

# ***Multidimensional imaging-based models for cardiovascular procedural skills training (BVP model)***

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*Date: April 11th, 2025 to April 18th, 2025*

## **Problem Statement**

Interventional cardiology is a rapidly expanding field in veterinary medicine. Pulmonary valve stenosis occurs when a dog is born with a malformed pulmonary valve, which restricts blood flow from the right heart to the lungs. Balloon valvuloplasty is a palliative procedure in which a balloon-tipped catheter is inserted into the jugular vein to the valve and is then inflated to help reduce the severity of the stenosis. Recently, the UW-Madison School of Veterinary Medicine has experienced a decrease in caseloads of canines with pulmonary valve stenosis, preventing the cardiology residents from being able to practice repairing this disorder. There is a need for a heart model to mimic pulmonary valve stenosis for residents to learn and practice repairing these valves.

This device, a model-based simulation program will be implemented to maintain the cardiologists' surgical skill set and to aid in cardiology resident training. Simulator training using multidimensional imaging-based models will augment the training already provided in the interventional lab and help protect against the ebb and flow of procedural caseload eroding skills. It also provides a more consistent experience for our residents and provides an objective method of assessing individual progress amongst our trainees.

The goal is to develop a silicone 3D model of canine pulmonary valve stenosis which can be used to learn/practice essential skills like handling of guidewires/catheters, balloon positioning and inflation, and communication between veterinary interventionists. Computed tomography angiography (CTA) of dogs with pulmonary valve stenosis will be used to create the 3D models, which will be secured in place. Lastly, a document camera will project an image of what the user is doing with their hands onto a screen. This provides a more realistic recreation of the interventional surgery, where the surgeon watches a fluoroscopy screen to monitor the movement of the interventional equipment inside the patient.

## **Summary of Weekly Team Member Design Accomplishments**

- Team:
  - Completed human subjects testing
  - Began analyzing human subjects testing results
  - Began creating final poster
  - Submitted Final executive summary
- Hunter Belting:
  - Completed the outreach assignment
  - Helped complete human subjects testing
  - Began working on poster and final report
- Anna Balstad:
  - Finished outreach assignment
  - Started working on poster and final report
- Rebecca Poor:
  - Revised executive summary
  - Assisted in human subjects testing
  - Completed poster sections
  - Completed outreach assignment
- Daisy Lang:
  - Helped with human subjects testing
  - Analyzed the human subjects testing results and drew important conclusions

## **Weekly / Ongoing Difficulties**

N/A

## **Upcoming Team and Individual Goals**

- Team:
  - Complete poster and print!
  - Poster presentation!
  - Begin final report
- Hunter Belting:
  - Revise poster for presentation
  - Complete my portion of the report
  - Practice the presentation with the group
- Anna Balstad:
  - Write discussion section of the report and edit the report
  - Complete poster presentation
- Rebecca Poor:
  - Revise final poster portions
  - Complete individual portions of final report
- Daisy Lang:
  - Finalize poster presentation
  - Write the final report

### Project Timeline

Project Goal	Deadline	Team Assigned	Progress	Completed
Preliminary Presentation	2/7	All	100%	X
IRB	02/26	All	100%	X
Preliminary Report	2/26	All	100%	X
Executive Summary Draft	4/18	All	100%	X
Final Poster Presentation	4/25	All	50%	
Final Deliverables	4/30	All	25%	

## Expenses

Running Total: \$616.07

Link to spreadsheet:

<https://docs.google.com/spreadsheets/d/1zrmdodVMY9Tak7XrOgHdQ6oMQDw5IYqgROYaAgWNkOQ/edit?usp=sharing>

Item	Description	Manufacturer	Manufacture Part Number	Vendor	Date	QTY	Cost Each	Total	Link
<b>3D Printed Materials</b>									
Elastic 50A	Heart and Jugular Material	Formlabs	RS-CFG-ELCL-02	Formlabs	10/14/2024	1	\$208.57	\$208.57	<a href="https://formlabs.com/store/materials/elastic-50a-resin-v2/">https://formlabs.com/store/materials/elastic-50a-resin-v2/</a>
Flexible 80A	Original Material for Heart	Formlabs	RS-CFG-FL80-01	Formlabs	10/14/2024	1	\$208.57	\$208.57	<a href="https://formlabs.com/store/materials/flexible-80a-resin">https://formlabs.com/store/materials/flexible-80a-resin</a>
<b>Model Materials</b>									
Super Glue	Secure Jugular to Heart and Stand to Base Plate: 0.07 oz Tube	The Original Super Glue Corporation	SGH2J	Makerspace	11/19/2024	2	\$2.42	\$4.84	<a href="https://supergluecorp.com/product/super-glue-tube/">https://supergluecorp.com/product/super-glue-tube/</a>
3D Printed Stand	PLA Prints of stand to hold the Jugular and Heart	N/A	N/A	Makerspace	11/19/2024	2	\$8.00	\$8.00	N/A
Acrylic Base Plate	Secure the Model	N/A	N/A	Makerspace	11/19/2024	1	\$0.00	\$0.00	N/A
Full Model Tank	Tank to hold the entire model submerged in water: Superior Clear Storage Box with Lid, 44 Quart Plastic Container	Superio	BOD8518W1F	Amazon	3/3/2025	1	\$34.01	\$34.01	<a href="https://www.amazon.com/Superio-Container-Organizing-Stackable">https://www.amazon.com/Superio-Container-Organizing-Stackable</a>
Industrial Lubricant	Coat the inside of the model to help the catheter slide easily through	Super Lube Kano Laboratories LLC	56204	Amazon	4/3/2025	1	\$8.94	\$8.94	<a href="https://www.amazon.com/Super-Lube-56204-Silicone-Lubricant/dp/">https://www.amazon.com/Super-Lube-56204-Silicone-Lubricant/dp/</a>
HDMI Adaptor Cord	Adaptor Cord to connect phone to monitor to project video of model for testing JSAUX USB C to HDMI Cable 10ft   4K@60Hz   USB 3.1 Type C to HDMI 2.0 Cord for Home Office, (Thunderbolt 3/4 Compatible) with iPhone 16 Pro Max, MacBook Pro/Air, Galaxy S8 to S24, iPad Pro, iMac, Black	JSAUX	USB-C to 4K@60Hz HDMI Cable	Amazon	4/3/2025	1	\$13.99	\$13.99	<a href="https://www.amazon.com/dp/B0BQ8M4SVZ/ref=cm_sw_r_cs_sp">https://www.amazon.com/dp/B0BQ8M4SVZ/ref=cm_sw_r_cs_sp</a>
Water Proof Super Glue	Secure model stand to the base of tank Flex Glue, Mini, White, Super Strong, Rubberized Waterproof Adhesive, Works Underwater, Use On Pools, Showers, Outdoors, Concrete, Brick, Pavers, Masonry, and UV Resistant, 0.75 fl oz	Swift Response, LLC	B07PNQPF6G	Amazon	4/3/2025	1	\$5.78	\$5.78	<a href="https://www.amazon.com/Flex-Strong-Rubberized-Waterproof-Adh/">https://www.amazon.com/Flex-Strong-Rubberized-Waterproof-Adh/</a>
Phone Stand	Phone Tripod Stand, 85" Tall Cellphone Tripod with Gooseneck Remote, Flexible Tripod Stand for iPhone, Portable Phone Stand Tripod for Recording, Compatible with iPhone 14 13 12 pro Android Cell phone	Vivitiv	p18-353	Amazon	2/13/2025	1	\$21.99	\$21.99	<a href="https://www.amazon.com/Cellphone-Gooseneck-Flexible-Recording">https://www.amazon.com/Cellphone-Gooseneck-Flexible-Recording</a>
<b>Pump Materials</b>									
Peristaltic Pump	900ml/min high Flow peristaltic Pump 12V dc Brush Motor Liquid dosing Pump with BPT Tube	Kamoer	KPHM900-HB-B24	Amazon	2/7/2025	1	\$58.88	\$58.88	<a href="https://www.amazon.com/dp/B08B75XPRX/ref=sspa_dk_detail_1?">https://www.amazon.com/dp/B08B75XPRX/ref=sspa_dk_detail_1?</a>
Tubing	10 Feet - 1/4" ID x 3/8" OD Clear Vinyl Tubing, Translucent Plastic PVC Tubing Hose Pipe for Water Air Pump	Kesoto	601279606865	Amazon	2/13/2025	1	\$6.99	\$6.99	<a href="https://www.amazon.com/Kesoto-Clear-Translucent-Plastic-Tubing">https://www.amazon.com/Kesoto-Clear-Translucent-Plastic-Tubing</a>
Small Hose Clamps	3/8" Heavy Duty Double Snap Grip Nylon Hose Clamps Several Ratcheting Adjustable Clamp	Quickun	767065462036	Amazon	2/13/2025	1	\$11.59	\$11.59	<a href="https://www.amazon.com/Quickun-Double-Sevent-Batching-Adjustable-808P357NHT17ref=sspa_dk_detail_1?">https://www.amazon.com/Quickun-Double-Sevent-Batching-Adjustable-808P357NHT17ref=sspa_dk_detail_1?</a>
Circuit Switch	6A 250V/ 10A 125V Circuit Switch	ELMA	39122226	Makerspace	2/18/2025	1	\$0.20	\$0.20	<a href="https://www.yorklighting.com/brand/salco-products-eco/low-voltage-metal-round-rocker-switch-w-diode-2-circuit-rated%3A-6a-250v-10a-125v/rsku-V27-80-2101">https://www.yorklighting.com/brand/salco-products-eco/low-voltage-metal-round-rocker-switch-w-diode-2-circuit-rated%3A-6a-250v-10a-125v/rsku-V27-80-2101</a>
Project Box	Zulkit Junction Box ABS Plastic Dustproof Waterproof IP67 Junction Boxes Universal Electrical Project Enclosure DIY Electronic Project Box Grey 7.87 x 5.91 x 5.12 inch (200 x 150 x 130 mm)	Zulkit	B08MYWTF6D	Amazon	3/3/2025	1	\$18.98	\$18.98	<a href="https://www.amazon.com/Zulkit-Dustproof-Waterproof-Electrical-Electronic/dp/">https://www.amazon.com/Zulkit-Dustproof-Waterproof-Electrical-Electronic/dp/</a>
Large Hose Clamps	12-3-14-2mm - 0.48-0.55in - Plastic Hose Clamp - Herbie Clip - Black - PP	HCL	HCL HC-D-PP-BK	HCL	3/3/2025	10	\$0.57	\$5.70	<a href="https://hcl-clamping.com/products/plastic-hose-clamp-herbie-clip-12-3-14-2mm">https://hcl-clamping.com/products/plastic-hose-clamp-herbie-clip-12-3-14-2mm</a>
Power Adaptor	12V DC 1.5A-2A Converter Adapter Power Supply Power Cord Power Cable Charger DC Power Supply Plug 5.5mm x 2.5mm	ShenZhen Moveforest Electric Appliance Industry Co.,LTD	9553171318326	Amazon	2/18/2025	1	\$7.89	\$7.98	<a href="https://www.amazon.com/1-5A-2A-Converter-Adapter-Supply-Charger/dp/B0CNV6BHL7/ref=asc_df_B0CNV6BHL7/moid=c2c693d820b3e4544cd0f95ca8b8448hvocij=4882312312521876959-B0CNV6BHL7-&amp;hvexpi=73&amp;tag=hyprod-20&amp;linkCode=pf0&amp;hvadd=7303128205988&amp;hvpos=&amp;hvnetw=g&amp;hvrand=4882312312521876959&amp;hvpeo=&amp;hvptw=&amp;hvgn=&amp;hvdev=c&amp;hvdmcd=&amp;hvlocint=&amp;hvlocphy=9018944&amp;hvtagid=918-2281435178298&amp;psc=1">https://www.amazon.com/1-5A-2A-Converter-Adapter-Supply-Charger/dp/B0CNV6BHL7/ref=asc_df_B0CNV6BHL7/moid=c2c693d820b3e4544cd0f95ca8b8448hvocij=4882312312521876959-B0CNV6BHL7-&amp;hvexpi=73&amp;tag=hyprod-20&amp;linkCode=pf0&amp;hvadd=7303128205988&amp;hvpos=&amp;hvnetw=g&amp;hvrand=4882312312521876959&amp;hvpeo=&amp;hvptw=&amp;hvgn=&amp;hvdev=c&amp;hvdmcd=&amp;hvlocint=&amp;hvlocphy=9018944&amp;hvtagid=918-2281435178298&amp;psc=1</a>
							<b>TOTAL:</b>	<b>\$616.07</b>	

