

Portable Cervical Cancer Screening Chair

ME 4015-4016: Capstone Design Project



VirginiaTech
Invent the Future

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Importance of this Design?

As cervical cancer is the leading cause of women's cancer deaths in Peru, we designed a portable cervical cancer screening chair.

Currently, there are insufficient clinics around Cusco and many women are not aware of the associated health risks.

Thus a portable version of a typical screening table will bring medical aid to impoverished and remote areas.

Challenges

As this design has a very specific expected use, some challenges we needed to take into account include:

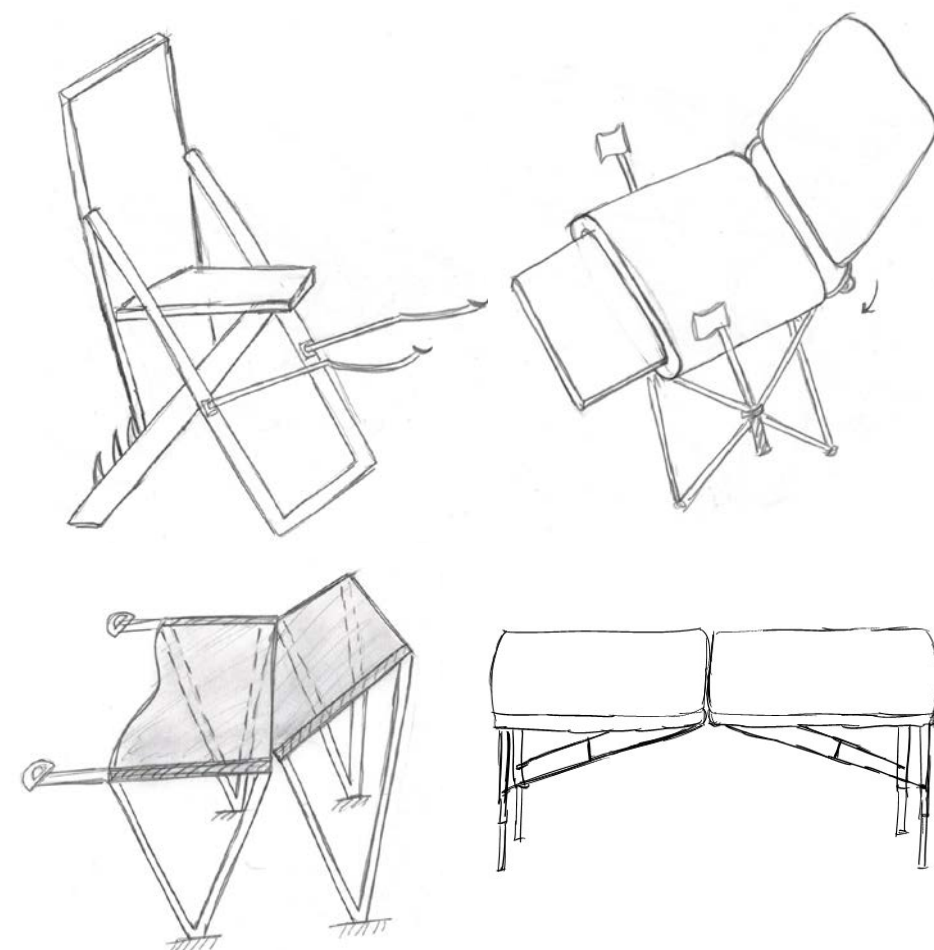
1. Lightweight
2. Backpackable, easy to transport
3. Intuitive setup and breakdown
4. Sanitary
5. Ergonomic design that takes into account appropriate screening positions

Objectives

Based on our customer needs and input from professionals in the field, some objectives were prioritized, the five most important being:

1. Ergonomic design
2. Coating/material for medical use
3. Minimal Bill of Materials (BOM)
4. Articulating motion—taking into account appropriate procedure positions
5. Durability/ruggedness

Chair Prototype Development



From left to right (above) chronicles the production of the patient's chair, from concept generation through multiple prototypes.

CAD renderings (left) show sub-assemblies. Final product is pictured on the right.

Final Product:

- Sized for a typical Peruvian woman of 5'4"
- Maximum allowed weight: 200 lbs
- Materials:
 - Carbon fiber rods, all 1" diameter
 - Joints made of aircraft-grade, 6061-T6 Aluminum
 - Waterproof vinyl upholstery



Product Evaluation and Testing

Ergonomics: 8.5/10 rating by Sponsor

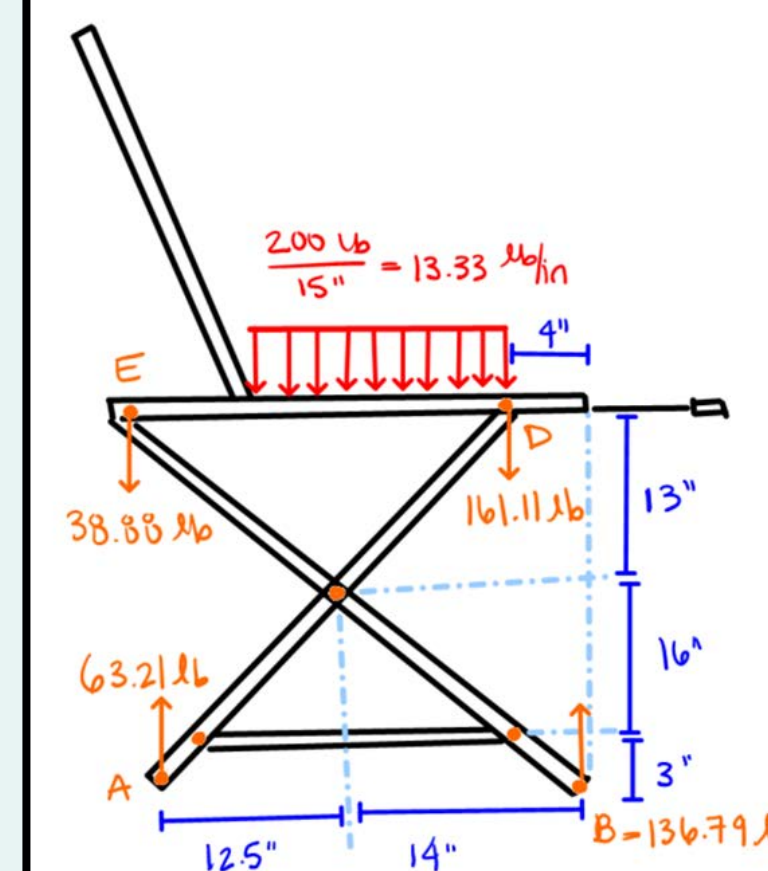
Sterility: Does not absorb fluid/hygienic

Articulating Motion: Yes (85°, 45°, and 25°)

Minimal Parts: 10 separate parts out of 15

Weight: Table is 20 lbs./passes target spec.

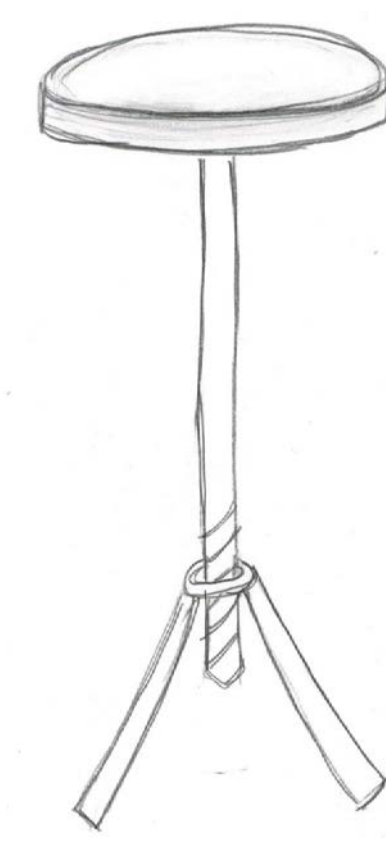
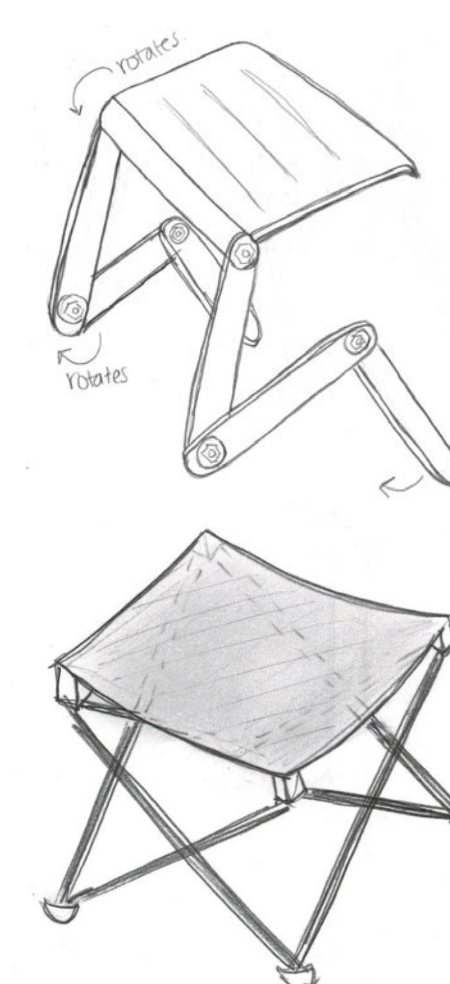
Mechanical Design Analysis



Safety factors at critical locations:

- Carbon fiber rod with reinforced pin-hole: $n = 2.16$
- Pins: $n = 10.23$

Doctor's Stool Prototype Development



Images (from left to right): Concept generation through product realization of the doctor's stool.

Final Product:

- Adjustable stool heights
- Same materials used as in patient's chair

Future Work and Recommendations

- Angle the stirrups upwards/add vertical adjustability for more support/comfort
- Consider variations of the main chair for other medical applications, such as a dental chair.
- Consider materials that are cheaper and could typically be sourced in a developing nation. (e.g. aluminum, wood)