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Budget for the Birds

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A Major Qualifying Project
Submitted to the Faculty
Of
WORCESTER POLYTECHNIC INSTITUTE
In partial fulfillment of the requirements for the
Degree of Bachelor of Science

By

Ryan Brown

Jaime Shannon

Advisor:

Prof. Fabienne Miller

Sponsored By:
Robert Krusas
University of Massachusetts Medical School

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Date:
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Report Submitted to:

Professor Fabienne Miller
School of Business

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Authorship

Ryan Brown served as the primary communicator between the project sponsor and advisor of this project. Ryan was the primary writer and editor for this report. He was responsible for gathering the information and communicating with other universities via networking of exchanging emails needed for this project. He conducted and was responsible for the authorship, abstract, executive summary, introduction, background, methodology; excel spreadsheet and conclusion as well as contributing to acknowledgement, literature review, analysis and powerpoint presentation. He was a leader in organizing schedules and meetings with advisor, project sponsor and Jaime Shannon. He managed all of the documentation and files that needed to be uploaded to the student sharepoint website and was responsible for providing edit and formatting of all writings.

Jaime Shannon was the primary researcher, leader in making verbal interaction and interviews, made the primary powerpoint presentation, contributed to writing and editing for this report. He was the leading reporter who tracked down all specific information needed that was provided during interviews. Jaime served as a notetaker to assist Ryan who is hard of hearing therefore could not take notes well due to lip reading. He did an excellent job making sure Ryan understood and got the information that he needed to know and helped him throughout with the writing and editing of the report. He conducted and was responsible for acknowledgement, literature review, and analysis as well as contributing to authorship, abstract, executive summary, introduction, background, methodology, excels spreadsheet and conclusion.

Abstract

The Department of Animal Medicine at the University of Massachusetts Medical School (UMass) in Worcester MA conducts biomedical research. They recently added a specific animal to their animal research facility. This new addition is the zebra finch from the songbird species. The budget for research includes per diem rates for each animal. The project team was requested to calculate a per diem rate specifically for the zebra finch. Along with determining the zebra finch per diem rate, the project team was asked to come up with a configuration to calculate the rate for UMass instead of their current way which is to use the calculating method established by the Massachusetts Institute of Technology (MIT).

Acknowledgments

This project would not have been conducted without the help and support of several key individuals whom we are extremely thankful for their assistance over these last three months. First, we would like to thank the faculty of the Department of Animal Medicine at the University of Massachusetts Medical School who were generous and helpful enough to take the time to answer our questions and provide us information we needed to obtain:

- Robert Krusas who is the assistant director and manager, our primary liaison and main contact for the Department of Animal Medicine. Robert provided us with many great comments, and was a valuable source of information for many things such as background information, numbers, etc.
- Holly Such who is the manager of the Department of Animal Medicine. She guided us around the facility, and showed us the processes necessary to enter into the animal medicine facility. We needed to understand how much equipment and time is necessary for the average day per person. Personally experiencing the walkthrough was extremely beneficial.
- Ellen Bridge and Cynthia Savard, are both supervisors who work with the birds directly. They varied their hours according to how much the other technicians worked. They were very knowledgeable about the processes needed and time spent working specifically with the birds. They also handle inventory and miscellaneous products that are required for the birds.

The most important person of all who have helped our team is Professor Fabienne Miller. Special thanks to Professor Miller who took two students with no technical knowledge of writing under

her wing. She was an excellent adviser from the beginning to the final steps in conducting the work leading to writing. She is a superb excellent project advisor in many aspects most importantly with constant guidance and support throughout the project. She led us with a great source of ideas of how to improve in researching information and as well as writing that helped us focus on the key issues and sharpen our perspectives and quality of the writing. She provided great feedback to us throughout the project.

We would also like to acknowledge Harvard University, Tufts University, Massachusetts Institute of Technology (MIT) and Wesleyan University. There assistance with topic related information as well as additional contacts was very beneficial to our gathering of research and data. We also appreciate their taking time out of their schedule to communicate with us.

Executive Summary

Funding for biomedical research in universities is often times a difficult process. First and foremost money must be available. Obtaining the money is just one obstacle that the establishment must face. Institutions must also oversee funds raised and donated as well as the grants received from both private parties and the federal government. The universities are obligated to follow federal and state laws for handling grants they receive. They also must adhere to and enforce laws related to animal care and public health. Most establishments implement additional laws for their departments as well as require training. An overall budget is created and then decisions need to be made as to which department receives monies as well as how much they are allotted. The amounts allocated are determined not only based on department need but the requested amounts must be valid.

Each department must have an accounting process to keep books and records to administer transactions of the facility including costs, staffing, and services. Research for each disease is handled separate from one another for costs. Animals are also assigned to a specific research project. Costs to care for each animal needs to be determined in order to properly ascertain how much money is required for the animal and that total must be included with the research project budget.

The goal of our project was to first determine the proper method of calculating per diem costs that best suits the Department of Animal Medicine at the University of Massachusetts Medical School (UMass). The method had to be constructed according to the process used by UMass for labeling all costs specific to the animal as well as those linked to the facility. The configuration

for calculating the rate needed to be accurate, efficient and effective. We then could move on to the ultimate goal of the per diem rate for one specific animal, the zebra finch.

Introduction

Our world is constantly battling diseases and searching for medical cures. Biomedical research plays an important role in fighting this battle. Various universities, medical establishments, and non-profit organizations are just a few in our society who participate in research. The research is conducted to find the root of various diseases and use those findings to create treatments as well as ways to prevent diseases. Research involves more than just people to carry out the task. It requires time, space, test subjects, as well as equipment and technology. All of these items cost money. An adequate facility must have the items needed for conducting the research as well as the means to care for test subjects.

The University of Massachusetts Medical School (UMass) in Worcester Massachusetts is an active supporter and participant of the research community. As many researchers often do, UMass uses animals in their process of biomedical research. Their Department of Animal Medicine is committed to the well being of the animals. Housing, husbandry services, education, technology, and training are all provided in their facility for each type of animal. Running a facility costs money. UMass relies on per diem costs for each animal in order to meet their budget and allocate funds properly. One new animal, zebra finch, was recently added to their facility. Having had a short time frame of working with the zebra finch gave the department a disadvantage for calculating an accurate per diem rate for this animal to be applied toward the budget.

Our goal was to calculate a per diem rate that would properly reflect the cost of maintaining the zebra finch. In order to accomplish this goal, we addressed each of the following objectives:

1. Research the needs of the zebra finch.

2. Identify various options for calculating per diem rates.

3. Request and compare per diem rate information from UMass and other universities that maintain the zebra finch in their research facilities.

4. Design and implement a per diem rate for UMass.

This paper will guide the reader through the process of setting a per diem rate for an animal research facility. We begin with the background followed by the literature review, methodology, analysis and conclusion.

Background

Biomedical research is an important part of our society. The research is conducted to determine the cause of various diseases and use those findings to develop resolutions to treat them, as well as prevent them and often times, animals are used in the process. Each facility practicing biomedical research is held to specific federal guidelines and must implement proper care (Silverman, 2010). Each institution must develop their own budget and oversee the use of grants and money raised for each biomedical department.

There are numerous universities throughout the Massachusetts area that use biomedical research including MIT, Tufts, WPI, Wesleyan and UMass. The same studies might not be taking place but the overall goal they are trying to reach is the same. Their goal is to use the animals to benefit human well-being. There are slight differences in the way they handle the animals, and there is also a large variance in what type of animals they use (Krusas, 2011). Taking care of animals could get very expensive. In order for the schools to be able to house animals, they must take all costs of taking care of the animals and come up with a per diem rate. A per diem rate is the average price of taking care of a unit per day. Different schools also charge the researchers different prices for taking care of animals differently depending on the way they feel is most effective.

The school we will be focusing on is the University of Massachusetts School of Animal Medicine. UMass does not buy their animals for their researchers (Krusas, 2011). However, researchers are hired by the Department of Neurobiology and they give UMass the animals they want to do research on (Silverman, 2010). When a researcher is hired he goes through a process of reviewing previous studies and looks at different ways of improving them. The Department of

Animal Medicine within the University of Massachusetts Medical School (UMass) is responsible for the care and welfare of animals used in biomedical research. The department has approximately seven million dollars revenue and cares for the currently around 27,000 cages of animals. It employs seventy four employees where forty five are Animal Care Technicians, five Veterinarians, seven Veterinary Technicians, twelve Managers/Supervisors and five Office Staff including the Administrator (Krusas, 2011).

The UMass animal care department provides environmentally controlled housing rooms for animals in different facilities that are monitored (Silverman, 2010). The housing rooms are built and supplied with the proper needs of the animals in mind according to their species. The Department of Animal Medicine has janitorial services where the animal care staff maintains the animals and provides the daily food and water (Silverman, 2010). They also conduct animal health monitoring and have special services offered for the animals such as accommodation for unique housing requirements, providing medicated food and water, euthanasia services, animal shuttle services and other services may be provided upon request (Silverman, 2010).

There are four buildings at UMass totally dedicated to animal research. Specific animals are designated to certain buildings. Various animals are used including zebra finches, cats, chickens, dogs, ferrets, fish, frogs, guinea pigs, hamsters, invertebrates, marmosets, monkeys, rabbits, rats, sheep, swine, and mice. The animal we are focusing on is the zebra finch. They are housed at the Lazarre Research Building (LRB) at UMass which was originally built for studies with only mice. However, the university expanded its research facilities by adding different types of animals such as the zebra finches. The research conducted at UMass focuses on a number of different diseases including diabetes, cancer, and Alzheimer's (Silverman, 2010). The researchers are trying to discover the root cause of different diseases as well as how to cure them.

Other scientific studies include those with obesity. The researchers are determining what the biggest effect on obesity is. They are figuring out if the cause is more from food, lack of exercise, or genetic. Melanoma is another study being researched by monitoring the skin cells of fish. Different factors like the water and algae are included in the monitoring process. Another type of study is related to behavior to determine the effects on the brain for various diseases and basic human development (Silverman, 2010). Different procedures are implemented to monitor a disease. One example is a transgenic core which is a procedure where genes in mice are knocked out and the mice are given affliction which is the process where the tested animal is given a medical problem like a tumor, skin disease, or even stunting their development (Silverman, 2010). The researchers then monitor the mice to track the effects of the medical problem. They apply different medications to determine side effects and the results to cure them. The researchers examine the genes to see what is missing or not working. According to those results, they then proceed with determining how they can correct the gene.

Zebra finch is a new animal to the research so the researchers do not have a lot of transactions or financial history of the birds. The use of songbirds for research has recently grown and is doing so rapidly. Not many schools have done research with the birds, and as of recently UMass is only one of a small number of schools world wide using zebra finches. Managing the birds requires specific housing which many animal facilities are not properly equipped to do so. The social setting is just as important as the type of food, lighting, and housing. Meeting the needs of the birds will affect the outcome of the bird's health and behavior (Schmidt, 2011). We may have to use only six months of the latest data from UMass in order to get a better picture of the per diem costs. The first three months were provided to us when we started this project. The additional three months is the ongoing data that transacted during our work on the project. They just started

housing the birds in October and will continue to do so till July of 2012 when they will move the birds into the new building UMass is building to better accommodate the birds (Krusas, 2011). UMass is running out of storage space and rooms for the birds and the veterinarians have to learn a new species since UMass has not dealt with these types of birds before. The department administrators who help researchers run the studies need to provide their portion of cost data to administrations they can calculate the per diem rate because the current rate they use was established at MIT. Since per diem rates are different between universities, UMass has to calculate a rate specific to UMass so that it will be able to manage its funds properly. Decisions are made as to whether the university will subsidize the department or whether the department will have to rely on its own per diem rates. Each university decides differently on what costs to include a per diem calculation, and must accommodate for any future changes.

In order to assist UMass with calculating a per diem rate for their recent new species addition to animal research, we needed to research the animal. In addition, we had to collect data from other university research facilities to compare their process. We also needed to obtain some knowledge of suggested ways to calculate a per diem rate from reliable sources.

Literature Review

The zebra finch is a bird species that is new to researchers and is being used for studies that have recently been added to medical schools across the United States. Zebra finches are the most common songbird, which are birds that make sounds resembling a melody. Researchers chose to work with these birds because they are the easiest bird species to investigate. Zebra finches are biomedically researched for two main reasons; the first reason is for their song learning. When the birds are in their early years and are learning songs, their social influences give insight to human speech and communication disorders. The other reason is for their physiology, which allows researchers to learn more about them and disorders such as stuttering and autism (Schmidt, 2011).

The UMass Medical School works with various animals but just began housing specifically zebra finches in October of 2010 for researchers. The animal research department began housing the birds in October which is also when they were moved into the Lazarre Research Building. The UMass Medical School is constructing a new building that will better accommodate the birds. The Department of Animal Medicine is currently using the MIT per diem rate, but has not come up with their own because the birds have not been housed long enough. We need to calculate per diem rates and to do this we need to find all variable costs that correlate with the zebra finches as well as the fixed costs translated on a per unit basis. An overall explanation of such costs were given to us by the primary liaison. Robert Krusas, in the Department of Animal Medicine at UMass. Some of his examples of costs that are included in the per diem rates are food, bedding, and things of that nature that make up direct costs.

In business, direct cost is a cost directly linked to a specific item. For example, cost of items needed to make pastry such as ingredients and baking supplies are direct costs for a bakery as is food and cages are things needed and used to calculate direct costs for animals in the facility. Indirect cost in relation to business is a cost that is not linked to only one specific item and instead could be traced to various items. Items such as depreciation of an oven compared to heat and electricity for the animal facility are both types of indirect costs. At times, a change in the activity of a business can also cause certain costs to change in proportion to those changes. This type of cost is variable. An example would be bird food since having more animals would imply that more food will be consumed. Some costs stay the same despite activity changes in a company. This constant cost is fixed. If the university has a contract with a vendor to wash floors in the facility on a monthly basis, that cost is the same regardless of any activity changes. Since the cost does not vary with fluctuations in the number of animals, it is considered fixed.

Setting per diem rates is a time consuming task and includes a great amount of detail and assumptions. We used two cost setting guides for guidance; neither of the guides was specifically made for birds but covered any species that is being researched. The first guide was the Cost Analysis and Rate Setting Manual put out by the National Center for Research Services (NCRR). The NCRR is one of 27 institutes that comprise the National Institute of Health (Grieder, 2000). It provides funding to scientists and researchers in an effort to find cures for diseases. Their manual was first put out in 1979, and revised in 2000. It had to be revised because animal care within schools has become much more sophisticated in terms of technology, as well as new species being used, and the enhancement of animal care methods (Grieder, 2000).

C.A.R.S. (Cost Analysis Rate Setting Manual) was first brought to our attention when we were reading a cost guide put out by one of the employees at UMass. We read both manuals and

noticed that the National Center for Research Service's manual was more concerned with identifying and allocating cost and not specifically per diem rates, so we wanted to first investigate this manual and second compare the two.

The second guide we used was a chapter titled 'Setting Per Diem Rates' in a book written by an UMass employee (Silverman, 2009). The author Jerald Silverman is a professor at UMass and the director of animal medicine. He based the chapter on the C.A.R.S. cost setting guide and when he did this he changed the format to what he believed was the best way to calculate the rates.

The goal of the National Institute of Health's cost setting manual is to give a consistent way for animal research facilities to accurately measure costing of animal research (Grieder, 2000). The National Institute of Health was beginning to notice some inconsistencies in costing as well as not properly allocating costs and confusion amongst who in the facility needs to be paid and why they are charging a fee to researchers. Being able to have a reliable source to look back on will not only help institutions make better predictions for the future costs, but they will also save money by not subsidizing an amount that may be too much due to high per diem rates.

When cost setting, C.A.R.S. lays out the basic principles that anyone setting prices for animal research facilities should know. These principles are making rates based on all costs associated with a specific animal or species, then finding a way to come as close to break even as possible. This includes identifying all costs as direct or indirect, comparing costs annually to make better future predictions and making adjustments on these to prepare for surpluses or variances. As we read further into the manual, we identified 6 basic steps for cost analysis. These steps will lead us to our ultimate goal of setting a per diem rate.

The first step is identifying all internal costs. With our information, we have identified these as direct and indirect costs. Direct costs are anything used specifically for the birds and this includes husbandry, food, bedding, supplies and wages (Silverman, 2010). These are the easiest to identify because one can add the whole cost of the specific animal without having to do any calculations in the process. Identifying indirect costs is where it can get a little tricky because services that are not being used consistently need to be tracked as to when they are used and listed per use. Indirect costs are costs that are not directly accountable and these can include administrative wages, medicine for animals, cage washing, cage repairs, security, depreciation and utilities (Silverman, 2010). This is the most important part because improper listing of the services affects the costs of taking care of the animals and could cost the school more money if they will have to subsidize more than previously planned (Grieder, 2000).

The second step is identifying which costs should belong to direct or indirect cost centers followed by the third step of organizing them into the appropriate cost center. Steps two and three are both concerned with organizing of the information collected by adding all costs into related groups. This is important because of the fact that we are making an extremely detailed list of costs included in our per diem rate so we can exclude anything we find unnecessary. The direct cost centers consist of items related to the daily care or any maintenance of the animals. The other items are technical activities including anything that is necessary for researchers to complete their tasks. The direct cost centers are administrative (payroll, etc.) disposal, cleaning housing enclosure, laboratory services and animal health care. While these cost centers can vary, C.A.R.S. identifies these as the most common and used these to organize the basic costs an animal research a facility will face.

Steps 4, 5, and 6 are all concerned with computing the information once it is established and organized. Step 4 is finding the data needed for a cost analysis. This data is crucial because it makes it easy for one to calculate the cost of each animal. The information needed is amount of time spent with the animal daily, a space survey (used to determine square footage), amount of food consumed by an animal species, amount of bedding used, and the number of variable technical activities performed in a given week; this will help us allocate indirect costs to a species. Step 5 gives different options of how to organize this data and get it ready for computation. The three basic computer programs are spreadsheets, cost analysis modules, and making a custom computer program. Step 6, accounting all animal days, is the final step and it could be done before or after the calculation of costs. Once you determine the animal days the process of calculating the amount of resources each animal uses can begin, and that is what is necessary to determine a per diem rate.

The second guide by UMass employee Jerald Silverman is Managing the Laboratory Animal Facility. This is specifically aimed towards setting a per diem rate and includes the total expenses minus the total revenue for a year per average number of animals housed per day. The way he starts the formula is by calculating the number of animal species housed per day. Once this is done, we can start calculating the cost per bird based on all the costs acquired by the department. As previously mentioned Silverman was more focused on the process of setting per diem rates after all the data was collected. In doing so he did not include certain cost that C.A.R.S. had mentioned. The direct and indirect cost Silverman includes consist of salaries, travel, business expenses, supplies, administrative expenses, purchased services facility costs, equipment and technological expenses. All of these costs have to be listed and then classified.

The most difficult part, suggested by Silverman, is going to be determining how much of each salary is dedicated to the birds.

Contrary to the fact that the guides differ on a lot of sections, their main structure is the same. They both stress the fact that you cannot begin to calculate a per diem rate until you have the amount of animals in each species housed and taken care of per day. The calculations are a little different but they both end with the same result. Calculating the different costs works the same way, one has to figure out all cost and allocate them to a specific cost center, whether it is internal, direct, or indirect. The final part is making sure the costs are equal to the percentage used per species. Since a lot of products for different species are ordered together from the same company, if one does not distribute them based on the resources used by each species, the per diem rates could become erroneous resulting in charging costs to the wrong species. Instead these costs should be broken down proportionately to each species.

The guides were both extremely helpful and while they were both leading us to the same goal, they differed on a lot of issues. Silverman includes the salaries of animal care technicians and most supervisors, food, bedding , mops, brooms, cleaning chemicals, new cages (in fact, just about all husbandry and medical supplies), direct costs of the technicians and supervisors from travel and housing at professional meetings. The direct costs are similar between the guides but it is the indirect costs where we see a difference. For the indirect costs Silverman does not include administrative costs, which would include employee health care. Heat, electricity, building depreciation, security, pest control, and library use are all costs excluded from Silverman's calculations even though C.A.R.S. emphasizes including these. Since UMass does not use these costs in the calculations, we will give suggestions of ways that would help them come closer to breaking even. Another difference is their wording of some of the allocated costs.

These guides gave us two ways two different ways to reach the same result. There is going to be a number of factors that will make setting the per diem a difficult and lengthy process. The first big problem we will run into is finding out how much of the department's spending is correlated with the birds. Calculating the amount of time spent with the birds by each employee is the best way to do this. That is the lengthy part. The difficult part will be calculating a per diem rate that will account for an increase in the bird population for the future as well as changes in the variable costs to accommodate for the increase. To do this we need to not only distinguish direct from indirect costs but fixed from variable costs also. Fixed costs will always be the same whether the bird population increases or decreases; variable costs will guide us when we make predictions for the near future because they will fluctuate with the size of the bird population.

Since all of the cost assessment and rate setting was relatively new to us, we wanted to make sure per diem rates we developed were not much higher or lower than what other universities charge or that they begin to look unrealistic. By seeing the per diem rates of other schools, we could validate our calculations. We began researching and found several universities throughout the Massachusetts area that do biomedical research on animals. They include Tufts University, Massachusetts Institute of Technology (MIT), Harvard University, and Wesleyan University. The first three schools were very helpful in giving us information on their set per diem rates. The table below compares all three schools. They did not include how much each cost contributed, but all we needed were the costs included and the final per diem rate.

Regarding the fourth school, Wesleyan University in Connecticut, they also have an animal facility used for research. We contacted the department requesting information related to per diem costs, animals and research. Unfortunately due to privacy guidelines that they have to follow, they were unable to email us any detailed information related to specifically per diem

costs and the animal lab. They suggested we review the university's website for general research information. We were able to find brief posting from the biology department that discussed "Developmental neurobiology of vocal learning in song birds". They do work with songbirds for research but no information posted regarding costs related to birds such as songbirds and zebra finches or facility.

Harvard University does biomedical research complying with federal, state and local laws on various different disease vectors such as Amyotrophic lateral sclerosis (ALS), Diabetes, and cancer. The staff of the office of Animal Resources is responsible for the provision of animal husbandry and veterinary care programs. The per diem rates for all of the small zebra finches are $1.94/small cage/day and for 30 days total up to $58.20 per month for all the small cages. The per diem rates for all of the large zebra finches are $4.98/large cage/day and for 30 days total up to $149.40 per month for the large cages (Bennett, Jorgenson, Brown, 2011). The items used for calculation of current per diem rates are related to direct operational costs such as diets, bedding, enrichment, animal husbandry, veterinary care, small repairs, program administration and non-capital equipment. Harvard does not include indirect costs in calculating their per diem rate because they are allocated to another department. Some of those items are utilities (water, electricity, steam and chilled water), capital equipment (over $5,000) and building and facilities costs (Bennett, Jorgenson, Brown, 2011).

Tufts University has biomedical research in nine programs which are 1) biochemistry 2) clinical and translational science 3) pharmacology and experimental therapeutics 4) cell, molecular and developmental biology 5) genetics 6) molecular microbiology 7) cellular and molecular physiology 8) immunology and 9) neuroscience. The birds are used for behavioral studies and due to university privacy rules, Tufts could not elaborate on the nature of these studies. The per

diem rate at Tufts is calculated with items such as food, water, veterinary time, veterinary technician time, husbandry staff time, equipment use (caging) as well as any other indirect costs such as various items like electricity, water, heating, ventilating, and air conditioning (HVAC). Their per diem rates for all of the birds such as pigeons and starlings are $1.01 per day/per bird. The per diem rate of a small cage at Tufts would be $1.01, over the span of 30 days it would come out to $30.30. They keep one or more of the same birds together but put different birds in different rooms. They never have the pigeons and starlings in the same room (Kun, 2011). The housing that they provide is within the guidelines set forth for housing of birds. They use a standard diet, grit, and vitamins for all of the birds and they check their health and body condition every day (Kun, 2011).

MIT does biomedical research in various areas but they were not able to give us a set per diem rate because they were in the middle of calculating new ones since that is a procedure carried out each year. Their rates include food, housing, labor care and enrichment, cage repair and cleaning and utilities. They said their expectation was to come as close to break even as possible.

Overall, the three schools gave us great information and showed us a way to get started. The schools did not vary on a lot of their costs so it was easy to see a consistent pattern between the schools. One school that was not included in the comparison was Arizona University. They use a one time $1,500 fee to use their one facility. We couldn't figure out the reason for this but it might be used to cover an overhead. This is something we will be suggesting to UMass. Considering the fact that the other three schools are around the area, other schools may have no problem following suit. These reports were great aids and once we received this information we were ready to get started.

All Costs

	Tufts	Harvard	MIT	Jerald Silverman's Guide	C.A.R.S.
Food	x	x	x	x	x
Supplies	x	x	x	x	x
Wages	x	x	x	x	x
Utilities	x	x	x		x
Security					x
Cage repairs		x			x
Depreciation	x			x	x
Man. O	x		x	x	x

Graph 1

The graph above shows the comparison of all the costs each school we emailed included in their per diem rate calculations, along with the two cost setting guides we read. In order for us to begin, we needed information on the cost, salaries, information on the birds and just a general understanding of what UMass needed from us. We conducted a number of interviews at UMass to achieve this. The first person we interviewed was Robert Krusas, the primary liaison for the Department of Animal Medicine. He provided us with invoices for all the products used for the birds, which included food, bedding, supplements and toys. He showed us which costs are direct and indirect as well how to calculate the indirect costs, and to put them in order. He gave us all the tools we needed to begin, as well as setting us up with the veterinary technicians so we could interview them and determine how much of their 8 hour shift is dedicated just to the birds.

The next interview we did was with the animal medicine manager Holly Such. She showed us the facility in which the majority of the animals are housed, as well as the supplies needed to enter the facility. These supplies were mandatory and needed to be used for the protection of the animals. Holly explained that we had to put on cotton foot protectors, a cotton body suit, a hair net, and face mask and rubber gloves. All of these items were non-reusable and were discarded when exiting the room. This process had to be done every time someone entered the room no matter the reason. This gave us an idea of the cost of multiple employees entering the facility. The next step was finding out how frequently employees entered the facility.

Our interviews with the veterinary technicians were to find out the amount of hours spent, the consumptions of food, use of bedding and the amount of supplies used by the zebra finches, so we could calculate average monthly cost per cage. They also helped us calculate the amount of time spent on a weekly basis in the bird room. We met with four technicians who specialized in taking care of the zebra finches; they informed us on how many bags of food, how much supplement, and how much bedding is being used every week. The time designated to the bird room was a substantially daily amount, so we had to add all the daily hours up and put them into a weekly amount since there were four technicians in rotation.

There are three different categories of costs. We organized the costs in that manner so we know exactly how costs will be affected if there was a sudden change to the department. There are direct fixed costs, direct variable costs and indirect fixed costs. Direct fixed costs include different types of respirators that are used every time an employee enters the bird room, and shoe covers that are mandatory to enter the room. Even though direct costs are usually variable, the shoe covers are fixed costs because employees enter the bird room once a day no matter how many birds there are. Food, bedding, water dishes, ballpoints, spring clips and coverall cases

make up direct variable costs. These correlate directly with the birds and will change as the amount of birds or cages increase.

In the case of UMass, all of their indirect costs are fixed. The supplies that are needed to enter the sterile area will not increase or decrease if bird population was to fluctuate. The administrative, manager or supervisor's wages will not change because no matter how many birds there are, they will still be doing the same job as prior. The last costs; travel, administrative expenses, materials and supplies, and equipment that is leased repaired, or purchased do not depend on population because they are being used to benefit the facility. These items are managed by their accounting department and listed in the department's financial statements.

Conducting research for background information was the most important part of this project because it is tough to start something when you have no previous examples. An extremely crucial part of our project was getting sources on the correct way to calculate per diem rates based on costs. Having a guide to refer back will be a great way to make sure we are heading in the right direction. Getting the per diem rates and what is included in them by other schools was tremendously helpful because it helped us get a realistic idea of the rate researchers are willing to pay. They will also play an important part in what we will suggest to UMass because they are reliable sources to compare to.

Once we had resources we could refer back to, it was time to actually begin the process of collecting all the data and organizing in a way that would make it easy for us to calculate. The methodology shows how we went about the process of collecting information. From invoices to interviews, it was all a process and ultimately was the biggest part in coming up with the per diem calculations.

Methodology

When we first learned about the project, it seemed as if we were going to come up with one total cost of moving the zebra finches from one building to another but we were assigned the task of coming up with a per diem rate. A per diem rate would help the animal department to know the cost of caring for the birds and how much is needed to budget once the bird facility moves from the old building (LRB) to the new building that will better accommodate the birds.

Since we were trying to complete our MQP in two terms we immediately had to start researching to find what are zebra finches, why use them for research and how long they've been researched. The first thing we focused on was finding out what exactly a zebra finch is. When we began, we thought there were two birds we had to do research on, a zebra finch and a songbird. It was not until our first meeting with Robert that we found out a zebra finch is a species of the songbird. Next, we were able to learn why zebra finches are used in research followed by how long they have been used in research and finally whether or not they are expensive to do research on. Even though per diem rates have no dependency on knowledge of the species, we still wanted a general understanding of the zebra finches because they might present challenges that are different from those encountered by other species.

The zebra finch is the most common finch of Central Australia. It is located in most of the continent where it is warm and dry. It can also be found in Indonesia but it is not nearly as common and it has been introduced to Puerto Rico, Portugal, Brazil and the U.S. They grow to about 4 inches long and prefer to eat grass seeds (Braaten, Petzoldt & Colbath, 2006). Their habitats are grasslands and forest that are close to water. They breed after substantial rains but all

year around if kept in captivity. Their nests can be found in scrubs, low trees, bushes, ground, termite hills, cavities, and cracks and ledges of human structures.

The life span of a zebra finch can vary due to genetic or environmental factors. They can reach 5 years old in their natural habitat, but 8-10 years in captivity. The longest is around 14 years if they are well looked after and happy (Schmidt, 2011). There biggest threats are cats and loss of natural foods. The zebra finch has been used in research labs over the past 20 years. They are one of the more expensive species because of the narrow variation of food. Since their life expectancy is based on how happy they are, it is important to get the food that best suits them. If grass seeds are expensive then it would make caring for them expensive.

Once we found out what kind of animals we were going to be working with, we needed to gain a better understanding of what we had to do. Before the first term of our project began, Robert emailed us Jerald Silverman's guide to setting per diem rates. Since we had no previous experience with cost setting, this guide was a great way to get us started with finding out what we needed because we then began to understand what a per diem rate is along with the steps to calculate it. Once we finished reading we noticed that Silverman referred a guide put out by the National Institute of Health. Reading the Cost Assessment and Rate Setting guide (C.A.R.S.) so we could get a broader view of the process the NIH recommends.

In order to gain a better understanding of what costs are regularly included in a per diem rate, we wanted to emails other schools and find out how they calculate their per diem rates. We sent email to four schools Harvard, Tufts, MIT and Wesleyan. They all had birds and Harvard and Tufts explained exactly what was included as well as their standing per diem rate. MIT and Wesleyan were not able to give us much information because they were in the middle of

calculating a new one and did not want to release much information. All they said is that their goal was to break even.

In the literature review we highlighted the six steps of C.A.R.S. and used it to compare and contrast the two guides. After analyzing their differences and similarities and gathering information from other universities who conduct similar research, we found ourselves in a good position to recommend costs we think UMass should include so they could come closer to breaking even.

Items used for the UMass per diem calculation of current per diem rates are related to direct operational costs such as:

- Food
    - 20 lb bag of L/M Canary/Finch Diet Pharmaserv
    - Hard Boiled eggs with shells
    - 20 lb L/M Canary/ Finch Diet
    - 6 lb bag of High Protein Mash
    - 5 lb bag of High Protein Mash
    - 6 lb box of cuttle bones

- Bedding
- Enrichment
- Animal Husbandry
- Veterinary care
- Small repairs to cages

    - Techboard
        - 22.5” x 28.25” 100/bundle
        - 12.5” x 15” 100/bundle
- Program administration
- Non-capital equipment

Other items that can be included but are not in the calculation are indirect costs such as:

- Utilities (water, electricity, steam, chilled water)
- Capital equipment (over $5,000)
- Building and facilities costs

Once we determined which costs should be included to calculate the per diem rate, it was time to start collecting the data we needed to execute our plan. Although all these costs would not be included in UMass per diem rate we needed to interview Robert Krusas to determine which costs to include and gather the various amounts. First, he gave us invoices for all the direct costs associated with the birds. These were food (Diet), bedding, supplies and supplements (enrichment). We took down all the costs from October to the end of April and entered them onto a spreadsheet. We labeled everything, what the product was, the price, the date, and the business that provided them. Labeling assisted us with determining if the cost was directly related to the zebra finch and if it would fall under direct or indirect cost.

Dates	Quantity	Description/Product	Price/Each	Total	Total Price
9/21/2010	3	6 lb bag of High Protein Mash, prudct #HPM05	$ 20.16	$ 60.48	**$ 70.20**
10/12/2010	12	20 lb bag of L/M Canary/Finch Diet Pharmaserv	$ 29.95	$ 359.40	**$ 359.40**
10/14/2010	4	5 lb bag of High Protein Mash, prudct #HPM05	$ 20.16	$ 80.64	**$ 92.94**
10/18/2010	400	Techboard 12.5" x 15" 400/bundle	$ 0.24	$ 96.00	
	700	Techboard 22.5" x 28.25" 100/bundle	$ 0.55	$ 385.00	**$ 481.00**
10/20/2010	12	20 lb bag of L/M Canary/Finch Diet Pharmaserv	$ 29.95	$ 359.40	**$ 359.40**
10/28/2010	4	5 lb bag of High Protein Mash, prudct #HPM05	$ 20.16	$ 80.64	**$ 92.94**
11/4/2010	7	20 lb bag of L/M Canary/Finch Diet Pharmaserv	$ 29.95	$ 209.65	**$ 209.65**
11/10/2010	4	5 lb bag of High Protein Mash, prudct #HPM05	$ 20.16	$ 80.64	
	6	20 lb bag of L/M Canary/Finch Diet Pharmaserv	$ 29.95	$ 179.70	
	2	5lb box of cuttle bones (6-8") Pharmaserv	$ 36.95	$ 73.90	
	800	Techboard 12.5" x 15" 400/bundle	$ 0.24	$ 192.00	**$ 526.24**

Direct Cost Table 1

The first Direct Cost Table shown above shows the transactions of food, bedding, supplies, and supplements that they purchased in order to refill the old food, bedding, supplies and supplements. The following three charts down below shows the same thing. Four tables showing all of the transactions of which items they purchased, the quantity and price. These are all direct material costs that can be with fixed or variable costs.

11/23/2010	200	Techboard 22.5" x 28.25" 100/bundle	$	0.55	$ 110.00	
	5	20 lb bag of L/M Canary/Finch Diet Pharmaserv	$	29.95	$ 149.75	
	1	estimated shipping	$	30.00	$ 30.00	**$ 289.75**
11/24/2010	100	Classic Matte Stainless Steel 8oz Dish	$	3.99	$ 399.00	**$ 359.10**
11/30/2010	14	L/M Canary/Finch Diet 20 lb bag	$	29.95	$ 419.30	
	800	Techboard 12.5" x 15" 400/bundle	$	0.24	$ 192.00	
	200	Techboard 22.5" x 28.25" 100/bundle	$	0.55	$ 110.00	**$ 721.30**
12/1/2010	8	5 lb bag of High Protein Mash, prudct #HPM05	$	20.16	$ 161.28	**$ 183.26**
12/10/2010	6	Masks, 3MN95 - Coneshaped(reg.) 1860 (#104640)	$	8.63	$ 51.78	
	6	Masks, 3MN95 - Coneshaped(sm.) 1860S (#104641)	$	8.63	$ 51.78	
	6	Masks, Duckbill small #100907	$	17.55	$ 105.30	
	6	Masks, Duckbill, regular #100612	$	17.55	$ 105.30	
	6	L/M Canary/Finch Diet 20 lb bag	$	29.95	$ 179.70	
	400	Techboard 12.5" x 15" 400/bundle	$	0.24	$ 96.00	
	100	Techboard 22.5" x 28.25" 100/bundle	$	0.55	$ 55.00	
	6	5 lb bag of High Protein Mash, prudct #HPM05	$	20.16	$ 120.96	**$ 765.82**
12/16/2010	100	Techboard 22.5" x 28.25" 100/bundle	$	0.55	$ 55.00	**$ 55.00**
1/6/2011	5	L/M Canary/Finch Diet 20 lb bag	$	29.95	$ 149.75	
	400	Techboard 12.5" x 15" 400/bundle	$	0.24	$ 96.00	
	100	Techboard 22.5" x 28.25" 100/bundle	$	0.55	$ 55.00	
	50	4" - 1" bent, ball point	$	7.95	$ 397.50	
	50	stainless steel spring clips	$	4.25	$ 212.50	**$ 910.75**
1/13/2011	200	Techboard 22.5" x 28.25" 100/bundle	$	0.55	$ 110.00	
	5	20 lb bag of L/M Canary/Finch Diet Pharmaserv	$	29.95	$ 149.75	**$ 259.75**

Direct Cost Table 2

1/20/2011	18	Masks, Duckbill small 100907	$ 17.55	$ 315.90	
	50	Hard boiled eggs with shells on (each) - estimated	$ 0.18	$ 9.00	
	18	Masks, Duckbill small	$ 17.55	$ 315.90	
	1	gerson N95 respirator masks 200/case	$ 125.17	$ 125.17	**$ 765.97**
1/31/2011	100	Hard boiled eggs with shells on (each) -estimated	$ 0.18	$ 18.00	**$ 18.00**
2/9/2011	10	L/M Canary/Finch Diet 20 lb bag	$ 29.95	$ 299.50	
	200	Techboard 22.5" x 28.25" 100/bundle	$ 0.55	$ 110.00	
	1	estimated shipping	$ 30.00	$ 30.00	**$ 439.50**
2/23/2011	10	L/M Canary/Finch Diet 20 lb bag	$ 36.95	$ 369.50	
	400	Techboard 12.5" x 15" 400/bundle	$ 0.24	$ 96.00	
	400	Techboard 22.5" x 28.25" 100/bundle	$ 0.55	$ 220.00	**$ 685.50**
2/28/2011	150	Hard boiled eggs with shells on (each) -estimated	$ 0.18	$ 27.00	**$ 27.00**
3/2/2011	50	4" - 1" bent, ball point	$ 7.95	$ 397.50	
	160	Classic Matte Stainless Steel 8oz Dish	$ 2.99	$ 478.40	
	70	Classic Matte Stainless Steel 1pt Dish	$ 3.99	$ 279.30	**$ 1,155.20**
3/3/2011	30	x large polypropelene coverall case of 25	$ 17.57	$ 527.10	
	30	2x large polypropelene coverall case of 25	$ 17.90	$ 537.00	
	20	4x large polypropelene coverall case of 25	$ 18.90	$ 378.00	
	20	jumbo poly. Shoe covers 300 (150 prs)	$ 13.15	$ 263.00	**$ 1,705.10**
3/17/2011	10	L/M Canary/Finch Diet 20 lb bag	$ 29.95	$ 299.50	**$ 299.50**
3/24/2011	200	Techboard 22.5" x 28.25" 100/bundle	$ 0.55	$ 110.00	**$ 110.00**

Direct Cost Table 3

3/30/2011	10	L/M Canary/Finch Diet 20 lb bag	$ 29.95	$ 299.50	
	800	Techboard 12.5" x 15" 400/bundle	$ 0.24	$ 192.00	
	200	Techboard 22.5" x 28.25" 100/bundle	$ 0.55	$ 110.00	
	30	jumbo poly. Shoe covers 300 (150 prs)	$ 13.15	$ 394.50	**$ 996.00**

Direct Cost Table 4

L	M	N	O	P
Supplies	**Quantity**	**Cost**	**Total**	**Total Overall**
Techboard 22.5" x 28.25" 100/bundle	2800	$ 0.55	$ 1,540.00	
Techboard 12.5" x 15" 100/bundle	4000	$ 0.24	$ 960.00	
gerson N95 respirator masks 200/case	1	$ 125.17	$ 125.17	$ 2,625.17
Masks, Duckbill small 100907	42	$ 17.55	$ 737.10	
Masks, Duckbill, regular #100612	6	$ 18.55	$ 111.30	
Masks, 3MN95 - Coneshaped(reg.) 1860 (#104640)	6	$ 8.63	$ 51.78	
Masks, 3MN95 - Coneshaped(sm.) 1860S (#104641)	6	$ 8.63	$ 51.78	$ 951.96
Classic Matte Stainless Steel 8oz Dish	100	$ 3.99	$ 399.00	
4" - 1" bent, ball point	100	$ 7.95	$ 795.00	
Classic Matte Stainless Steel 8oz Dish	160	$ 2.99	$ 478.40	
Classic Matte Stainless Steel 1pt Dish	70	$ 3.99	$ 279.30	
stainless steel spring clips	50	$ 4.25	$ 212.50	$ 2,164.20
x large polypropelene coverall case of 25	30	$ 17.57	$ 527.10	
2x large polypropelene coverall case of 25	30	$ 17.90	$ 537.00	
4x large polypropelene coverall case of 25	20	$ 18.90	$ 378.00	
jumbo poly. Shoe covers 300 (150 prs)	50	$ 13.15	$ 657.50	$ 2,099.60
Food				
20 lb bag of L/M Canary/Finch Diet Pharmaserv	52	$ 29.95	$ 1,557.40	
Hard boiled eggs with shells on (each) - estimated	150	$ 0.18	$ 27.00	
L/M Canary/Finch Diet 20 lb bag	65	$ 36.95	$ 2,401.75	
6 lb bag of High Protein Mash, prudct #HPM05	3	$ 20.16	$ 60.48	
5 lb bag of High Protein Mash, prudct #HPM05	26	$ 20.16	$ 524.16	
5lb box of cuttle bones (6-8") Pharmaserv	2	$ 36.95	$ 73.90	$ 4,644.69
			$ 12,485.62	$ 12,485.62

Direct Material Cost 1

Once we had recorded all the direct costs, we needed to account for the indirect costs. The indirect costs we will include are supplies, administrative wages, business expenses, administrative expenses, travel, purchased services, facility costs and equipment leased/purchased. In our interview, Robert Krusas informed us that there was one total cost for all of the supplies under indirect costs and we needed to assign a percentage of the costs to the bird population. The invoices were all supplies needed to enter the building housing all the animals, since the birds take up a small part of the building Robert informed us that we needed to assign 1 percent of the costs to the birds.

Indirect Expense							BIRDS	TOTAL
Oct-10	0.001799						26.07	14488
Nov-10	0.0025						36.64	14658
Dec-10	0.002065						31.01	15020
Jan-11	0.002835						43.46	15329
Feb-11	0.002879						44.46	15443
		Total Invoices	**Allocating**		**Allocating**	**Adding all**		
Indirect Costs		**Per Month**	**to .01%**		**to .1%**	**numbers up**		
		702.8	7.028	440.98	44.0978	51.1258		
						13.15		
						1.32		
		1143	11.43	142.95	14.295	25.725		
		1189.1	11.891	406.45	40.6451	52.5361		
					54.75	54.75		
		547.5	5.475	399.98	39.9975	45.4725		
		1601.7	16.017	279.02	27.9017	43.9187		
		1338.2	13.382	407.94	40.7942	54.1762		
		1601.7	16.017	279.02	27.9017	43.9187		
			5.271			5.271		
			3.945			3.95		
			12.5898			12.5898		
						407.89		

Left: Each month, we divided the total number of birds they have / to the total number of animals they have.

Right: Numbers we read from the data sheet

Indirect Material Cost 1

The next thing Robert informed us about was wages for the department. There are some that are direct because they are spending a good amount of hours every week with the birds. The salaries that are direct are the veterinary technician and the veterinarian. The indirect salaries are the higher-level positions; these are supervisors, animal care managers, and total administrative personnel.

To get the accurate cost of all the wages, we needed to find out how much time is spent with the birds by each employee. We went back to the animal research facility and interviewed the veterinary technicians who worked with the birds, the two supervisors, and the animal care manager. The animal care manager brought us on a tour around the facility and showed us the

process of entering the building. There was a station where all employees must stop and put on the supplies necessary to enter. We then went into the building where the birds were housed. We could not enter because special respirators as well as showers were needed to enter all the way into the room. There were a good amount of cages in about a 15x20 ft room.

Next we interviewed the two supervisors. They gave us the amount of hours spent with the bird weekly, and they also helped us calculate some numbers for the direct cost. The inventory that was available as well as the average weekly consumption let us wrap everything in an accurate way so we had no more questions.

Although there were four technicians in the room during our interview, we got the majority of our information from one individual. Jeremy Savard was a veterinary technician, and had the most experience with the birds since he was the first person trained to work with them. He told us that there was a combined total of 27.5 hours per week spent on 40 small cages with a maximum of 6 birds per cage and 20 large cages with a maximum of 30 birds. As for daily usage of supplies food and bedding, he gave us some surprising information. One 10 lb bag of food is used each day because the technicians are instructed to throw it out each day no matter how much has been eaten. A bag of Canary/Finch Diet is 20 lbs and a bag of Bird Mash is 5 lbs. Two sheets of bedding are used for the large cages and 1 sheet is used for the small cages. The supplies will be the hardest part for us to estimate because they are used so infrequently. There has only been one order of cuttlebones and supplements are ordered variably, depending on how much the birds consume them. There are a number of challenges we face but being able to work directly with all employees is very helpful for gaining information.

The last interview we conducted was the most important because the percentage of the technician's wage will be the highest in the whole animal care facility. They spend the most amount of time with the birds on a weekly basis; there also isn't a day where they don't work with the birds. There are a number of things they do with the birds, and most of them are time consuming. Even though there are four veterinary technicians that are trained to work with the birds, we only interviewed one. Jeremy informed us one technician each day spends an average of three hours per day with the birds including weekends. Two days a week there is a process of changing all the supplies that requires two people for an hour and the last thing we accounted for was the fact that anyone entering the bird room must take a fifteen-minute shower first. All this helped us come up with a total of how much of each wage will be attributed to our per diem rate.

After getting all the necessary information, we needed to start the first step of organizing the information and classifying what we had. We put the cost into categories of direct or indirect and variable or fixed. We needed to do this because it will be easier to make projections in the future if we know how to account for any changes. After allocating everything we wanted to make sure Robert was satisfied with everything we completed up to this point. We went to UMass and did a presentation, allowing him to see our progress and give us his insight. This was extremely beneficial because it helped us validate our analysis and clarified the data we still needed to obtain.

All of this information could have gotten overwhelming, so we organized all the interviews and information into our writing but we needed to find a way to organize the numbers so we made an excel sheet. It had everything from the total cost for each category, to every factor needed to carry out the calculations, we give an example of the excel sheet in the next section.

Analysis

Calculating the per diem rate was a lengthy process which took us a total of four months to collect the data as well as write up the process. Once we allocated the total costs associated with the birds, we were able to begin making the calculations necessary to find the cost per bird. As we had previously mentioned in the methodology, there were three ways to organize the costs; put them into fixed direct costs, variable direct costs and fixed indirect costs. We will put things into cost centers and calculate the costs in each cost center the same way. Our excel document calculates all the cost and we organized them by the cost center they were in.

The first cost center is general/administrative costs. These include indirect costs that the administrators in the department use to keep caring for the animals running smoothly. The four costs are administrative expenses, purchased services, facility costs, and equipment purchased/leased. Since we were looking to find the cost per day, the first thing we needed to do was find out the time period to which the total cost covered. We then divided the total cost by the number of days to which they covered. Once this is finished we will have the total cost for all the animals per day. The next step was to find the ratio of birds as compared to all animals that are housed. We talked to Robert about this because of the fact that the birds accounted for less than one percent of the animal population. Robert then told us just to allocate one percent of each cost to the birds. This allowed us to get the cost of each bird per day.

The second cost center is animal health care. This will be the wages of the employees that directly take care of the birds. The veterinary technicians and veterinarians directly spend time every week with the birds, so we have to allocate them differently. Technicians are the biggest cost because a high percentage of their wages would be added to the birds since they spend a lot

of time each day taking care of them. To break it down by how much of the veterinarian's and veterinary technician's wage is allocated on a daily basis, we needed to find how much they are paid by the hour. The first step was taking the wage in a year and dividing it by the number of hours worked per year. This gives us the value of one hour spent with the birds. Since there is only one veterinarian or veterinary technician working with the birds each day, we needed to find out how many hours per day all of the employees contribute. To do this we took how many hours each employee spends with the birds in a given week divided by how many days they work. They keep timecards of how many hours they work, but don't specify how much time is spent with the birds so Robert told us to just base the figures off of the interviews. The final step is to put how many employees are in each department. This gave us the cost of $65 per day for the veterinary technicians to take care of all the birds, and $8.49 for the veterinarians to take care of the birds.

The third cost center was the easiest to calculate because all of the costs were direct and had been recorded over a short amount of time. This cost center is basic husbandry; this is all products used to supply the basic needs for housing the zebra finches. The costs included in this are food, supplies (bedding etc.) and supplements. Before we could calculate the supplies, we needed to minus the amount of food they didn't use for the month. All of these costs were recorded through the invoices that Robert gave to us. It was over a six month period so it was pretty easy to understand how we would break the cost down to a per day figure. The first thing we needed to do was find out how many days were in this particular six month period. So we checked from the first day a cost was recorded until the very last day. We ended having costs that covered 181 days. We added up all the total cost and divided it by the number of days, this gave us how much of each product the birds used per day. Once we did that we divided the cost per day by 780

birds, that is how many birds there currently were in the LRB, that gave us the cost per bird. The currently housed number of birds can be changed to match the facility's actual number in future calculations.

Even though we had been able to come up with a number it was not accurate because we had accounted for what they ordered but not what they had used. We then contacted the animal care manager and asked if we could go in and record how much of the each product had been used. They had about a six day supply of each product at the end of the month. This was reasonable considering the fact that during our interview the animal care manager explained that they always try to keep a week's worth of each product in case of an emergency.

The last cost center is laboratory and services cost center. This includes the indirect supplies as well as the indirect wages. The wages didn't include benefits. They included the total administrative wages, supervisor wages and the animal care managers' wages. Since they very rarely or never go into the bird room and work directly with the birds, Robert informed us that since these employees have no set schedule of how much time is dedicated to a species, it would be much easier to calculate the cost by percentage of the birds as compared to total animals. That made it much easier for us because we knew that the birds accounted for less than 1% of the total animal population. Robert instructed us to use 1% for calculating purposes. We first found out if the wages we were given were based on a yearly salary, since they were we just divided the wage by days of the year. That gave us the cost for all birds in one day, so we just went ahead and divided it by number of birds, giving us the cost per bird per day.

The second part is where it gets complicated. The supplies would be allocated the same way only if the products were going to be used for all species and not a majority of the supplies used for

just the birds. This meant everything needed to be figured out for only 1% to find the amount just for the birds. The first set of invoices Robert gave us were going to be allocated the same way; total cost for the year divided by days of the year multiplied by 1%. The second set of invoices had products on it that were ordered for the specific purpose of working with the zebra finches. Those products are a direct cost but since they are ordered with all the supplies, Robert just had us allocate a higher percentage. The process was the same up until the last step; we took the total cost divided by number of days and instead of multiplying by 1% we had to multiply by 10%, this helped us account for the extra cost of the products used for the birds.

Calculating the cost for the birds was not a very hard process. We were able to figure things out very quickly because of the fact that we had two great cost setting guides. They helped us get an understanding of bird days, which is finding the cost of each bird per day. When we first came up with the numbers we were unsure if we executed the process correctly because some costs were so minimal, they didn't even contribute 1 cent. This is where the school emails really helped us out. We were able to compare our rate to theirs and saw that we were right on target for what we wanted to accomplish for UMass. It seemed as if our numbers were a little low for the per bird cost, but since our small and large cage costs were only different from other schools by one or two cents; we knew we were on target.

In order to organize everything and get all the information we collected into one document we had to put all of our final numbers into an excel sheet. The excel sheet would use the numbers for everything such as: employee wages, number of employees, number of birds per small cage, number of days we recorded the invoices, etc. The screen shot of the first sheet below is the input. This is all the information we needed in order to carry out the calculations. The numbers are under the same name as the label to the left.

INPUT			Explanations	Source of information	Period
Animal/Bird statistics					
Total number of animals	42,258			Animal population sheet	Monthly
Total number of birds	780			Animal population sheet	Monthly
Number of small cages	40			Vet tech interviews	Monthly
Number of large cages	18			Vet tech interviews	Monthly
Birds per small cage	6			Vet tech interviews	Monthly
Birds per large cage	30			Vet tech interviews	Monthly
supplies allocation rate	1%	10%		Indirect supplies invoices	
	Multiply by B26	Multiply by C26			
Wages					
Veterinarian technician wages			Yearly per person	Email from Rob	
Veterinarian Wages			Yearly per person	Email from Rob	
Total administrative wages			Yearly all admin personnel	Email from Rob	
Supervisor wages			Yearly per person	Email from Rob	
Animal care manager wage			Yearly per person	Email from Rob	
Products					
Food cost	$ 4,450.67		based on invoices less unused	Invoices	6-month period
Fixed supplies cost	$ 1,584.03		based on invoices less unused	Invoices	6-month period
Variable supplies cost	$ 5,856.90		based on invoices less unused	Invoices	6-month period
Indirect Supplies cost	$ 67,162.00	$ 41,830.25	based on invoices less unused	Invoices	5-month period
Supplements cost	$ 640.54		based on invoices less unused	Invoices	6-month period
Wage Statistics					
Hours per veterinarian	0.3125				
Number of veterinarians	4			Veterinarian interview	
Number of vet techs	4			Vet tech interview	
Number of Supervisors	2			Email from Rob	
Hours per vet tech	7		Per person weekly working w/ birds	Vet tech interview	
Number of days for invoices	181			Invoices	
Number of hours worked	2080		per person annually	40 hrs*52 weeks	
Days per week	7		amount of days vet/vet techs work	Vet tech interview	
Days per year	365				
lumber of days for fixed/variable supplies	151				
Department costs					
Business expenses	$ 34,832.00			Animal care budget	Annual FY '11
Administrative expenses	$ 20,000.00			Animal care budget	Annual FY '11
Travel	$ 27,381.00			Animal care budget	Annual FY '11
Purchased services	$ 250,395.00			Animal care budget	Annual FY '11
Facility costs	$ 28,905.00			Animal care budget	Annual FY '11
Equipment/lease/purchased	$ 196,995.00			Animal care budget	Annual FY '11

INPUT			**Explanations**	**Source of information**	**Period**
Animal/Bird statistics					
Total number of animals	42,258			Animal population sheet	Monthly
Total number of birds	780			Animal population sheet	Monthly
Number of small cages	40			Vet tech interviews	Monthly
Number of large cages	18			Vet tech interviews	Monthly
Birds per small cage	6			Vet tech interviews	Monthly
Birds per large cage	30			Vet tech interviews	Monthly
supplies allocation rate	1%	10%		Indirect supplies invoices	
	Multiply by B26	Multiply by C26			
Wages					
Veterinarian technician wages			Yearly per person	Email from Rob	
Veterinarian Wages			Yearly per person	Email from Rob	
Total administrative wages			Yearly all admin personnel	Email from Rob	
Supervisor wages			Yearly per person	Email from Rob	
Animal care manager wage			Yearly per person	Email from Rob	
Products					
Food cost	$ 4,450.67		based on invoices less unused	Invoices	6-month period
Fixed supplies cost	$ 1,584.03		based on invoices less unused	Invoices	6-month period
Variable supplies cost	$ 5,856.90		based on invoices less unused	Invoices	6-month period
Indirect Supplies cost	$ 67,162.00	$ 41,830.25	based on invoices less unused	Invoices	5-month period
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Facility costs	$ 28,905.00			Animal care budget	Annual FY '11
Equipment/lease/purchased	$ 196,995.00			Animal care budget	Annual FY '11

For the input, we knew people wouldn't quite understand what our numbers meant if we simply had number and labels, so we went further and put down explanations, the source of information and period. The explanations show what the numbers mean, the sources show where we got the information in case someone wanted to find how we calculated the numbers and the period shows how long the information was recorded for.

Once that was done we went on to our assumptions. The assumptions separated the direct and indirect costs and gave the formula we did in order to execute the calculations. The calculations we did gave us the cost of all birds per day, so once we got to the next section we just needed to divide the total cost of all birds by the number of birds. Finally on this second section we wanted to classify the costs because not all of them can be calculated by bird per day since some are fixed. The ones that are variable, are classified by variable per bird or per cage.

Sources	ASSUMPTIONS - Cost of all birds per day		Cost Classifications		
DIRECT COSTS			Fixed	Variable per bird	Variable per cage
	(Total 6 month cost less unused/number of days)				
Food	$	24.59		x	x
Total					
	(Total 6 month cost less unused/number of days)				
Supplies					
Total fixed	$	8.75	x		
Total variable	$	32.36		x	x
	(Total 6 month cost less unused/number of days)				
Supplements					
Total	$	3.54			x
	(vet tech wages/number of hours worked)*number of vet techs*hours per vet tech/ days per week				
Wages					
Veterinarian					
Total	$	65.00		x	x
	(veterinarian wages/number of hours worked)*number of veterinarians*hours per veterinarian/ days per week				
eterinarian technician					
Total	$	8.49		x	x

Assumption 1

Sources	ASSUMPTIONS - Cost of all birds per day			Cost Classifications		
INDIRECT COSTS				Fixed	Variable per bird	Variable per cage
	(total cost*0.01/number of days)					
Supplies						
Total	**$**	**1.84**		x		
	(total cost*0.10/number of days)					
Total	**$**	**11.46**		x		
	(Yearly salary/annual days)(% of birds in the facility)					
Wages						
Total administrative	**$**	**21.15**		x		
Supervisors	**$**	**5.74**		x		
Animal care manager	**$**	**3.77**		x		
	(Total expense/365x % of birds)					
Business expenses	**$**	**1.76**		x		
Administrative expe	**$**	**1.01**		x		
Travel	**$**	**1.38**		x		
Purchased services	**$**	**12.66**		x		
Facility costs	**$**	**1.46**		x		
Equpment/leased/pu	**$**	**9.96**		x		
	$	**72.21**				

Assumption 2

The final step we took was coming up with the calculation UMass could actually use. We labeled this section of our excel sheet ‘Calculations of cost per day’ because every cost that we needed to come up was on a daily bases. Once again we broke it down into the two sections of direct and indirect costs. The fixed costs were put into the last row because fixed cost cannot be calculated per bird. For the variable costs we carried along the calculation of the cost of all birds per day from up top and divided that by the number of birds, which is shown in the fourth row. It was interesting because some cost were less than a cent. Once we had the cost per bird it was time to finish our ultimate goal of calculating the per diem rate of a small and large cage. In order to do so we took the number of birds per small cage and large cage and multiplied it by each cost then we added up the total giving us a finished per diem rate. The fixed costs were in a section on their own and this maybe the part that UMass subsidizes for the researchers.

Calculation of costs per day

			Per Diem Rates			
DIRECT COSTS	Cost per day for all birds	Type of Cost?	Per diem rate	Per diem rate	Per diem rate	Daily fixed costs
			per bird	small cage	large cage	
Food	$ 24.59	variable	$ 0.03	$ 0.19	$ 0.95	
Supplies						
fixed supplies cost	$ 10.49	fixed				$ 10.49
variable supplies cost	$ 38.79	variable	$ 0.05	$ 0.30	$ 1.49	
Supplements						
	$ 3.54	variable	$ 0.00	$ 0.03	$ 0.14	
Wages						
Veterinarian	$ 65.00	variable	$ 0.08	$ 0.50	$ 2.50	
Veterinarian Techicians	$ 8.49	variable	$ 0.01	$ 0.07	$ 0.33	

Calculation of Costs per Bird 1

Calculation of costs per day

			Per Diem Rates			
INDIRECT COSTS	Cost per day for all birds	Type of Cost?	Per diem rate	Per diem rate	Per diem rate	Daily fixed costs
			per bird	small cage	large cage	
Supplies						
	$ 1.84	fixed				$ 1.84
	$ 11.46	fixed				$ 11.46
Wages						
Total administrative	$ 21.15	fixed				$ 21.15
Supervisors	$ 5.74	fixed				$ 5.74
Animal care managers	$ 3.77	fixed				$ 3.77
Business Expenses	$ 1.76	fixed				$ 1.76
Administrative Expenses	$ 1.01	fixed				$ 1.01
Travel	$ 1.38	fixed				$ 1.38
Purchased Services	$ 12.66	fixed				$ 12.66
Facility Costs	$ 1.46	fixed				$ 1.46
Equpment/Rentals	$ 9.96	fixed				$ 9.96
Total Per Diem Rate	**$ 72.21**		**$ -**	**$ -**	**$ -**	**$ 72.21**

Calculation of Costs per Bird 2

Amount to bill			
	Number of cages	Variable cost per cage	Total
Large cages	18.00	$ 5.40	97.21
Small cages	40.00	$ 1.08	43.20
Fixed costs			$ 82.70
		Total Due	$ 223.11
	Umass		
	Small Cage	$ 1.08	
	Large Cage	$ 5.40	
	Harvard		
	Small Cage	$ 1.90	
	Large Cage	$ 4.98	
	Tufts		
	Small Cage	$ 1.01	
	MIT		
	Small Cage	$ 2.16	
	Large Cage	$ 5.40	

Calculation of Costs per Bird 3

Above is the finished product as well as the comparison to other schools. It was ironic because the calculations we made for UMass were right on pace with MIT's which they had previously used. Harvard is a lot more expensive because they actually break-even making it a lot more expensive for a researcher.

Conclusion

Our project team was able to come up with a great way of creating a per diem rate, and an even better way of making it easy to change for the future when they make the change. Even though all of our information is backed up by a source there were still limitations to the project that made it harder for us to finish. Right from the beginning we began researching information on the process of per diem rate calculations as well as past research done on zebra finches. It was hard to find either, as far as per diem rate there was not much information that would help us. When we did find an article pertaining to per diem rates they had nothing to do with animals. One example is when we found how to do per diem rate calculation for foster children. Even though everything seemed ok, there were too many differences to use that article as a resource.

Another limitation we faced was the lack of communication from other schools due to confidentiality. We saw a trend of universities letting us use their information only if they were in the immediate Worcester area. All three universities that we referenced were in a 50 mile radius. When we did research we saw that the University of Arizona was doing the same exact process we were trying to do, so we took initiative and emailed the head of animal medicine asking whether or not they were able to send any information or suggestions. They emailed us back stating they were not willing to send any information or suggestions. They stated they couldn't respond back through email due to the fact that they did not want their information spread to those who were not going to use it for the right reasons. The fifth school we approached for help was Wesleyan University in Connecticut. We asked them whether it was possible to send an email with information on their per diem rates for animals. They stated that they would rather us go down to the University but that never took place so we were not able to get information from them either.

The last limitation dealt directly with the per diem rate calculation. The UMass medical center was in the process of constructing a new building with a room to better accommodate the birds. Robert stated that there were going to be new technological advances that would be specifically for the birds but no one was sure exactly what they were or what costs would come with them. This meant that making a per diem rate for the future years would be extremely tough for us since there would be new costs. This is where the excel sheet that is up above became such a crucial part of the project. Due to the excel sheet, Robert is now able to not only change the costs that already exist, but add new costs once he has a better understanding of how it works. These three major factors as well as smaller hurdles we faced made it a tough process but helped us learn how to overcome difficulties when performing a task.

Due to the fact that it was not easy and it brought us out of our comfort zone, we were able to explore an area of expertise that would tremendously help us in the future. We learned that in order to efficiently execute a task, you need to at the least gain a good understanding of everything that contributes to it. Our advisor, Professor Fabienne Miller really showed us how to see the big picture. When we first began, the only things we thought we needed were the numbers that Robert could provide us with as well as the interviews we previously discussed, so we immediately began meeting with him. Professor Miller told us we had to stop until we were able to read the two guides as well as do research on zebra finches and collect information from other schools. We took about two weeks off from our visits to UMass to do all of this research, and once we began recording the numbers again we started to organize them in a way that would benefit us because of the fact that we had a much better understanding of how to start and finish the process.

The place that we learned the most was in the field of accounting. We were able to experience both managerial as well as financial accounting and all the difficulties that accountants face everyday. Managerial accounting was experienced by us during the research process. We had to find resources that we could base our assumptions off of; otherwise our number would have held no weight. So the sources of the calculation are so important, another part of managerial accountants is finding a way that you would like to process information. There are so many opinions on how to do the same process that two managerial accounts may not agree on any one process even though they get the same numbers. As for financial accounting, that is more internal and is carried out once the numbers have been derived. Even though the numbers are already laid out, it is not an easy task. Making sure everything is accurate is the hardest part. In our excel sheet, everything is connected so if one number is off it could change the whole per diem rate. Another difficult task is finding out how long the costs took to be recorded, without the correct time span, numbers could be off by more than a dollar per cost which is drastic.

Through all of this, we created a formula to calculate per diem rates that was custom fit to include all the various costs and services utilized by the Department of Animal Medicine at the University of Massachusetts Medical School in Worcester MA. It was important to develop the formula according to the way their facility operates. This way the costs and services related to the biomedical research and animal facility would all be accounted for and listed under the appropriate cost center. This allowed for a conformed method which can be applied to each specific animal. Numbers and calculations can be plugged in accordingly allowing for an efficient system to be in place. Factoring in the direct and indirect costs including the proper percentage of staff hours as well as outside services allows for a more accurate per diem rate directly related to one type of animal, which in this assignment was the zebra finch. Running a

facility involves many different facets. One particularly is budgeting to ensure sufficient funding is obtained to enable the facility to properly supply the care and services required for the animals as well as giving the researchers access to obtain information and gather findings.

Technology and the environment are forever changing as is the world of diseases. Biomedical research has an enormous impact on the lives of so many people. Although there is no one set way of solving things we can only do our best to provide the services needed to reach that point. Having a well-designed method that meets the needs of those providing the research is just one small step. It has been a privilege to have had this opportunity to assist UMass. Their work is so invaluable to us all. We are proud to have represented Worcester Polytechnic Institute and even more honored to have had the opportunity to contribute to such a worthy cause that benefits the world. We admire the hard work and dedication of all those involved at the UMass Department of Animal Medicine and thank them.

References

Autumn Bennett, Jason Jorgenson, Peter Brown. (2011). Supervisors of Animal Department at Harvard University.

Franziska B. Grieder. (2000). *Cost Analysis and Rate Setting for Animal Research Facilities.* (ManualNation Institute of Health. doi:May

Jerald Silverman. (2009). Managing the Laboratory Animal Facility., Chapter 4-End of Chapter 4.

Jerald Silverman. (2010). *Department of Animal Medicine.* Retrieved March 19, 2011 from http://umassmed.edu/about/index.aspx?linkidentifier=id&itemid=1582

Keith Kun. (2011). Professor Kun from Tufts University.

Marc F. Schmidt.An IACUC Perspective on Songbirds and Their use in Neurobiological Research. *ILAR Journal, ,* 424. Retrieved from http://dels-old.nas.edu/ilar_n/ilarjournal/51_4/pdfs/v5104Schmidt.pdf

Robert Krusas. (2011). Assistant Director/Manager of Department of Animal Medicine at UMass.