

BME Design: Progress reports

Title: Milrinone alternative delivery system

Date: 9/10/2026

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 completed team role assignments on project selection day and began background research on congestive heart failure and Milrinone therapy. Yisi, the communicator, set up a client meeting for the team to introduce ourselves to the client, learn about the client's expectations, and ask crucial questions regarding the project logistics. The team has continued researching the background information of the project to prepare for an advisor meeting on Friday. No expense has been incurred this week. The progress is on track with the predicted timeline. Only difficulties experienced was the lack of overlap of team members' free time, making it difficult for the team to meet and discuss in person before the advisor meeting, but expected to be resolved in future weeks as campus events slow down.

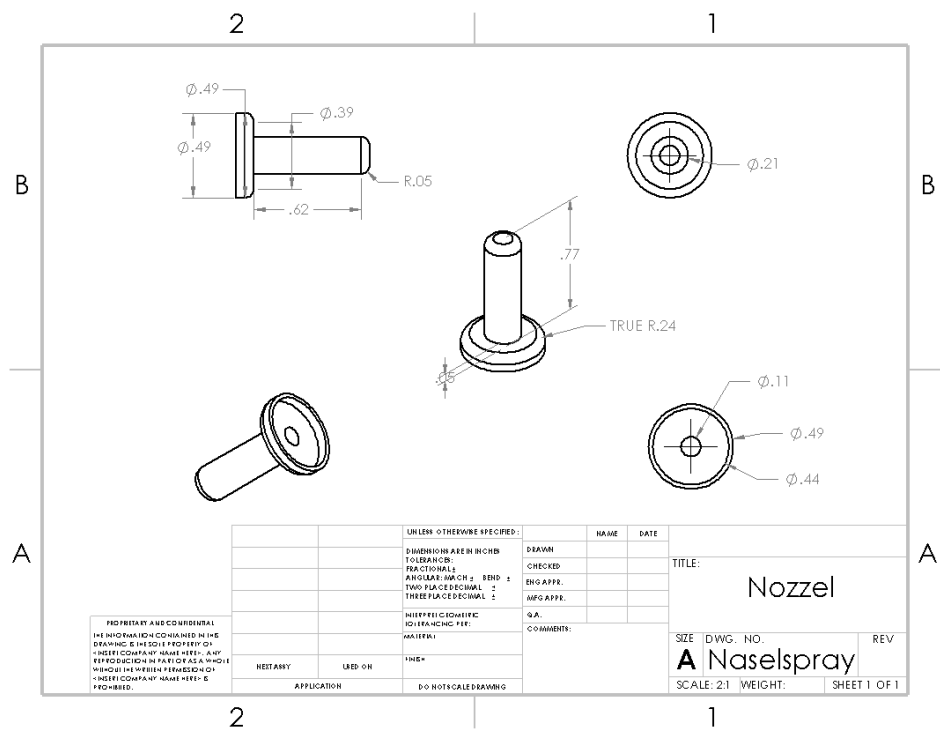
Difficulties/advice requests

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 nozzle to the nasal spray remains very rudimentary, although it incorporates a couple of important features. The tube portion is designed to be long enough to propel all medication into the nasal cavity without being long enough to cause a great amount of discomfort. The base also remains wide for the possibility of both a pump bottle that allows for multiple uses or a single piece of plastic to push medication through the nose for a single-time use.

Materials and expenses

Item	Description	Manufac-turer	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.

Goals

Major team goals for the next week

1. Finish preliminary background research on milrinone and heart failure
 - Understand current IV administration, dosing, and major safety concerns with milrinone delivery
 - Identify key quantitative data that can help guide the design
2. Refine the problem statement and the project's goals
 - Discuss the current problem statement and use notes from the meetings with the client and advisor to specify and refine our project's goals
 - Clarify the intended use and target patient population
3. Begin investigating alternative milrinone delivery routes
 - Research inhaled, intranasal, and oral methods of delivery
 - Document limitations and advantages for each option
 - Identify current research on milrinone using these alternative methods
4. Outline initial design criteria and constraints
 - Review the client's criteria and goals from the meeting with him on September 8th
 - Identify which requirements still need further clarification

Next week's individual goals

- Samuel Glanville
 - Further develop an integrated nozzle to the nasal spray and create a pump to propel spray into the nostril as needed.
 - Continue researching long-lasting nasal spray medication particularly to ensure that a spray to the nose of medication will not have any harmful side effects.
- Yisi Yang
 - Talk with the client again to determine which route we want to pursue for the alternative delivery system.
 - Summarize all possible alternatives before meeting with the advisor to check for possibility.
 - Continue researching the possibility of long-lasting nasal spray or nasal gel medication.

- Steve Lee
 - Attend the client meeting to understand the client's expectations.
 - Research on the pros and cons of different types of medication delivery systems, understand the effectiveness of all types of systems.
- Katie Wright
 - Update website with status, weekly progress report, and add basic project information
 - Do further research on possible alternatives and prepare questions for the meeting with our advisor
- Noelle Johnston
 - Update the website with information from our first client meeting and add important information such as our project statement and timeline.
 - Prepare questions to ask our client and advisor to gain more information on our project and routes that we could take.
- Leo Thayer
 - Further research the potential of a long-lasting oral tablet or pouch form of Milrinone administration.
 - Work to refine current ideas surrounding the nasal spray administration approach.

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														
Prototyping															
Testings															
Deliverables															
Progress Reports	x														
Prelim presentation															
Final Poster															
Meetings	x														
Client															
Advisor															
Website	x														

Filled boxes = projected timeline

X = task was worked on or completed

Detailed accomplishments

Previous week's goals and accomplishments

- Samuel Glanville
 - Began design of a nasal spray head to increase pump pressure and deliver enough medication
 - Prepared first progress report for the team and set up notebook
 - Began preliminary research on milrinone
- Yisi Yang
 - Set up the first client meeting with the team, introducing group members.
 - Find out which type of heart failure are we targeting as our patients, we are targeting stage D/advanced heart failure patients.
- Steve Lee
 - Signed up for BME mentor program as BSAC
 - Research the current medication delivery system and its pros and cons
- Katie Wright
 - Begin preliminary research on milrinone to understand the pitfalls of its current IV delivery method. Review studies of alternative methods already tested, such as oral, nasal, and inhalable
 - Started website design by updating team information and uploading the team picture
- Noelle Johnston
 - Began our project website and assigned team roles.
 - Started research on milrinone to develop a better understanding on how the medication works and the current delivery system.
- Leo Thayer
 - Began preliminary research into Milrinone administration techniques and history of testing.
 - Generated topic-specific questions for the first client meeting.

Activities

Name	Date	Activity	Time (h)	Week Total (h)	Sem. Total (h)
Samuel Glanville	9/9/2026	CAD	1	2	
Yisi Yang	9/8/2026	Client Meeting	0.8	0.8	0.8

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

Yisi Yang					
Steve Lee					
Katie Wright	9/9/2026	Background Research	1	1	1
Noelle Johnston	9/10/2026	Background Research	1	1	1
Leo Thayer	9/8/2026	Background Research	1.5	1.5	1.5