

Thesis Project Portfolio

Redesigning the Medical Examination Table for Improved Accessibility

(Technical Report)

“Necessary and Appropriate”:

The Inaccessibility of Accessible Medical Diagnostic Equipment

(STS Research Paper)

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Ashtin Jannuzzi

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Sociotechnical Synthesis

In a 2022 phone survey conducted by the Department of Health and Human Services, 34 million U.S. adults reported having a mobility disability. For this portion of the population, the fixed-height examination tables present in most healthcare facilities do not allow for easy transfer and often result in patients being examined off-table. This informal examination inhibits providers from detecting early indicators of disease and contributes to poorer health outcomes reported by people with disabilities.

For our technical project, my group and I aimed to redesign a medical examination chair for accessibility. The redesign was at the behest of our advisor, Dr. Masahiro Morikawa, who recognized many flaws in the design of an accessible chair in the UVA Health's Family Medicine Clinic. In addition to aesthetic changes, he requested a design that had minimal hydraulic and electronic components to reduce future costs and allow use in low-resource settings.

Following the work of a previous group, we aimed to create the mechanisms of motion for the predefined chair features. Originally, we aimed to create mechanisms for reclining the chair, raising and lowering the table, and positioning the patient's legs. During the design process, we omitted the leg positioning mechanism in lieu of a swivel component to rotate the chair. We used a combination of SOLIDWORKS and Autodesk Fusion 360 to design original parts, visualize off-the-shelf components, and incorporate them into functional assemblies. In addition to designing the mechanisms, we conducted a cost-benefit analysis for our proposed design. We found the material cost for one redesigned exam chair but had difficulty determining exact overhead costs from manufacturers and distributors. After estimating labor expenses, we approximate the cost of our redesigned exam chair to be \$1,100; this design is cheaper than other accessible chair models on market and competitive with fixed-height exam tables that have fewer features.

We also distributed a survey to providers across multiple specialties at UVA Health to predict how our product would be received. We asked for years of experience, percentage of patients who had mobility

impairments, thoughts on fixed-height examination tables, and opinions on whether an accessible table would be beneficial. Over 50 providers responded, with a majority saying a more accessible exam table would benefit their practice and that features we incorporated into our design would improve their ability to position patients. The responses to this survey, as well as our design notes, 3D files, and research, were saved in a central drive to be passed on to a future capstone group. This will allow the project to further develop under the guidance of a new team, who could potentially create a prototype of our design.

My STS research paper focuses on the absence of accessible medical diagnostic equipment (MDE). Preliminary research for our technical design led me to wonder why accessible exam tables weren't present in many practices already. I performed a meta-review on health policy publications to see what researchers identified as factors preventing widespread acceptance of accessible models of MDE. I also analyzed the history of legislation regarding accessible MDE, which supplemented my findings from the journal articles. A prevalent belief I found was that practitioners were not educated on care for people with disabilities, which colors their perception of disability and impacts the level of care provided.

Legislation impacting accessible MDE dates to the 1970s, beginning with civil rights and anti-discrimination laws on the basis of disability. With additional regulations for accessible structures and a standardization of accessible features, acceptance and care for people with disabilities has improved. However, these protections were only recently put in place and are not secure, especially with the trend of deregulation and an emphasis on efficiency in the current for-profit healthcare system. Improved provider education and an increase in the number of legal protections would be effective ways to ensure accessible MDE remains present in healthcare facilities and works to improve health outcomes for people with disabilities.

My technical project and STS research paper explored the design process and public opinion research necessary to create a medical product, specifically the medical examination chair. Both approaches are needed to create an effective product: without social research, the need for such a product would be unknown and without a streamlined design, a product would be nonexistent. The lack of accessible MDE

isn't one of poor distribution; it's of a misunderstanding its necessity. An accessible model that has additional features and a competitive price would make said design desirable over a fixed-height exam table. Together, the presence of more accessible examination tables and understanding of their need would better serve people with disabilities in healthcare settings.