

1 Article

# 2 Student Learning Experiences and Outcomes in 3 The Mississippi State University College of 4 Veterinary Medicine Shelter Medicine Program

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17 **Abstract:** While referral-level medicine is important in the veterinary curriculum, students also need  
18 a solid base knowledge of clinically relevant routine surgery and diagnostic skills. Veterinary  
19 hospitals must maintain a steady caseload that provides wellness cases and commonly encountered  
20 conditions. Shelter Medicine programs can create the opportunities to meet these challenges.  
21 Students can gain quantifiable surgical experience in spay/neuter with measured growth in surgical  
22 efficiency and competency while providing needed community service for animal shelters. Students  
23 can directly interact with shelter animals by performing examinations, diagnostic testing, and  
24 development of treatment protocols and recommendations for commonly encountered problems.  
25 Furthermore, students can obtain a working knowledge of biosecurity on a population level to  
26 minimize risk of infectious diseases spreading to healthy populations.

27 **Keywords:** shelter medicine; animal sheltering; shelter surgery; veterinary medical education;  
28 veterinary student training; population medicine; biosecurity

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## 30 1. Introduction

31 Mississippi State University College of Veterinary Medicine (MSU-CVM) is located in Starkville,  
32 MS, with a population of about 25,000. The closest metropolitan area in the state is 130 miles away  
33 (Jackson, MS with a population of about 170,000). Even with a solid referral case load for specialty  
34 services, there can be challenges in receiving adequate numbers of primary/first opinion cases.[1]  
35 While referral-level medicine is important in the veterinary curriculum, students also need a solid  
36 base knowledge of clinically relevant routine surgery and diagnostics.[2] The MSU-CVM Shelter  
37 Medicine program fills the case load gap by creating opportunities with shelter animals to perform  
38 high quality/high volume spay/neuter (HQHVSN), physical examinations and hundreds of basic  
39 diagnostic tests, effectively adding on average 9,000 cases a year to the overall hospital case load.

40 All services of the Shelter Medicine Program directly engage communities across Mississippi  
41 while providing best practice, high quality clinical instruction in surgery, medicine, and population  
42 medicine. Fourth-year veterinary students average 65 spay/neuter surgeries at 7 different animal  
43 shelters while on the Shelter Medicine spay/neuter elective. Students hone clinically relevant  
44 medical and diagnostic skills while participating in shelter medical days, and the population  
45 medicine rotation equips students with the knowledge and skills needed to understand the health

46 needs of companion and food animals on a population level. This situational learning environment  
47 allows students to refine their newly developed surgical and medical skills while building  
48 relationships with animal caretakers in their community, which in turn fosters the mindset of a  
49 community veterinary practitioner.

## 50 2. Shelter Surgery

51 The MSU-CVM Shelter Medicine program has two mobile veterinary units that provide  
52 HQHVSN services to 26 different shelters and rescue groups in central and north Mississippi. The  
53 mobile unit program has sterilized over 70,000 animals since its inception in 2007, and has saved the  
54 lives of numerous animals by increasing adoption rates. In 2013, the collective euthanasia rate of the  
55 shelters serviced by Mississippi State was 62%, but the adoption rate of the animals sterilized by the  
56 program was 82%. By 2016 the collective euthanasia rate was 28.5%, and the adoption rate of the  
57 animals sterilized was 88.5%. While providing community and statewide service is a great benefit of  
58 the program, the main goals are to increase veterinary student surgical skills and confidence, while  
59 providing them with an understanding of the problems of pet overpopulation. This program  
60 provides two opportunities for students to increase surgical skills and confidence.

61 As part of a 6-week Community Veterinary Services (CVS) rotation, third year students are  
62 required to spend 2 days on the mobile units learning HQHVSN techniques under the direct  
63 supervision of a shelter medicine faculty member or resident. The goals of the mobile unit experience  
64 for third year students are to provide opportunities to perform multiple sterilization surgeries with  
65 direct surgical guidance and verbal and written feedback, and for students to become familiarized  
66 with the issues that animal shelters face, to be exposed to the problems encountered in animals  
67 confined to animal shelters, and to develop an increased understanding of the issues surrounding  
68 overpopulation of unwanted pets.

69 Prior to their first surgery day, all CVS students are required to view instructional videos of  
70 HQHVSN techniques in both pediatric and adult dogs and cats. The surgical techniques used are  
71 consistent with the standards outlined by the Association of Shelter Veterinarians 2016.[3] Students  
72 then perform surgeries with a faculty surgeon scrubbed in as their assistant, guiding them through  
73 the procedures and intervening to prevent complications. Each third-year CVS student averages 15-  
74 20 sterilization surgeries in two trips, which helps to increase their surgical skills and confidence.  
75 Furthermore, they are exposed to current research projects evaluating surgical techniques in  
76 HQHVSN. Students are graded on multiple parameters and are provided with direct feedback both  
77 during surgery and after each trip. Preparation for surgery and surgical skills are evaluated using an  
78 objective structured assessment (Appendix A). Students are overwhelmingly positive about their  
79 experience on the mobile units, and most third year students then go on to enroll in a 2-week Shelter  
80 Medicine spay/neuter elective on the units during their fourth year.

81 Building upon the experience gained in the CVS rotation, the Shelter Medicine spay/neuter  
82 elective is a 2-week course in shelter surgery providing more in depth training. Fourth year students  
83 are given the time needed to become proficient and efficient in HQHVSN techniques under direct  
84 supervision and guidance of shelter medicine faculty. The course has two main goals: teaching and  
85 community service. Learning objectives include:

- 86 • Become proficient and efficient in spay/neuter techniques.
- 87 • Recognize the severity of pet overpopulation and how veterinarians can plan a role in solving  
88 the problem.
- 89 • Understand the standards of care in animal shelters.
- 90 • Understand the veterinary medical care guidelines for spay/neuter programs.

91 The elective is available nearly year-round and can enroll 115 students a year. A typical week  
92 consists of 4 trips on the mobile veterinary units to local shelters and 1 day of individual study.  
93 Working with faculty and house officers, students participate in the shelter spay neuter programs at  
94 various animal shelters, and in community spay day programs when available. Independent of the  
95 onsite shelter activities, the students:

- 96 • View spay/neuter instructional videos prior to the first trip.  
 97 • Familiarize themselves with the drug protocols used on the mobile units.  
 98 • Read the document *Guidelines for Standards of Care in Animal Shelters*.<sup>[4]</sup>  
 99 • Read the document *The Association of Shelter Veterinarians Veterinary Medical Care Guidelines for Spay-neuter Programs*.<sup>[3]</sup>  
 100  
 101 • At the midpoint of the course, submit a self-evaluation to the instructor.  
 102 • At the end of the course, submit an examination to the instructor.  
 103

104 On the first day of the rotation, students scrub in with a faculty member and are guided through  
 105 an adult dog neuter, adult dog spay, puppy spay, and cat spay. During this time, student preparation  
 106 is directly assessed by the faculty member through questioning of surgical anatomy procedural  
 107 details. Afterwards, most students perform surgeries unassisted, while still under direct supervision  
 108 of a faculty member. If complications arise, students are guided through appropriate measures to  
 109 safely resolve the issue. Faculty members will step in to complete the surgery if the patients' health  
 110 is at risk or if the surgery lasts longer than an hour. Allowing students to perform the surgeries and  
 111 procedures without direct faculty assistance instills confidence and allows them to take responsibility  
 112 for the surgical outcomes. Senior students are overwhelmingly positive about the surgical experience:  
 113

114 *"Wonderful rotation that allowed me to gain confidence and experience in spays and neuters. I do not*  
 115 *know what the first months out in practice would be like without having this valuable experience under*  
 116 *my belt. Very thankful to all the clinicians and technicians that make this rotation one of the most valuable*  
 117 *(in my opinion) rotation in vet school."*  
 118

119 Students perform the clear majority of the spay/neuter surgeries on the mobile units, which total  
 120 approximately 7,500 a year. On average, each fourth-year student performs 65 sterilizations during  
 121 their two-week rotation (Table 1). The quantity of procedures allows students to develop a great  
 122 increase in surgical confidence, efficiency, and proficiency. A retrospective study performed by the  
 123 authors and their team examined 1,132 dog spays completed by 86 students. The 86 students  
 124 performed a range of 1-46 surgeries (mean 9.8). Surgical times ranged from 8 to 153 minutes (mean  
 125 43.9). Linear regression demonstrated that the average surgical time for a student's first solo surgery  
 126 (intercept) was 50.6 minutes and that surgical times decreased 0.61 minutes (p value < .0001) for each  
 127 consecutive surgery performed by the individual student (Table 2).

128 Table 1. Average Case Log for Fourth Year Student on Shelter Surgery Elective

<b>Date</b>	<b>Shelter</b>	<b>Kitten neuter</b>	<b>Cat neuter</b>	<b>Kitten spay</b>	<b>Cat spay</b>	<b>Puppy neuter</b>	<b>Dog neuter</b>	<b>Puppy spay</b>	<b>Dog spay</b>	<b>Total</b>
8/22/16	WestPoint				6	3		2	1	<b>12</b>
8/23/16	Macon		2		1	1		2	2	<b>8</b>
8/25/16	HB		3		2		1	1		<b>7</b>
8/26/16	Aberdeen		1		5		2	1	2	<b>11</b>
8/30/16	Starkville		2		4	2	1	1	1	<b>11</b>
9/1/16	Indianola		3		5		2	1	1	<b>12</b>
9/2/16	Indianola				1	6		3		<b>10</b>
										<b>71</b>

130 Table 2. Linear Regression Analysis for Student Surgical Time

<i>Effect</i>	<i>Estimate</i>	<i>Standard Error</i>	<i>DF</i>	<i>t Value</i>	<i>PR &gt;  t </i>
<i>Intercept</i>	50.5838	1.2682	85	39.89	<.0001
<i>order</i>	-0.6070	0.08192	1044	-7.41	<.0001

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133 Student evaluations are accomplished through direct observation and a final examination. A  
 134 mid-point self-evaluation encourages students to reflect on their strengths and weaknesses during  
 135 surgery, and to identify areas where improvement is needed. A faculty member reviews each  
 136 evaluation and responds with feedback on ways to improve during the second week. Final grades  
 137 for the two-week rotation are determined by 80% instructor evaluation and 20% final examination.  
 138 All faculty members provide an evaluation based on an objective structured assessment (Appendix  
 139 B). The examination covers topics from the ASV guidelines for standards of care in animal shelters  
 140 and the standards of care for spay/neuter programs.  
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### 142 3. Shelter Medical Days

143 Shelter medical days were created to provide students with practical diagnostic, technical and  
 144 examination skills. Third year students attend 2-3 shelter medical days during their 6-week CVS  
 145 rotation. During a shelter medical day trip, 3-5 veterinary students receive hands-on training though  
 146 onsite shelter visits with a faculty member. Students interact directly with the supervising  
 147 veterinarian during the examination, diagnostic testing, and development of treatment protocols and  
 148 recommendations. In addition to direct patient care, students gain experience and skills in  
 149 biosecurity, infection control within a population of animals, and animal behavior. Learning  
 150 objectives include:  
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- 152 • Become proficient in canine and feline physical examinations techniques.
- 153 • Learn how to perform point of care diagnostic procedures.
- 154 • Develop treatment plans for individual shelter animals.
- 155 • Understand population medicine concepts as they relate to individual animal care.
- 156 • Recognize the severity of pet overpopulation and how veterinarians can play a role in solving  
 157 the problem.
- 158 • Understand the standards of care in animal shelters.  
 159


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160 Students visit numerous types of shelter models including privately and municipally funded  
 161 shelters and both limited admission and open admission facilities. Shelter medical days begin with a  
 162 brief introduction to the shelter system by the shelter veterinarian and shelter staff. Students  
 163 perform a brief walkthrough evaluation of animals housed in the facility. Animals are selected for  
 164 evaluation by students based on the needs of the shelter. Students perform intake examinations,  
 165 routine wellness examinations, and sick-animal examinations under the direct supervision of a  
 166 veterinarian. Students have access to the equipment needed for physical examinations and common  
 167 point-of-care diagnostics. Physical examination equipment includes personal protective equipment,  
 168 ophthalmoscopes, otoscopes, video otoscopes, thermometers, and stethoscopes. Point-of-care  
 169 diagnostic supplies include needles, syringes, slides, microscopes, fecal flotation solution, scalpel  
 170 blades, clear plastic tape, cytology staining liquids, blood collection tubes, and a Wood's lamp.  
 171 Additional point-of-care diagnostics including parvovirus ELISA tests, heartworm antigen ELISA  
 172 tests, and FIV/FELV ELISA tests are provided by the shelters. With these supplies, students perform  
 173 and become proficient in numerous point-of-care diagnostics including fine needle aspiration with

174 cytology, ear swab cytology, impression smear cytology, skin scrapings, tape-prep cytology,  
175 venipuncture, Wood's lamp evaluation, fecal oocyte identification, and wet-mount microfilaria  
176 evaluation. Students also perform routine procedures such as vaccine administration, anthelmintic  
177 administration, ear cleaning, and wound care. Under the supervision of a veterinarian, students use  
178 the information obtained from animal histories, physical examinations and diagnostic tests to make  
179 further diagnostic and treatment recommendations for the animals in the care of the shelter.  
180 Medical notes created by the students are recorded on a patient examination form (Figure 1) and  
181 inserted into the patient's file at the shelter for future use by the shelter, potential adopters and  
182 veterinarians. Physical examination findings, diagnostic procedure results, and treatment  
183 recommendations are also catalogued into a digital format for data collection and case number  
184 reporting.  
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Figure 1. Patient Examination Form used on CVS medial days.

<b>Shelter Name:</b> <b>Date:</b> <b>Intake Date:</b> <b>Species:</b> <b>Patient Name:</b>		<b>MISSISSIPPI STATE UNIVERSITY™</b> <b>COLLEGE OF VETERINARY MEDICINE</b>																
<b>Presenting Complaint:</b>																		
<b>Signalment/History:</b> <table style="width: 100%; border: none;"> <tr> <td style="width: 25%;">Breed: _____</td> <td style="width: 25%;">Appetite: N A _____</td> <td style="width: 25%;">Urination: N A _____</td> <td style="width: 25%;">Heartworm Status: _____</td> </tr> <tr> <td>Color: _____</td> <td>Water Intake: N A _____</td> <td>Vomiting: No Yes _____</td> <td>Unkn Neg Pos N/A</td> </tr> <tr> <td>Age: _____</td> <td>Attitude: N A _____</td> <td>Coughing: No Yes _____</td> <td>FIV/FELV Status: _____</td> </tr> <tr> <td>M <input type="checkbox"/> F <input type="checkbox"/> Altered <input type="checkbox"/></td> <td>Feces: N A _____</td> <td>Sneezing: No Yes _____</td> <td>Unkn Neg Pos N/A</td> </tr> </table> <b>Known Pre-Existing Diseases and Current Medications:</b> _____			Breed: _____	Appetite: N A _____	Urination: N A _____	Heartworm Status: _____	Color: _____	Water Intake: N A _____	Vomiting: No Yes _____	Unkn Neg Pos N/A	Age: _____	Attitude: N A _____	Coughing: No Yes _____	FIV/FELV Status: _____	M <input type="checkbox"/> F <input type="checkbox"/> Altered <input type="checkbox"/>	Feces: N A _____	Sneezing: No Yes _____	Unkn Neg Pos N/A
Breed: _____	Appetite: N A _____	Urination: N A _____	Heartworm Status: _____															
Color: _____	Water Intake: N A _____	Vomiting: No Yes _____	Unkn Neg Pos N/A															
Age: _____	Attitude: N A _____	Coughing: No Yes _____	FIV/FELV Status: _____															
M <input type="checkbox"/> F <input type="checkbox"/> Altered <input type="checkbox"/>	Feces: N A _____	Sneezing: No Yes _____	Unkn Neg Pos N/A															
<b>Physical Exam:</b> Temp (f): _____ Pulse Rate: _____ Respiratory Rate: _____ Weight (lb): _____ BCS (1-9): _____ Fecal Score (1-7): _____ <b>General Appearance:</b> N A _____ <b>Eyes:</b> N A Ocular Discharge <input type="checkbox"/> _____ <b>Ears:</b> N A Otic Inflammation <input type="checkbox"/> Ear Mites <input type="checkbox"/> _____ <b>Respiratory:</b> N A Nasal Discharge <input type="checkbox"/> Abnormal Lung Sounds <input type="checkbox"/> _____ <b>Oral Exam:</b> N A Periodontal Disease (Grade 1 2 3 4) <input type="checkbox"/> Oral Ulcers <input type="checkbox"/> Stomatitis <input type="checkbox"/> _____ <b>Lymph Nodes:</b> N A _____ <b>Cardiovascular:</b> N A Murmur (Grade 1 2 3 4 5 6) <input type="checkbox"/> _____ <b>Abdomen:</b> N A Distended <input type="checkbox"/> _____ <b>Genitourinary:</b> N A _____ <b>Skin:</b> N A Alopecia <input type="checkbox"/> Pruritus <input type="checkbox"/> Scales/Crusts/Collarettes <input type="checkbox"/> _____ <b>Musculoskeletal:</b> N A _____ <b>Neurological:</b> N A _____ <b>Other Exam Findings:</b> Fleas <input type="checkbox"/> Ticks <input type="checkbox"/> Tapeworms <input type="checkbox"/> _____																		
<b>Examination/Diagnostic Tests/Doctor's Notes:</b> Fecal Flotation: _____																		
<b>Treatment Plan:</b>	<div style="border: 1px solid black; padding: 5px;"> <b>Your Newly Adopted Pet Needs:</b>            _____            _____            _____            _____            _____            By: ____/____/____            With Your Regular Veterinarian         </div>																	
<b>Student:</b> _____ <b>Faculty:</b> _____																		

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In addition to direct patient care, students also gain experience and knowledge of biosecurity during shelter medical days. Faculty lead students through the shelter for a biosecurity walk-through evaluation. After discussing biosecurity as a group, students participate in a biosecurity photo-scavenger-hunt. Numerous examples of good and poor biosecurity are documented in photographic format and are later discussed in a round-table format. Students lead problem-based discussions to solve biosecurity issues that they encounter during the photo-scavenger-hunt.

At least 1 trip for each student is a shelter behavioral health day. Students are exposed to routine behavioral health, safe/low stress handling techniques and enrichment techniques. Shelter behavioral

197 health days operate similarly to shelter medical days, but >50% of the day is spent working through  
 198 behavioral concepts and cases. Students are accompanied to the shelter by a MSU clinical instructor  
 199 in behavioral medicine. Students are introduced to reading animal body language, non-stressful  
 200 handling techniques, enrichment strategies, behavior assessments, and basic training strategies.  
 201 Students also work through more complex behavior cases and develop treatment protocols involving  
 202 training, enrichment, and sometimes pharmacologic intervention.

203 Students that participate in the shelter medical days are very positive about the experience and  
 204 leave with greater confidence in performing physical exams, point-of-care diagnostics and treatment  
 205 plan development. The following is an excerpt from a student evaluation:  
 206

207 *“This has been my absolute favorite thing to do in vet school. We get hands on experience and I felt like I*  
 208 *was actually making an impact and using the skills I have learned... I felt that all the clinicians were*  
 209 *encouraging and helped answer any questions you had, while also trying to get you to think and problem*  
 210 *solve on your own. I wish I could do this every day!”*  
 211

212 Shelter medical days provide a large number of cases for veterinary students at MSU-CVM. Each  
 213 student in the MSU-CVM class of 2016 evaluated an average of 8 patients and performed an average  
 214 of 16 procedures/diagnostic tests during their CVS medical/behavioral days. As a whole, the class of  
 215 2016 evaluated 674 patients and performed 1359 procedures/diagnostic tests. Each student in the class  
 216 of 2017 evaluated an average of 9 patients and performed 20 procedures/diagnostic tests. The class of  
 217 2017 evaluated 785 patients and performed 1691 procedures/diagnostic tests. While many animals  
 218 are young and relatively free of serious disease processes, the chance to gain a solid knowledge base  
 219 of normal physical examination findings builds a foundation for future cases. Furthermore, the  
 220 repetition of multiple cases aids in improving diagnostic and technical skills.

221 Students are given direct feedback through hands-on instruction during shelter visits along with  
 222 formal evaluations using an objective structured assessment (Appendix C.) Students receive 40 total  
 223 possible points for shelter medical days that account for 10% of their overall CVS rotation grade.  
 224

#### 225 4. Population Medicine

226 Veterinarians, no matter what their area of interest or expertise, will find themselves addressing  
 227 animal health issues both at the individual and population level. Private practitioners whose main  
 228 responsibilities lie with treating and preventing disease in individual patients need a working  
 229 knowledge of biosecurity on a population level in order to minimize the risk of infectious diseases  
 230 spreading to healthy populations. Students receive this training in a required 3-week Population  
 231 Medicine rotation and learning is guided by five core principles (Table 3).  
 232

233 Table 3. Core Learning Principles in Population Medicine Rotation

Core Principles	Secondary objectives
Learning how the “system affects animal health outcomes	Rules, regulations, policy Human and natural resources, capital Personal decisions
Thinking critically about causation	Application to outbreak investigations Evaluation of scientific literature

**Utilizing diagnostic tests in population-based disease investigations**

Predictive value  
Herd/population-level testing

**Using data (evidence) to investigate/monitor population health**

Data collection  
Organizing data  
Graphing data  
Inferential statistics

**Implementing and communicating strategies for disease control and prevention**

Increase immunity  
Prevent effective contacts  
Remove the agent/keep the agent out

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This rotation teaches the concepts across a variety of species, including cattle, swine, catfish, chickens, dogs and cats. The shelter program plays a large role in this rotation, as the students are on-site in a shelter for at least 3-4 trips per rotation. The students' first shelter visit of the rotation is focused on providing care for dogs at intake through preventive care, screening for signs of disease, and establishing or following biosecurity protocols. The second visit to another shelter exposes them to a variety of shelter systems. The culmination of their time in shelters during the Population Medicine rotation occurs when the students take part in on-site targeted consults, comprehensive shelter consults, or outbreak investigations.

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Between June 2016 and August 2017, 15 onsite consultations were conducted with shelters or animal holding facilities. Shelters reach out to the faculty of the Population Medicine rotation seeking answers to questions regarding disease control, shelter management or animal health needs. Students play an important role in the consultation or outbreak investigation. Guided by faculty members, they collect data and gather specific information regarding the concerns of the shelter employees or the disease process of interest. Following participation in the consultation or outbreak investigation, the students analyze the data, gather credible scientific literature, and form recommendations regarding the issues. Working with faculty, the students learn another important principle: concise and constructive communication. It is the responsibility of the students to draft an initial recommendation letter that, after review and editing by faculty, will be submitted to the shelter.

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**5. Challenges**

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Challenges exist in the MSU-CVM Shelter Medicine program. Providing mobile veterinary care to area shelters across north Mississippi requires a flexible approach by teaching faculty and staff. Three full-time faculty along with available house officers are responsible for approximately 9,000 teaching cases per year. This requires creative scheduling to ensure quality teaching and contact time for the students involved. Under the umbrella of the Shelter Medicine Program, there are many activities — often each happening at the same time, but in different locations. Therefore, having the necessary veterinary and technical man-power is required to ensure program success. Beyond personnel, vehicle and trailer maintenance and mechanical failures can become difficulties, sometimes completely disrupting a day's activities. Routine preventive maintenance must be performed, therefore a 2-week hiatus from road trips in July and December provides the necessary time for servicing needs.

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Post-operative care for surgical patients must be accomplished by shelter personnel due to the mobile nature of the program. To ensure high quality medical care for all patients, each shelter is required to have a local veterinarian agree to manage post-operative medical needs. Follow-up from



269 MSU-CVM faculty is accomplished through routine email and phone communications to shelter  
270 personnel and local veterinarians when complications do occur.

271 Relying on shelters and humane organizations to provide animals and cases for student  
272 experience, like relying on a client-based caseload, can be a frustrating scenario. Objective structured  
273 assessments are a priority for the faculty, but every student cannot be guaranteed the same learning  
274 experiences due to the variable case load between animal shelters. For example, one student may  
275 perform three adult dog castrations during their two-week surgical elective while another student  
276 may perform 20 adult dog castrations. Similarly, students can become frustrated because they do not  
277 get to see the outcome of surgical and medical cases. Furthermore, one group of students may  
278 handle an initial population medicine consult by delivering the initial communication and  
279 recommendations, while a later group provides the follow up visit and benefits from seeing the end  
280 results.

281

282 **6. Conclusions**

283 Animal shelters and humane organizations offer opportunities that can be mutually beneficial  
 284 for both the animal organization and veterinary students. Students gain valuable experience and  
 285 confidence that prepares them for their career, and shelters are provided with animal health care and  
 286 consultative services that otherwise would not have been attainable. The overall caseload for the  
 287 teaching institution is positively impacted, and goodwill is fostered in the communities served.

288

289 **Author Contributions:** All four authors contributed substantially to the authorship of this paper.

290

291 **Conflicts of Interest:** The authors declare no conflict of interest.

292 **Appendix A**

293 Objective Structured Assessment of Third Year Students. Each skill is graded 1-5 with a total of 35  
 294 points possible.

Skill	1	2	3	4	5
Understanding anatomy	Not familiar with surgical anatomy	Struggles with understanding of surgical anatomy	Understands the anatomy of most structures encountered	Understands all major structures encountered	Full understanding of anatomy related to surgery
Understanding surgical procedure	Not familiar with the surgical procedure	Struggles with understanding of surgical procedure	Understands the basic surgical procedure	Understands the surgical procedure completely	Full understanding, including alternatives and potential complications
Attention to asepsis	Does not understand/follow aseptic technique	Problems with aseptic technique; required repeated instructor intervention	Pays attention to aseptic technique; minor breaks corrected by instructor	Attention to asepsis; breaks in asepsis noted and corrected	Absolute attention to asepsis; no breaks in sterile technique noted
Prevention/control of hemorrhage	Does not follow appropriate techniques for prevention/control of hemorrhage	Problems with management of hemorrhage; required repeated instructor intervention	Minor problems with hemorrhage that required intervention by instructor	Consistently manages hemorrhage with no risk to the patient	Consistently prevents hemorrhage before it occurs

Minimizing tissue trauma	Tissue severely damaged unnecessarily	Inadvertent trauma to structures not routinely involved in the surgical procedure	Frequent unnecessary tissue manipulation resulting in considerable tissue trauma	Occasional tissue manipulation; slight increase in tissue trauma	Minimal tissue trauma
Efficiency of surgical skills	Considerable wasted motion, indecisive; surgical time excessive	Frequent wasted motions/indecision	Occasional wasted motions/indecision	Surgery performed efficiently; minimal wasted motion	Surgery performed with utmost efficiency; no wasted motions
Surgical competence/confidence	Confidence in surgical skills is unwarranted; lacks basic surgical skills necessary for minor/routine procedures	Lacks confidence in surgical skills; lacks basic surgical skills necessary for minor/routine procedures	Competent in many aspects of surgical procedure	Competent in most aspect of surgical procedure; minor problems as described below	Confident in surgical skills; very competent skills
	Pass		Fail		
Patient care	<b>All students are expected to provide thorough and competent care for their patients. This is a threshold skill.</b>				
Professional attributes	<b>All students are expected to communicate effectively with clients, technicians, and faculty, to complete medical records and surgery reports accurately and expeditiously and to act professionally at all times.</b>				

295 **Appendix B**296 **Objective Structured Assessment of Fourth Year Students**

<b>Student</b>				
<b>Date</b>				
<b>Grade</b>				
<b>Surgical Skills</b>	<b>Description</b>	Value	Score	Comment

Understands each procedure	Understands the basics of each procedure at the start of the rotation (i.e. has thoroughly reviewed the PowerPoints and videos)	10		
Applies what is learned	Applies what is learned each day to subsequent surgeries, i.e. doesn't repeat mistakes.	10		
Detail	Thinks about what he/she is doing. Pays attention to detail. Performs tasks appropriately.	10		
Efficient surgical skills	Adopts efficient techniques. Shows improvement in efficiency over the course.	10		
Maintains hemostasis	Effectively prevents hemorrhage.	10		
Minimizes tissue trauma	Treats tissues gently.	10		
Maintains asepsis	Pays attention to maintaining asepsis.	10		
Closures	Secure body wall closures. Consistently closes dead space. Good skin to skin apposition with subcuticular patterns.	10		
<b>Total Points from Rotation</b>		80		
<b>Exam</b>		20		
<b>Total points</b>		100		
<b>Professional Values/ Behavior*</b>		<b>pass</b>	<b>fail</b>	
Animal care	Treats all animals with respect. Handles animals appropriately.	√		
Attendance punctuality	Arrives on time.	√		
Overall initiative	Pitches in to get all the work done.	√		

Remember, every skill you need for virtually any soft-tissue surgery commonly done in private practice, you use in a spay. So if you are comfortable doing spays, you have the skills to perform any routine soft-tissue surgery!

Attitude	Positive friendly attitude.	v		
Professionalism	Acts professional. Positive representative of Mississippi State and the Veterinary Profession.	v		

297 **Appendix C**

298 Objective Structured Assessment for CVS Medical Days. Each skill is graded 1-5 with a total of 40  
 299 points possible.

Skill	1	2	3	4	5
Understanding ASV Shelter Guidelines	Not familiar at all with ASV Shelter guidelines.	Struggles with understanding of guidelines.	Understands most of the basic shelter principles in the guidelines.	Understands all major principles encountered in the ASV guidelines.	Full understanding of guidelines; able to apply principles to current shelter.
Understanding biosecurity principles/photo scavenger hunt	Not familiar with biosecurity principles.	Struggles with understanding of biosecurity principles.	Understands basic biosecurity principles. Limited understanding of fine details biosecurity principles.	Understands biosecurity principles completely, familiar with fine details.	Full understanding of all aspects of shelter biosecurity principles and application to current shelter.
Physical examination	Does not know how to perform a physical examination.	Attempts a PE, but struggles, requiring repeated instructor intervention for basic principles.	Performs PE well, but occasionally misses body systems or abnormal findings.	Performs PE well.	Performs PE extremely well, covering all body systems and abnormal findings.
Fecal float technique and analysis	Does not understand how to perform fecal float or analysis.	Problems with fecal float technique and analysis. Required repeated instructor intervention.	Minor problems with fecal float technique and analysis. Misses most organisms with analysis.	Fecal float and analysis performed well. Most organisms ID'd correctly.	Performs fecal float and analysis extremely well. All organisms ID'd correctly.

Differential diagnosis	No effort to create differential diagnosis when warranted.	Differential diagnosis attempted.	Differential diagnosis created, but incomplete. Major diseases not included.	Differential diagnosis list created, only minor diseases not included.	Excellent differential diagnosis list; complete and thorough.
Diagnostic plan/abilities	Does not understand how to formulate diagnostic plan.	Problems with forming plan and unable to perform recommended tests. Required repeated instructor intervention.	Minor problems with forming plan and completing diagnostics tests. Only some organisms identified correctly.	Consistently forms excellent plan, but occasionally has problems with performing diagnostic tests. Most organisms ID'd correctly.	Creates diagnostic plan and performs diagnostics very well. All organisms ID'd correctly.
Treatment plan	No effort to create treatment plan when warranted.	Treatment plan attempted, but instructor intervention necessary.	Treatment plan created, but incomplete and major diseases not addressed; instructor intervention necessary.	Treatment plan created, minor details addressed and corrected.	Excellent treatment plan; complete and thorough. Able to present plan to shelter personnel.
Preventative medicine / general wellness	No effort to create general wellness plan.	Lacks understanding of general wellness (vacc. protocols, etc.)	Competent in many aspects of preventive medicine and wellness care.	Competent in most aspects of preventive medicine and wellness.	Confident and competent in creating and recommending general wellness plans to shelter personnel.
Comments					

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