A System-Wide Evaluation of the Dissemination of 3D Printed Assistive Devices for a Multi-Campus Health Sciences Library

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Texas Tech University Health Sciences Center – Libraries of the Health Sciences

PROJECT:

In patient care, infusion pumps stand as crucial tools, simplifying the precise delivery of fluids, nutrients, and medications to patients in a controlled manner. These devices can be found in clinical environments like hospitals and nursing homes, plus within patients' homes and beyond, i.e., travel. While skilled professionals play a role in assisting with overall maintenance, patients are left with the responsibility of managing the infusion pumps while going on with their daily lives.

While running errands with the pump does not present too much of an inconvenience, other activities like showering and bathing require MacGyver-like novelties, i.e., coat hangers and plastic bags, to protect the pump from water and other deep-water contamination.

These pumps are crucial for patients' survival because they provide continuous access to drugs like insulin, antibiotics, chemotherapy drugs, and pain relievers. Infusion pumps play a pivotal role in administering a wide array of substances. Their indispensable utility requires reliability, where even keeping it as dry as possible matters.

This project originally manifested from the mind of a 4th-year medical student enrolled in our elective, MIDS 8420 – "Thinking in 3D: An Introduction to 3D printing and Medical Imaging." We would like to expand and disseminate the inherent benefits from a shower caddy designed to hold and protect an infusion pump while showering and bathing. This project will utilize 3D printed devices, bringing to fruition the student's original vision of patients' ability to shower and bathe without fear of contamination, which promotes a higher quality of life. What is more, this project highlights the intrinsic benefits of customization that underscores 3D printing.

WHY IS IT IMPORTANT:

Starting at the Lubbock campus, TTUHSC introduced 3D print services in 2014 introducing the application as a rotation in the School of Medicine program. Residency placement of rotation participants spread across all disciplines: Family and Internal Medicine, Pediatrics, Physical Medicine and Rehabilitation, Psychiatry, Neurology, OB/Gyn, Child Neurology and Emergency Medicine.

To date, the Methodology Lab and maker space in the Odessa library have completed projects at the department and individual levels, contributing PPE after the onset of COVID and provided anatomic models for skills training in surgery, sonography, ultrasound, computed tomography and for other academic uses.

3D print technologies are now ubiquitous in the health sciences. It also exhibits a capacity for generating customized assistive devices, which improves the daily lives of patients requiring portable infusion pump that delivers fluids, such as nutrients and medications, into a patient’s body in controlled amounts. Our intent is to explore how this shower caddy can be disseminated efficiently, therefore promoting the broad adoption of best practices and innovative incorporation of 3D printing technology in meaningful ways.

INSTITUTIONS INVOLVED:

Texas Tech University Health Sciences Center – Libraries of the Health Sciences (Lubbock, Amarillo, and Odessa).

WHO WILL CARRY OUT THE PROJECT AND WHAT ARE THEIR ROLES?

C. Erik Wilkinson, MLS | Principal Investigator, Odessa

Kate M. Serralde, MA | Project Manager, Lubbock

Tyler Chapman, MD | TTUHSC School of Medicine

Whitney Atwood | 3D Print Specialist IV

Roger Smith |. 3D Print Specialist III

WHAT IS THE TIMELINE?

Planning:	April 2024
Survey Distribution:	
School of Medicine:	May 2024
School of Nursing (NP's):	May 2024
School of Health Professions (PA & OT):	May 2024
Data Collection:	June 2024
Data Reporting, Program Partner Communication & Marketing Development:	June/July 2024
SCAMeL Research Committee Report:	March 2025
Post-Survey:	April 2025
Post-Survey Reporting to Program/Stakeholders:	June 2025
Scholarly Activity:	May-December 2025
Comprehensive Report and Recommendations to TTUHSC Stakeholders:	December 2025

BUDGET:

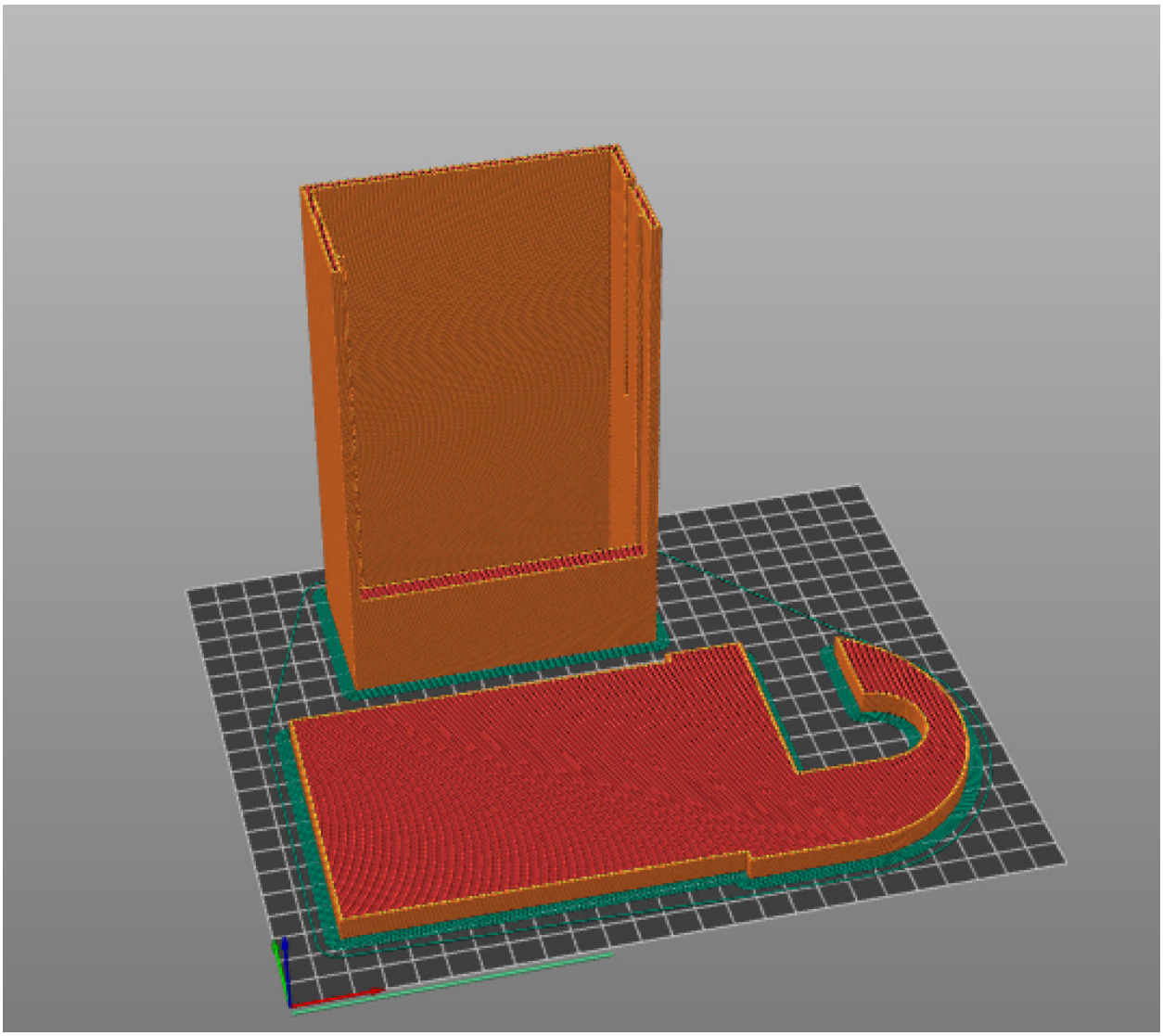
3D Printing Equipment:	$4500
Consumables:	$400
Marketing:	$100

(See Appendix for breakdown)

Andrew J Escude

Andrew Escude, Interim Executive Director | Date

Appendix II



3D Printed Shower Caddy

Example Infusion Pump

Tyler Chapman

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Why I designed this product:

I designed this shower caddy to assist patients receiving treatment consisting of continuous infusions administered via a CADD Legacy Pump. These pumps are used to provide life-saving medications to patients for a variety of conditions, some of which cannot be stopped for more than a few minutes without risking significant complications or death. Unfortunately, these pumps are aging, very susceptible to damage, not water resistant, and costly to replace/repair. The newer version is expensive and unobtainable for almost all patients. Most people using these pumps place them in a plastic grocery sack or in the belt carrier and use a clothes hanger to hang the pump from a shower rod. This places the pump at risk of water damage, drops, and exposure to contaminants such as mold/mildew. I developed this caddy to make the simple act of bathing more accessible and safer for these patients who are already dealing with complex and often debilitating conditions. My design places the pump in a dedicated holder that reduces the risk of dropping it and its exposure to water and contaminants.

Implementation/Production

I have partnered with The Texas Tech Health Science Center Methodology Lab to 3D print these shower caddies cost-effectively and donate them directly to the patients who need them through their physician's office. I have arranged with Dr. Victor Test, M.D., to provide the initial batch of these caddies to his patients suffering from Pulmonary Hypertension. This condition often requires medications that cannot be stopped, even for a short time, without risking severe complications or death. Other patient populations utilize this pump, such as those receiving chemotherapy, pain management, and others. My plans for the future are to continue proving this product's usefulness and distributing it, free of charge, to other patients who would benefit. To impact the most people possible, I intend this design to be open source to allow for further improvements/innovation, improved accessibility, and reduced profiteering.

If you need anything else, just let me know.

Thank you so much for all your help and support,

APPENDIX I

DRAFT PRE & POST DISSEMINATION SURVEY:

Pre-Dissemination

1. What do you know about 3D printing in healthcare?

2. I am open to the idea of using 3D printing to generate assistive devices like the shower caddy in patient care.
    a. Yes?
    b. No?
    c. Not Sure
    [If no, Why? If yes, Why?]

3. How many patients do you treat in a year (approximate)?

4. In a year how many patients do you treat that require assistive medical devices (approximate)?

5. What type of assistive medical devices have you recommended?

6. How many patients require the use of a portable infusion pump (approximate)?

7. Have you have ever recommended 3D printing as source of generating assistive devices?
    a. Yes?
    b. No?

8. Have you ever been asked about using 3D printing to create assistive devices to improve patient care by a patient?

Dissemination Survey 2025; 2026, 2027 (if needed)

1. How many patients did you treat in the past year?

2. In the past year, what is the number of patients you have treated that have required the use of a portable infusion pump?

    0 patients 1- 10 patients 11-20 patients 21-30 patients 31-40 patients

3. In the past year, what is the number of patients, who required the use of a portable infusion pump who have asked about the benefits of 3D printing assistive devices like the shower caddy?

4. How many shower caddy's have you given to patients in the past year?

5. How many shower caddy's have you requested to be made in the last year?

6. How many patients or colleagues have you recommended the benefits of 3D printing assistive devices like the shower caddy in the past year?

TTUHSC - Libraries of the Health Sciences - SCAMeL Speedy Startup 2024

Item	Description	Cost	Quantity	Ext. Cost
White PETG	Overture PETG FIlament	$ 18.99	2	$ 37.98
Black PETG	Overture PETG Filament	$ 22.99	2	$ 45.98
Red PETG	Overture PETG Filament	$ 21.99	2	$ 43.98
Gold PETG	Polymaker PETG Filament	$ 22.99	2	$ 45.98
Magenta PETG	Polymaker PETG Filament	$ 22.99	2	$ 45.98
Purple PETG	Overture PETG Filament	$ 22.00	2	$ 44.00
Grass Green PETG	Overture PETG Filament	$ 22.99	2	$ 45.98
Chrome Chameleon PETG	Stronghero 3D	$ 19.99	1	$ 19.99
Translucent Multicolog	Stronghero 3D	$ 19.99	1	$ 19.99
Misc.				
Bob Smith Insta-Cure	Used to attach printed parts	$ 28.00	1	$ 28.00
Instant set	Used to cure super glue	$ 15.99	2	$ 31.98
Metal Files	Used Clean Up and Assemble Shower Caddy	$ 25.99	1	$ 25.99
Marketing Materials	For Adversting	$ 100.00	1	$ 100.00
Equipment				
Original Prusa XL	The Original Prusa XL is a unique large-scale CoreXY 3D printer with a build volume of 36×36×36 cm (14.17''×14.17''×14.17'').	$ 1,999.00	2	$ 3,998.00
Shipping	Shipping Fee	$ 398.00	1	$ 398.00
			TOTAL:	$ 4,931.83