the device group			

- The device makes a significant impact at the 95% confidence level.
- Wilcoxon Signed Ranks Test was used because the questions shown in Fig.1 were answered by circling agree, somewhat agree, neutral, somewhat disagree, or disagree.
- Three questions were fill in the blank and analysis suggests that the use of the device results in the better recall of blood pressure components
- Figure 2 shows the percentage of participants that could recall at least one component of blood pressure after education with the device increase from 37.5% to 60.75% compared to the control group, 20% to 30%.

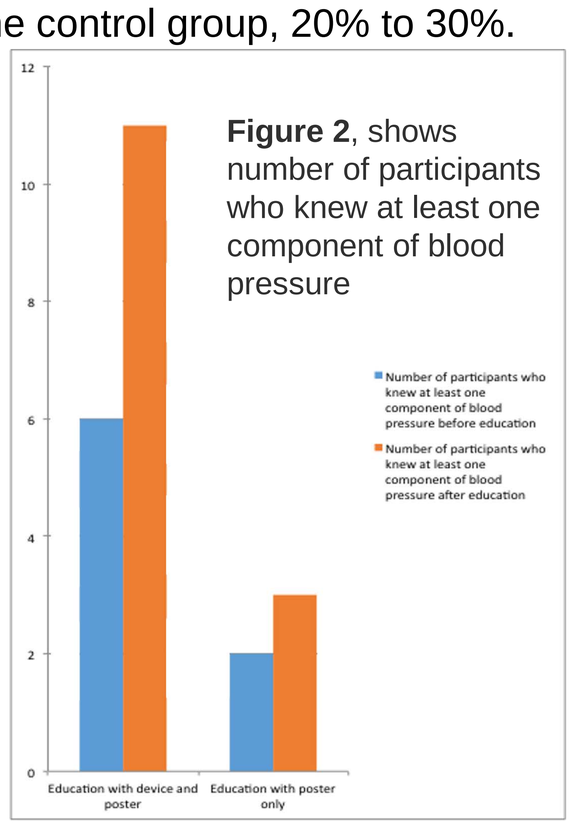


Figure 2, shows number of participants who knew at least one component of blood pressure

Discussion & Conclusion

- To the authors' knowledge, this is the only known device to physically simulate controlled and uncontrolled blood pressure.
- Device used at the Jane Pauley Community Health Center, Indianapolis, during Hypertension Education classes. Determined to be anecdotally effective in demonstrating difference between healthy and unhealthy hearts.
- Analysis of results has indicated that the device has a positive affect on heart education comprehension
- By providing individuals with a tangible model of the heart's pumping process, the novel educational device has potential to enhance knowledge and empower patients with better understanding of concepts associated with hypertension.
- Future research with College of Nursing for diversity in participants. Evaluation should also include items assessing the efficacy of education using the device and its effect on adherence to blood-pressure medications.
- Collaborate with the American Heart Association and offer the tool for use by other health educators.

References

1. "About High Blood Pressure." *About High Blood Pressure*. American Heart Association, 4 Aug. 2014. Web. 1 Mar. 2015.
2. "What Is High Blood Pressure?" - *NHLBI, NIH*. US Department of Health and Human Services, 2 Aug. 2012. Web. 1 Mar. 2015.
3. Centers for Disease Control and Prevention. High blood pressure facts. 19 February 2015. Accessed March 23, 2015. Available at www.cdc.gov/bloodpressure/facts.htm