

BME Design: Progress reports

Title: Milrinone alternative delivery system

Date: 9/17/2026

Client: Dr. Lenard Markman
Advisor: Prof. William Murphy
Team: Beyond the IV

Samuel Glanville - *Team Leader*

Yisi Yang - *Communicator*

Steve Lee - *BSAC*

Katie Wright - *Co-BWIG*

Noelle Johnston - *Co-BWIG*

Leo Thayer - *BPAG*

Problem statement

Congestive heart failure (CHF) patients use Milrinone therapy, but current delivery relies on IV administration, limiting outpatient use and long-term management. There is a need to develop and validate alternative, non-invasive delivery formulations of Milrinone, such as nebulized/inhaled, oral (tablet or liquid), or nasal spray for rapid daytime symptom control, paired with a longer-acting oral formulation for sustained nighttime dosing that achieve therapeutic equivalence to existing delivery methods while minimizing side effects and improving patient adherence and quality of life.

Brief status update

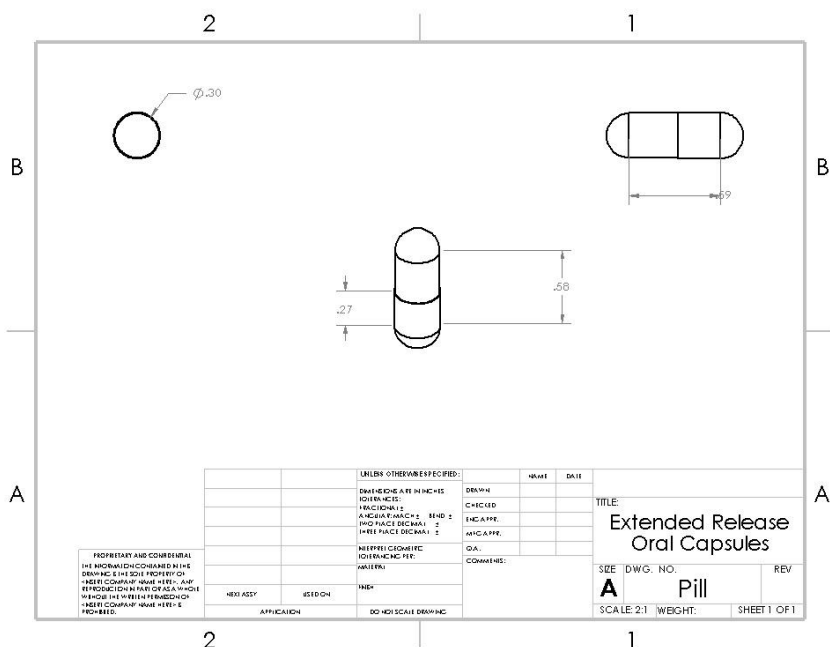
The team met up on Monday to complete the determination of design matrix criteria. The three final design choices are the sublingual pouches, the nasal spray, and the extended release capsule. After careful consideration, the extended release capsule was selected to be the final design choice due to its ease of fabrication, ease of use, and lower dosage per day. The team is also scheduled to meet with a potential collaborator on Friday to discuss the different designs and how the team can proceed further with testing the fabricating the prototype.

Difficulties/advice requests

Our project focuses on patients with stage D heart failure who currently receive milrinone through a portable intravenous (IV) infusion pump. We aim to investigate a more convenient delivery method that reduces the burden of IV treatment while maintaining therapeutic support. The alternative should also address the needs of patients who have difficulty swallowing or cannot swallow oral tablets.

Following our first client meeting, the client suggested exploring a long-acting nasal spray for the night and a short-acting spray for the daytime, potentially incorporating a vasoconstrictor to prolong its effect. A key uncertainty is whether this approach could provide sustained, predictable milrinone absorption while remaining safe for patients with stage D/advanced heart failure. We need to distinguish between prolonged relief from existing nasal medications and sustained systemic delivery of milrinone.

Current design



The current design consists of an extended release oral capsule. This design allows for the patient to only take medication once every twelve hours. The design also allows for a simple fabrication with little to no extraneous cost. The capsules are made of plant-based polymers delaying the medication delivery when it reaches the stomach for up to half an hour.

Materials and expenses

Item	Description	Manufacturer	Mft Pt#	Vendor	Vendor Cat#	Date	#	Cost Each	Total	Link
Category 1										
									\$0.00	
									\$0.00	
Category 2										
									\$0.00	
									\$0.00	
								TOTAL:	\$0.00	

- Starting budget of \$100 from our client
 - From there the university can provide medications that are needed or we could possibly receive soft funding from the American Heart Association if we explain our project to them.
- An additional budget of \$50 can be accessed for Design Innovation Lab specific purchases such as 3d printing.

Goals

Major team goals for the next week

1. Prepare for the preliminary design oral presentations on Friday
 - Create slideshow
 - Practice presentations
2. Continue researching our preliminary designs with a focus on the extended-release oral capsule
 - Determine the material of the capsule, number of dosages per day, and concentration of milrinone in the capsule to achieve desired therapeutic concentration
3. Continue contacting professionals and researchers
 - Ask them for advice on our extended-release oral capsule and the pouch delivery methods

Next week's individual goals

- Samuel Glanville
 - Continue further research on the use of extended release capsules and sublingual pouches
 - Obtain materials for initial testing
 - Work on preliminary deliverables
- Yisi Yang
 - Find out the categories for the design matrix with the team
 - Finalize the preliminary designs and find out what type of alternatives we want to deliver for the preliminary design report.
 - Meet with a professor from the department of cardiology to discuss how to make our current design better.
- Steve Lee
 - Complete design matrix with the team
 - Finalize the preliminary design and discuss with potential collaborators

- Meet with potential collaborators
- Katie Wright
 - Assist team with the preliminary presentation slides
 - Continue researching which material would be the most effective for the extended-release oral capsule design
 - Send follow up emails to researchers and professionals I reached out to last week
- Noelle Johnston
 - Start preparing our preliminary presentation slides.
 - Research more into the oral milrinone capsule study and learn more about the various types of extended-release capsules.
 - Continue to update our website with current information and updates.
 - Finalize our product design.
- Leo Thayer
 - Create a purchasing organization spreadsheet for team expenses.
 - Communicate with the client about all accounting aspects of the project.
 - Complete a section of the preliminary design presentation slides.

Timeline

Task	Sep				Oct					Nov				Dec	
	4	11	18	25	2	9	16	23	30	7	14	21	28	5	9
Project R&D															
Background...	x	x	x												
Prototyping				x											
Testings															
Deliverables															
Progress Reports	x	x	x	x											
Prelim presentation				x											
Final Poster															
Meetings	x	x	x	x											
Client		x	x												
Advisor		x	x												
Website	x	x	x	x											

Filled boxes = projected timeline

X = task was worked on or completed

Detailed accomplishments

Previous week's goals and accomplishments

- Samuel Glanville
 - Complete capsule CAD
 - Design matrix section
 - Extended release capsule research
- Yisi Yang
 - Research about potential substitutes for milrinone testing if we cannot get the medicine itself.
 - Search for potential professors or MDs from the school of Pharmacy or UW Health to talk with about our design matrix.
 - Research about categories that might appear on our design matrix, for example, will the texture of pouches irritate the sublingual tissue.
 - Update our potential design matrix to the client
- Steve Lee
 - Setup meeting with potential collaborator at the Department of Cardiology
 - Continue to search for collaboration and resources from School of Medicine and School of Pharmacy
 - Continue researching on testing environment and draft bioreactor design
 - Propose 3 design ideas and make design matrix with the team
- Katie Wright
 - Assisted the team with completing our design matrix
 - Researched the possibility of using a transdermal patch as one of our preliminary designs
 - Continue to update ur website
- Noelle Johnston
 - Researched sublingual pouches and milrinone solubility to determine the possibility of using pouches in order to administer the dosage of medication.
 - Worked with the team to complete and fill out the design matrix.
 - Continued to update our website
- Leo Thayer
 - Compile detailed research into three solutions for a design matrix of preliminary design proposals.

- Further research oral delivery pouches for milrinone.
- Research side effects of similar molecules in pouch administration.
- Attended a BPAG meeting about all accounting necessities of the team.

Activities

Name	Date	Activity	Time (h)	Week Total (h)	Sem. Total (h)
Samuel Glanville	9/9/2026	CAD	1	2	6
Samuel Glanville	9/18/2026	Research	2	3	6
Yisi Yang	9/8/2026	Client Meeting	0.8	0.8	0.8
Yisi Yang	9/13/2026	Client Meeting	0.8	0.8	1.6
Yisi Yang	9/16/2026	Background Research	2	2.8	3.6
Yisi Yang	9/17/2026	Client requirement part of PDS	1	3.8	4.6
Yisi Yang	9/21/2026	Background Research	2	2	6.6
Yisi Yang	9/21/2026	Teams Meeting	1.5	3.5	8.1
Steve Lee	9/10/2026	Background Research	1	1	
Katie Wright	9/20/2026	Transdermal patch research	1	2	6.1
Katie Wright	9/21/2026	Design matrix meeting with team	1	2	6.1
Noelle Johnston	9/10/2026	Background Research	1	1	1
Noelle Johnston	9/15/2026	Capsule Type Research	1.75	1.75	2.75
Noelle Johnston	9/16/2026	Various Sections of PDS	1	2.75	3.75
Noelle Johnston	9/20/2026	Sublingual Pouch Research	2	2	5.75
Noelle Johnston	9/21/2026	Design Matrix Team Meeting	1.5	3.5	7.25
Leo Thayer	9/8/2026	Background Research	1.5	1.5	1.5
Steve Lee	09/15/26	Client Meeting	1	1	2
Steve Lee	09/16/26	Contact potential collaborator	1	2	3
Steve Lee	09/17/26	Contact potential collaborator	0.5	2.5	3.5
Steve Lee	09/18/26	Research testing environment	1	3.5	4.5
Leo Thayer	9/16/26	Research oral milrinone and PDS	2	2	3.5
Leo Thayer	9/17/26	Pouch similar designs research	1	3	4.5

BME Design: 200, 300, 301, 400 and 402

Steve Lee	09/21/26	Design Feasibility Research	1.5	1.5	6
Steve Lee	09/25/26	Potential Collaborator Meeting	2	3.5	8
Leo Thayer	9/25/25	BPAG and Team Meeting	1.5	1.5	6
Leo Thayer	9/22/25	Pouch side effect research	1.5	3	7.5