

Designing a Modified Armboard for Cardiovascular Medicine

(Technical Paper)

Does a Sweet Tooth a Heavy Body Make?

(STS Paper)

A Thesis Prospectus Submitted to the

Faculty of the School of Engineering and Applied Science
University of Virginia • Charlottesville, Virginia

In Partial Fulfillment of the Requirements of the Degree
Bachelor of Science, School of Engineering

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Spring, 2020

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On my honor as a University Student, I have neither given nor received
unauthorized aid on this assignment as defined by the Honor Guidelines
for Thesis-Related Assignments

Introduction

Armboards are used as tools to help in surgical operations around a patient's arm and even to restraint the patient's arm, if needed. The armboard is used in a variety of surgical practices to allow for proper positioning and restraint of the patient without significant orthopedic stress. During some of these procedures, patients are awake and may need an armboard to restraint them, or to simply provide comfort. Therefore, a secure, yet comfortable, armboard is ideal. Also, the surgical team should be able to position this much of the same orthopedic stress. The Capstone project is centered around armboards' use, design, implementation at the University of Virginia hospital. There are currently plenty of armboards in the UVA hospital, but each of them has a list of problems, such as not enough stiffness, poor geometry, materials that cause splinters on both hospital staff and patients, falling off hospital beds or obese patients pushing them off by accident, etc. The goal of the capstone project is to create a universal armboard that could be used in multiple labs and serves the most amount of functions and has the least amount of problems.

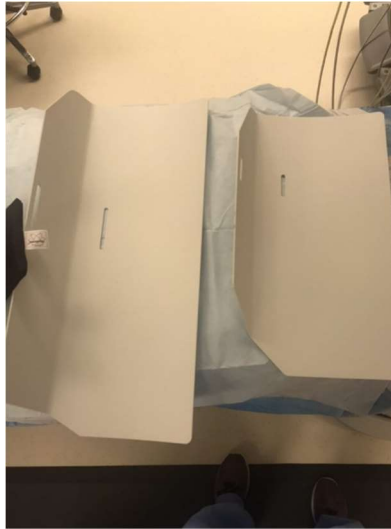
The second proposed project is in relation to obesity, which is still an epidemic around the world, especially in the United States. A growing population of obese people directly leads to an increase in obesity-related diseases ranging from heart attacks to diabetes. What is in these processed foods that makes them so addicting? Are there people who cannot help but eat fast-food? The STS topic will be exploring into whether additive sugar is additive, and how, and what are the socioeconomics, company methods, and habits that cause people to still eat additive sugars.

Technical Topic

During surgeries that involve arms or armpit regions, an armboard ensures proper and comfortable positioning of the patient. The capstone advisor for this capstone project is Dr. Nishaki Mehta, M.D., of UVA Cardiovascular Medicine. Additional team members include Katerina Morgaenko, a graduate student at UVA and two fourth-year students in the biomedical engineering department at UVA: Nathan Barefoot and Jason Woloff. The goals of the project are to learn from medical professionals about the limitations of surgical armboard models currently in use at the UVA Hospital and to apply the results in the design of an armboard to combat limitations of the current designs.

Divisions of cardiovascular medicine at UVA that have been explored thus far mainly use two armboard models: the Siemens Armboard (Figure 1) and the Banjo Armboard (Figure 2). The catheterization (Cath) laboratory, which consists of an examination room with diagnostic imaging equipment used to visualize the interior structures of the heart and treat any stenosis or abnormality found, mostly uses the Banjo model. The electrophysiology (EP) laboratory utilizes various interventions for the diagnosis and treatment of heart rhythm disorders, and uses both models depending on the procedure being performed. According to 20 medical professionals interviewed from UVA's Cath and EP labs, each model has its own associated benefits and drawbacks. The Siemens Armboard is slid under the patient's body when the arm is placed parallel to his or her body. Positive features of this model include a rising cusp that allows for proper security of the arm and an ABS polycarbonate material which many of the interviewed registered nurses (RNs) praised for the ease of cleaning with a bleach wipe, the common method of disinfection used in the hospital. That said, the material and dimensions of this armboard hinder its stability; these factors are especially problematic with overweight patients with heavier arms as it causes the board to bend down. In fact, one RN interviewed indicated that a Siemens

Armboard once broke during a procedure and multiple complaints were issued about the armboard becoming loose or falling out.



*Figure 1: Siemens Armboard.
This Armboard is made out of an ABS polycarbonate material and has a rising cusp for added security to the arm. (Serbulea, 2019)*



*Figure 2: Banjo Armboard.
This Armboard is made out of a carbon fiber material with a flat shape but well-defined geometry. (MRI Armboard, Medicus Health, accessed 2019)*

The Banjo Armboard is comprised of a carbon fiber backbone with styrofoam cushioning constructed into a semicircular head fitted under the patient and an extension for situating the patient's arm. Its geometry allows for a wider range of applications compared to the Siemens Armboard as it can be rotated to accommodate the arm at different angles. However, while some

interviewed doctors and hospital staff have praised its stability and functionality, others have complained about difficulties cleaning the apparatus. Many of the RNs interviewed cited that the styrofoam material occasionally splintered causing difficulty cleaning, and an impossible task if bodily fluids leaked into cracks of the material to become unreachable. For this reason, many armboards made with this material were thrown out to avoid potential infection.

The goal of this Capstone project is to take more feedback from hospital staff and patients on the different armboard models, shadow doctors during operations with involvement of armboards, and then take all the feedback and observations to design and prototype a universal armboard that possesses less of the limitations of current armboards and keeping most, if not all, the pros of current armboards that can aid all the different labs at UVA hospital. A universal armboard flexible and reliable enough to be used in most labs of the UVA hospital.

STS Topic

Obesity is an epidemic that is present amongst the human population; it is predicted that there will be an additional 65 million obese adults, in the USA, by 2030 (Wang et al, 2011). The main concern is that not enough people are aware that sugars can be a big contributor to weight gain, perhaps more so than fats. Additive Sugars will be a big part of the STS topic based on four articles; one article that showed two different families eating two different diets (Epstein et al, 2001), an article showing how the cultural significance of sugar in India may have increased obesity and obesity-related diseases (Gulati et al, 2014), and two articles revealing the history of the sugar industry and how they bribed and meddled with scientific data (Kearns et al 2015, Kearns et al 2016). The topic for the STS Research Paper is to find out how addicting sugar is, the history of sugar industry and the socioeconomics of groups of people consuming foods with additive sugars such as: fast-food, candies, sodas or sugary drinks, etc.

The STS topic was inspired by the documentary *Super Size Me*, by Morgan Spurlock. In the *Super Size Me* documentary, Spurlock went on a McDonald’s diet for a month, eating about every McDonald’s item on the menu, back in 2004, and ate 90 McDonald’s meals. Also, Spurlock said, “I ate over 30 pounds of sugar in total, that’s about a pound a day.” (Spurlock, *Super Size Me*, 2004). Not only could sugar have an addicting effect, but could be based on cultural and/or religious significance. An article shows a correlation about how the cultural and religious significance sugar has on the people of India leads to a rise in an overweight population as well as in obesity-related diseases (Gulati et al, 2014). An article by Bowman et al shows the socioeconomics of different groups of people based on age, race, urban or rural setting, and other factors to see if there is any correlation to determine which group of people mainly consume fast-food; Figure 3 shows the data of this article (Bowman et al., 2004).

Characteristics (Percent of Total Sample)	Percent Having Fast Food	
	Weighted Mean	95% CI
Age groups		
4–8 years old (32.0%)	24.6	22.6–26.6
9–13 years old (32.2%)	26.4	23.9–28.9
14–19 years old (35.8%)	39.0	35.3–42.7
Gender		
Males (51.0%)	32.3	29.5–35.1
Females (49.0%)	28.3	26.0–30.6
Household income as % poverty		
0%–130% (26.2%)	24.9	20.8–29.0
131%–350% (43.9%)	30.4	27.5–33.3
>350% (29.9%)	35.1	31.2–39.0
Race		
Non-Hispanic whites (65.8%)	31.4	28.9–33.9
Non-Hispanic blacks (15.8%)	33.3	28.9–37.7
Non-Hispanic other races (4.7%)	27.1	18.5–35.7
All Hispanics (13.7%)	23.2	19.2–27.2
Urbanization		
MSA, central city (29.0%)	29.2	26.1–32.3
MSA, suburban areas (49.2%)	32.6	29.8–35.4
Non-MSA, rural (21.8%)	26.7	21.5–31.9
Region		
Northwest (18.6%)	27.3	23.2–31.5
Midwest (24.1%)	32.5	28.0–37.0
South (34.8%)	33.6	30.7–36.5
West (22.5%)	25.6	23.0–28.2

Of 6212 children 4 to 19 years old 1720 (30.3%) had fast food.
CI indicates confidence interval.

Figure 3: Table showing data of different age and race groups and their obesity levels. Taken from article by Bowman et al, 2004.

Advertising is another important factor in how fast-food has kept its popularity. As stated in *Super Size Me*, by Spurlock, “The average American child sees about 10,000 food advertisements per year, 95% of those are for sugared cereals, soft drinks, fast food or candy” as well as “In 2001, on direct media advertising, McDonald’s spent \$1.4 billion worldwide” and “The 5-a-day fruit and vegetable campaign’s total advertising budget in all media was a lowly \$2 million, a hundred times lower than the advertising spending of a candy company” (Spurlock, 2004). This is important as it shows that candy and fast-food companies have more money for advertising than companies or movements to sell healthy foods, such as fruits and vegetables.

STS theories involved in this could be the Actor-Network Theory (ANT) and political technology. A reason why ANT is involved is because there are multiple factors as to why so many people still purchase and eat sugar. Companies and customers could be represented as factors in the complex network the ANT theory the article details as well as advertisements could represent the “intermediaries” that link the potential customers to the products of fast-food (Cressman, 2009). Political technologies are another STS framework involved with this topic. Humans evolved so that when a type of food contains sugar, the sugar rewards the human with great taste and an increase in neurotransmitters in the brain. The sugar industry is major contributor, as shown from both articles by Kearns. The sugar industry has been shown to have tampered with research and the data collected about sugar, and even bribed scientists to make sugar appear not as bad or as addicting. Perhaps the sugar industry knew how addicting sugar is and tried to not lose their customers (Kearns et al 2015, Kearns et al 2016). Advertisements are also a part of political technologies as they are made to be alluring and to make sure the viewer(s) know the product and keep it in the back of their head (Winner, 1980). The correlation of advertisement viewing, and childhood weight gain was shown in an article by Chou (Chou et

al, 2008). Socioeconomics may not be the only factor. Bad habits could be another factor contributing to the popularity of these additive sugar foods. One person, whom was interviewed has a story of bad habits and his identity will be anonymous. He was born in Romania around the late 1960s. Eventually he started a family and moved to the USA. He was able to financially support his family, but he had a bad habit where if the family eats and leaves leftovers, he would eat the leftovers even if he was full because he felt like he “didn’t want to waste money”. This habit caused him to gain significant weight over the years (R. Serbulea, personal interview, November 12th 2019). Fast food restaurants have grown and expanded to be convenient for people to reach. Plus, people may feel inclined to eat everything from a meal as to feel like they did not waste their money. This research should be further looked into as to help decrease the growing population of overweight people and rise in number of obesity-related attacks and/or deaths.

Research Questions and Methods

For the STS Topic, the research question is: how addicting are additive sugars and what factors keep people eating foods with additive sugars? The methods to answer this research question will involve multiple steps. The first step is to research from articles and textbooks what are the effects sugar has on the body and brain and whether those effects cause addiction. The second is to do more research on the sugar industry and what role they played in the development of companies that sell foods with additive sugars. The third step is to look more into how companies advertise their products and keep their brands remembered. The fourth step is to do more research on socioeconomics of foods with additive sugars and on which groups of people are most affected or even rely on foods like fast food. The fifth and final step will be interviewing consumers of additive sugars to see how they feel about the products, whether these

products plays a critical role in their lives, and to determine what factors affect these people that still has them consuming foods with additive sugars, whether it be socioeconomics, bad habits, cultural background, etc.

Conclusion

While armboards are useful tools they have various problems from model to model. If the modified armboard capstone project is a success, this will lead to multiple labs having the same uniform armboard, which will fulfill many requirements whilst also lowering the number of annoyances and limitations of each armboard for hospital staff and patients. This can help to reduce costs as one armboard will be used in the UVA hospital.

Obesity is still a problem in this world for which there is no easy answer. After researching for the STS topic, the results are hypothesized to be reasons as to why foods with addictive sugars are still selling well, what is causing it, and whether additive sugars are a cause for addiction and weight gain. The STS frameworks that will be used in this topic are: Actor Network Theory and Political technology. Additive sugars are used as a political technology as sugar can be used as a biological addiction to keep customers buying products of companies such as candy, soda or fast-food. ANT can show the multiple factors into how companies can keep people buying foods with additive sugars by using social economics, cultural background, etc. The results of the STS topic can help people realize what the components of fast-food do to your body, mental and physical, and which groups are most affected by this fast-food epidemic and why they are. Hopefully, this could help decrease the rate of an increasing population of obese people in the USA.

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