

Designing a Modified Armboard for Cardiovascular Medicine

(Technical Paper)

Obamacare: A Lasting Legacy or Hanging by a Thread?

(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

Jason Woloff

Fall, 2019

Technical Project Team Members

Dr. Nishaki Mehta, M.D.,

Katerina Morgaenko

Nathan Barefoot

Radu Serbulea

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

Signature _____ Date _____

Jason Woloff

Approved _____ Date _____

Dr. Nishaki Mehta, M.D., Department of Cardiovascular Medicine

Approved _____ Date _____

Sean Ferguson, Department of Engineering and Society

General research problem

How can patient experience at hospitals and medical centers be improved? The U.S. healthcare sector serves patients at a frequency of roughly once per second. Global spending on healthcare in 2017 is estimated at \$7.724 trillion; it is projected to rise at an annual rate of 5.4% to \$10.059 trillion USD by 2022 (Allen, 2019). Medical innovations range from zero tech to high tech. Innovation in healthcare coverage could extend care access. In 2018 the number of uninsured Americans rose for the first time in a decade to an estimated 27.5 million people (NBC News, 2019).

Optimization of cardiovascular armboards

How can cardiovascular armboards be improved? During operation 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 4th-year students in the biomedical engineering department at UVA: Nathan Barefoot and Radu Serbulea. The goals of this project are to learn from medical professionals about the limitations of surgical armboard models in use at the UVA Hospital and to apply the results in the design of an armboard of optimal shape and material.

The armboard is used in various surgical procedures to ensure proper restraint and comfortable positioning of the patient's arm. The department of cardiovascular medicine at the University of Virginia currently uses two flawed armboard models. The electrophysiology (EP) lab primarily uses the Siemens model (figure 1), while the catheterization (cath) lab uses the Banjo model (figure 2). According to 30 surveyed medical professionals at UVA, the Siemens

armboard is easy to clean but has durability issues, while the Banjo armboard has greater stability, but often splinters and breaks when cleaning.

The goals of this project are to shadow and interview additional medical staff, design and prototype a new universal armboard, and test the prototype on volunteer patients. The prototype will satisfy the limitations of the Siemens and Banjo models through

optimizing its material and geometry. It will enhance stability and comfort, while retaining design simplicity. Preliminary models will be prototyped using computer-aided design (CAD), and the final model will be 3-D printed and assembled. Time permitting, the model will be tested on volunteer patients, who, along with the

treating professionals, will be interviewed about their experience. The universal armboard model will ideally promote more efficient procedures by medical professionals, improve patient experience, and lower costs.



Figure 1: Siemens Armboard. This armboard is made out of a plastic material. (self-taken image)



Figure 2: Banjo Armboard. This armboard is made out of a carbon fiber material. (medicus-health.com)

Obamacare: A Lasting Legacy or Hanging by a Thread?

How do opponents and defenders of the Affordable Care Act advance their agendas? The Patient Protection and Affordable Care Act (ACA or Obamacare) was signed by President Barack Obama in 2010. It was the most significant federal intervention in the US healthcare

system since Medicare and Medicaid were enacted in 1965. The law requires Americans either to enroll in a qualified healthcare plan or incur a penalty of \$95 or 1% of their income, whichever is greater. The ACA also offers inexpensive plans for those with incomes between 100% and 400% of the federal poverty level. More than 20 million Americans have gained healthcare insurance since the ACA was passed, but opposition is strong (Gordon et. al., 2017). Controversy over the law has been used to further political agendas in unrelated areas and was a key component of President Trump's election in 2016 (Oberlander, 2016). Polls have consistently shown that less than 50% of Americans support the ACA primarily due to a distrust of government, and specifically to a government role in healthcare (Dalen et. al., 2015).

The heated debate over the viability of the ACA led to an immediate review of its effect on US healthcare. The first open enrollment period following the enactment of the ACA was analyzed by the *New England Journal of Medicine* to determine if the ACA would stimulate the marketplace or if opponents would have fuel for arguments to repeal the law (NEJM, 2014). The study revealed enrollment exceeded projections. The number of uninsured people fell, and the sustainability of coverage expansion was promising if overall cost of care can be controlled. Medicaid eligibility expanded, but the researchers claimed that states that do not expand Medicaid will benefit far less. However, reversing Medicaid expansion was a proposed change to the ACA following its approval. In a review of Medicaid expansion, critics argued the program does not provide value to its beneficiaries, and that some states cannot afford to fund it (Mazurenko et. al., 2018). According to the 77 studies analyzed, Medicaid expansion improved access to and quality of care, Medicaid spending, and cost of care.

Approval of the ACA is partisan. The Trump Administration claims the law "is hurting American families, farmers, and small businesses with skyrocketing health insurance costs"

(White House, 2019). Seema Verma, the administrator of the Centers for Medicare & Medicaid Services, condemns the ACA as unaffordable and ineffective (Terhune, 2018). In a 2017 briefing on Republicans' health care legislation plans, House Republican leaders Kevin Brady and Greg Walden blamed the ACA for collapsing insurance markets, rising premiums and deductibles, and fewer patient options (Desjardins, 2017). At the request of Republicans, Edmund Haislmaier, a Heritage Foundation expert in health care and public policy, testified to Congress on the failures of Obamacare. Haislmaier condemned the ACA for pursuing enrollment at any cost. He alleged Obamacare's effect on healthcare enrollment was exaggerated by previous report estimates derived from government and private surveys. Haislmaier concluded accrediting enrollment increases to the expansion of Medicaid eligibility, not the ACA's effect on private sector coverage options (Heritage Foundation, 2017).

The threat of unaffordable treatment costs is a significant growing concern over what remains of the ACA. As lawmakers take aim at rising drug prices the pharmaceutical industry, largely represented by the Pharmaceutical Research and Manufacturers of America (PhRMA), is shifting its stance on Obamacare. Stephen Ubl, president and CEO of the trade association, stated in 2017 that the group is not taking a position on the issue, however analysis of the organization's spending tells a different story (Hancock, 2018). In 2009 the group spent a record-breaking amount lobbying for and publicly supporting the ACA prior to its passage with the organization's leader at the time Billy Tauzin deciding the industry would be better off making a deal and delaying more radical healthcare transformation (Norman and Karlin-Smith, 2016). In 2018 PhRMA exceeded its previous record and spent a total of \$27.5 million lobbying against the ACA including contributing to a \$10 million ad campaign by the American Action Network (AAN) designed to build voter support for the law's elimination. The campaign for repealing the

ACA is also backed by one of the business world's lobbying powerhouses: The National Federation of Independent Business (NFIB). NFIB has opposed Obamacare for years, playing a leading role in the failed attempt to overturn the ACA in the Supreme Court in 2012 (Morgan, 2013). More recently NFIB has called for amendments to the current healthcare system to improve affordability, flexibility, and predictability both on its website and in a 2017 letter to Speaker Paul Ryan of the House of Representatives (NFIB, 2017).

The World Health Organization, however, contends that universal health care is vital (WHO, 2013). The National Multiple Sclerosis Society was one of 26 patient advocacy groups to issue a joint statement in support of the Protecting Pre-Existing Conditions and Making Health Care More Affordable Act of 2019, a bill designed to strengthen the ACA. Signatories of the statement claimed the ACA "represented major progress toward ensuring all people with pre-existing conditions have access to affordable health care" (NMSS, 2019). The American Association of Retired Persons (AARP) also supports the ACA for easing coverage of those with preexisting conditions and asserts that the ACA strengthened Medicare and improved affordability and access for plans of those ages 50- to 64-years old (Skopec et. al., 2016). In a letter to Congress opposing the American Health Care Act, a bill proposed to counteract various components of the ACA, AARP stated that the ACA extended the Medicare Part A Trust Fund's solvency by 11 years (AARP, 2017). Participants on various sides of the debate over the ACA have claimed the backing of doctors and insurance companies. Today the struggle largely takes the form of competing bills to strengthen or weaken the ACA with large strides from either side looking unlikely in the near future.

References

- AARP (2017, March 7). American Association of Retired Persons. AARP Opposes Healthcare Bill. (2017, March 7). <http://www.aarp.org/politics-society/advocacy/info-2017/aarp-opposes-healthcare-bill.html>
- Allen, S. 2019 Global health care sector outlook | Deloitte. <https://www2.deloitte.com/global/en/pages/life-sciences-and-healthcare/articles/global-health-care-sector-outlook.html>
- Dalen, J. E., Waterbrook, K., & Alpert, J. S. (2015). Why do so Many Americans Oppose the Affordable Care Act? *The American Journal of Medicine*, 128(8), 807–810. <https://doi.org/10.1016/j.amjmed.2015.01.032>
- Desjardins, L. (2017, February 16). House GOP documents outline plan to replace Obamacare. <https://www.pbs.org/newshour/politics/house-gop-documents-outline-plan-to-replace-obamacare>
- Gordon, P. R., Gray, L., Hollingsworth, A., Shapiro, E. C., & Dalen, J. E. (2017). Opposition to Obamacare: A Closer Look. *Academic Medicine*, 92(9), 1241.
- Hancock, J. (2018, July 27). The Stealth Campaign to Kill Off Obamacare. *The New York Times*. <https://www.nytimes.com/2018/07/27/business/the-stealth-campaign-to-kill-off-obamacare.html>
- Heritage Foundation (2017, January 31). Heritage Expert Testifies Before Congress on the Failures of Obamacare. <https://www.heritage.org/health-care-reform/impact/heritage-expert-testifies-congress-the-failures-obamacare>
- Mazurenko, O., Balio, C., Agarwal, R., Carroll, A., & Menachemi, N. (2018). The Effects Of Medicaid Expansion Under The ACA: A Systematic Review | Health Affairs. <https://www.healthaffairs.org/doi/full/10.1377/hlthaff.2017.1491>
- Morgan, D. (2013, March 24). Opponents mark Obamacare’s third anniversary with lobbying surge. *Reuters*. <https://www.reuters.com/article/us-usa-healthcare-lobbying-idUSBRE92N0B620130324>
- NBC News. (2019, September 10). Number of Americans without health insurance rises for 1st time in a decade. <https://www.nbcnews.com/politics/politics-news/number-americans-without-health-insurance-rises-1st-time-decade-n1052016>
- NEJM. (2014, July 17). Health Care Coverage under the Affordable Care Act—A Progress Report. <https://www.nejm.org/doi/full/10.1056/NEJMhpr1405667>

- NFIB. (2017, March 3). Affordable Care Act Repeal and Replace Principles. <https://www.nfib.com/content/issues/healthcare/nfib-affordable-care-act-repeal-and-replace-principles/>
- NMSS (2019). National Multiple Sclerosis Society. 26 Patient Groups Support Bill to Stabilize and Strengthen the Affordable Care Act. <http://www.nationalmssociety.org/About-the-Society/News/26-Patient-Groups-Support-Bill-to-Stabilize-and-St>
- Norman, B., & Karlin-Smith, S. (2016, July 13). The one that got away: Obamacare and the drug industry. POLITICO. <https://politi.co/2BFRvDR>
- Oberlander, J. (2018). The Republican War on Obamacare—What Has It Achieved? *New England Journal of Medicine*, 379(8), 703–705.
- Skopec, L., Waidmann, T., Urban Institute, Sung, J., & Dean, O. (2016, January 21). Monitoring the Impact of Health Reform on Americans Ages 50-64. <http://www.aarp.org/ppi/info-2015/monitoring-the-impact-of-health-reform-on-americans.html>
- Terhune, C. (2018, July 26). Top Trump Health Official Takes Swipes at ACA, Single-Payer in Enemy Territory. <https://khn.org/news/top-trump-health-official-takes-swipes-at-aca-single-payer-in-enemy-territory/>
- Whitehouse (2019). Healthcare. <https://www.whitehouse.gov/issues/healthcare/>
- WHO (2013). World Health Organization. Arguing for universal health coverage. <https://apps.who.int/iris/handle/10665/204355>