

Expanding Armrest Module For Electric Bariatric Chair
Beyond the 1%: A Telemedicine Strategy to Enhance Bariatric Surgery Adoption and Patient Follow-Through

A Thesis Prospectus

In STS 4500

Presented to

The Faculty of the

School of Engineering and Applied Science

University of Virginia

In Partial Fulfillment of the Requirements for the Degree

Bachelor of Science in Biomedical Engineering

By

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11/4/2024

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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.

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Introduction

Access to specialty care is often hindered by logistical, physical, and systemic barriers. The Center for Medicare and Medicaid Services defines specialty care as, “Health services that focus on a specific area of medicine or a group of patients with specific types of symptoms and conditions.” (Specialty Care, 2024) Bariatric surgery is one such form of specialty care that refers to a variety of procedures aimed at managing obesity and obesity-related conditions. Only about 1% of those who are eligible for bariatric surgery actually go through with it, meaning most people who require the surgery to improve quality of life will not get the help they need (Chao et al., 2021). 9.2% of adult Americans and 6.1% of children and adolescents have a BMI over 40, classifying them as severely obese, and once you reach this point, bariatric surgery is the most viable option to return to a normal BMI (Center for Metabolic and Weight Loss Surgery, n.d.). This number continues to grow as the obesity problem in America continues to worsen (Tiwari and Balasundaram, 2023).

There are various types of chairs and beds made specifically for work in the bariatric field. These can vary from static chairs that are designed with specifications of bariatric patients in mind to motorized chairs that can be transformed into a bed with the push of a button. The current bariatric chairs in use at the university hospital are only as wide as they are made or cannot fully adjust to a size that can fully support all the patients that arrive at the university hospital. Most static bariatric chairs are currently designed to support a width around 61 cm to 76 cm (Hitka, 2023), which is not wide enough to accommodate certain patients. Without acceptable accommodations, many patients are exposed to physical health risks. Making a patient who is 800+ pounds fit into a chair that

can only accommodate up to 650 pounds is dangerous. An adjustable module that could widen the armrests and seating area to provide accommodation to a variety of patients in one chair model could help various people in a single package.

On the other hand, telemedicine has rapidly transformed healthcare delivery in the past decade, which underscores the importance of innovative equipment, like the expanding bariatric chair module, which aims to improve patient comfort and safety. Telemedicine is the use of telecommunications in order to provide healthcare to patients in need with a large physical distance in between them. Finding more insights into how telemedicine is currently used and how it can be improved to support more groups of people in need of specialized care is important. This leads to the question: How can we best implement telemedicine in areas of specialized care to make healthcare easier to access and to expand access beyond 1% of eligible patients?

Technical Project

The technical project focuses on the development of a bariatric chair attachment module that can mechanically adjust to the needs of the patients with parameters requiring larger sizes. Now, the University of Virginia hospital comes across issues where the chairs in their given states are not wide enough to support certain patients without impacting certain bodily areas. Patients come within various parameters, and adjustments need to be made in order to ensure patient health. This module will look to attach to current chair models to allow them to widen to up to 50 inches, which allows for larger body types. The design will also be motorized and adjustable for maximum comfort for all body sizes and to allow these chairs to go through normal door frames for storage.

There are current electric models of chairs in place, but most have a set adjustment when it comes to width. The idea is to either provide these chairs with an adjustable module that can reach up to 42 inches wide, which is the recommended target width for a bariatric chair, or more (Muir and Archer-Heese, 2009). This target is from the peer-reviewed journal, *The Online Journal of Issues in Nursing*, though we believe it is outdated and does not best address the current problems in the bariatric space. The evolving nature of such problems suggests that the chair could be made adjustable to widths larger as well, as there are more cases of severity being reported over time (Tiwari and Balasundaram, 2023). Optimal designs for connecting a mechanical part to existing chairs must be researched, and if proprietary designs interfere with a potential solution, then those ideas must be taken into consideration. A classic iterative approach will be used for the physical design, and if a completely new chair design must be taken into account, then that requires a total overhaul of the current designs of electric bariatric chairs.

From this point, if a prototype is eventually designed and created, testing must be done to ensure it completes its intended function. The prototype must adhere to applicable FDA regulations and other organizational standards. The device will most likely fall under the FDA regulation as an accessory to a medical device (Center for Devices and Radiological Health, n.d.). The International Organization of Standardization sets high standards for safety, usability, and durability in medical settings (International Organization for Standardization, 2016, 2019). This will allow us to best design for user safety in its intended use environment. Finally, there is the International Electrotechnical Commission, which sets the standards and benchmarks for medical electrical equipment and its potential commercialization (International Organization for Standardization, 2015).

Keeping in mind not only organizational design standards but also practical, accessible designs for all types of users and patients. The idea of designing for one specific type of user can lead to consequences through unintended bias. Thus, many different types of use cases and user types must be taken into account to create the best possible design.

STS Research Problem

Despite telemedicine's potential to improve accessibility, its integration with bariatric care remains incomplete due to logistical, physical, and systemic barriers. With only 1% of eligible patients undergoing bariatric surgery (Chao et al., 2021), expanding telemedicine use could address access issues, reduce healthcare disparities, and combat rising obesity-related health concerns. One study states that bariatric care is beginning to implement telemedicine in a variety of ways, focusing on education and consultation, and is held back in the physical space (Poljo, 2024). The Diffusion of Innovations theory seeks a way to explain how, why, and at what rates innovation spreads in society (Rogers, 1962). It proposes that there are five main elements in the spread of an idea: innovation, adopters, communication channels, time, and social system. Innovation is the novel idea in question; adopters are the users, communication channels, time, and social systems are all self-explanatory. Adopters have five main categories: innovators, early adopters, early majority, late majority, and laggards. In tandem with this framework, literature review and case study analysis will be performed to analyze telemedicine's use in bariatric care.

Telemedicine in bariatric care is compatible with our current technology and everyday life, easy to use, and can help users save time. Hence, it meets all five of the important characteristics of innovations. Though, with all of this in mind, I believe the general public falls in the early and late majority right now. In a survey of 10 telemedicine

implementations done for bariatric care, 9 were considered to show positive outcomes. (Coldebella et al., 2018). This is one of the first studies that looks at telemedicine as a potential intervention for delivering healthcare. Though it is a literature review of previous studies, so I would classify it as more early adopters. These are the people who do not need much convincing of the innovation, telemedicine in bariatric care, and they are interested in using it. Importantly, the study only concludes that there is potential in telemedicine in the bariatric space, as there was not a lot of conclusive evidence showing beneficial impacts.

Over the COVID-19 pandemic, there was a shift towards the use of telemedicine in specialized sectors. After telehealth implementation, the no-show rates to consultations decreased from about 39.3% to 16.6% (Schlottman et al., 2022). This case study of telemedicine shows potential in specialty care and has been in use since 2020, and while there are new ways to perform physical surgery through telecommunications, it is not widespread. Other literature showed that ease of access via meeting with telecommunication methods greatly contributed to overall better outcomes for bariatric patients as well (Brown et al., 2020). This is an example of a much more recent implementation of telemedicine in the bariatric space, with experimental evidence of success. This study mainly looks at how the forced implementation of telehealth due to the COVID-19 pandemic affects the people who use it. Those who did use the telehealth option showed more to consultations, showing how the ease of access directly contributes to more people taking the first step. I would still consider these users within the early adopters, though there is some outside circumstance impacting the normal diffusion of innovation here. In a case study that responded to COVID-19, the Michigan Health system had 530

providers from 75 ambulatory practices offer some form of virtual healthcare, which is impressive when the number was nearly zero before the pandemic started (Hirko et al., 2020). With yet another study of implementation success, these early adopters completely changed how healthcare was being administered and heavily improved ease of access. We are at a point where the early majority is just starting to access telemedicine for use in specialty care, thus showing a lack of studies on a larger population. The healthcare space is also notoriously conservative when it comes to adopting new ideas, and I would categorize most users as the late majority, or even laggards.

Conclusions

Overall, specialized care and the improvement of healthcare via telecommunications are fast-moving areas of study with vast implications. Literature shows potential improvement has already been shown (Hlavin, 2023), though it does not state a clear path forward. Expanding research beyond the realm of pre-surgery consultations could lead to increased amounts of patients getting the help they need. Pairing patient comfort both in and out of the clinical space is still a priority and can combine to show a dynamic bariatric treatment space. Creating a module that can personalize bariatric chairs to more types of users is the first step forward in the clinical space. Finding ways to best implement telemedicine to supplement bariatric care is the next step forward in expanding technology in the specialty care space.

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