

**Willingness for whole body donation:  
associations with participation in cadaver-based Anatomy and blood/plasma donations**

By

Danielle Severns

In

Biology

A Thesis

Presented to the

Honors Program of

Missouri Southern State University

Dr. Alla Barry

Associate Professor of Biology

Spring 2015

**Abstract**

**Willingness for whole body donation:  
associations with participation in cadaver-based Anatomy and blood/plasma donations**

Danielle Severns, B.S. Biology

Missouri Southern State University, 2015

Faculty Mentor: Dr. Alla Barry

Whole body donation is a practice of critical importance in improving medical care. However, the shortage of cadavers remains a problem. Multiple studies worldwide have assessed individual willingness and identified demographic correlations associated with whole body donation. Research has also indicated significant associations between being an organ donor and a willingness to consider the donation. Reported data also suggest a negative relationship between participation in cadaveric dissection and a willingness to consider the donation. This study surveyed three previously unexplored factors: individual participation in (1) blood donation, (2) plasma donation, and (3) cadaver-based Anatomy to determine how they correlated with a willingness to consider whole body donation.

Current and previous students (n=261) at Missouri Southern State University whom have taken (n=120, 46%) and have not taken (n=141, 54%) cadaver-based Anatomy were surveyed. Willingness for the donation was asked in yes/no format and using a Likert scale, 1 being strongly unwilling and 5 being strongly willing. The survey included demographic factors such as gender, age, college major and year. Data were analyzed using Statistical Package for the Social Sciences software. Participation in cadaver-based Anatomy with prosected cadavers was not found to be significant with increased willingness for the donation ( $p=0.072$ ). Enrollment in cadaver-based Anatomy and increase in age were collectively significant with correlation for increased ranking of willingness ( $p=0.026$ ). Being current blood and plasma donors, as well as having a history of blood donation, were all found significantly correlated with willingness to become a whole body donor ( $p=0.045$ ,  $0.015$ , and  $0.002$ , respectively). Study results reveal that students who participated in both blood and plasma donation are more willing to consider whole body donation. All findings further contribute to current knowledge regarding factors associated with willingness for this crucially important donation.

## **Introduction**

The development of this thesis began with an interest in my online Biomedical Ethics class during the summer of 2014. I cultivated a keen interest in ethical and controversial situations in medicine through participation in this class. I then was selected for enrollment in Advanced Human Dissection in the fall 2014 semester and certainly came to understand the benefits of whole body donors as they provided me with a source through which to gain immense anatomical education. In this class, students dissect people whom have provided their bodies via whole body donation. Those people, who ultimately made the decision to become whole body donors, also intrigued me. I developed a curiosity regarding the characteristics of whole body donors and the factors that are related to willingness for this noble donation. After exploring the research on whole body donation and becoming familiar with the factors that have already been assessed, I was left with a few questions regarding factors that have yet to be explored. Further discussion of the existing research follows. This will give complete understanding of the specific factors for assessment in the developed survey and resulting findings.

Whole body donation is, and has been, a topic of research around the world. One could reason that comparing factors associated with willingness in one country is not comparable to willingness in other countries due to differences in culture, religion, ideologies, and overall lifestyles. It can be argued that generalizations should not be made from significant results in country or population to encompass the entire world. On the contrary, I suggest that willingness for whole body donation is a concept without cultural borders. I believe it is a basic and entirely natural instinct for the human race to be unsure about life after death and what happens after we have died. That is not to say religion does not have an impact on a person's beliefs about what happens in regard to their soul and an afterlife. Still, I maintain that the inability to separate your

living, breathing, and functioning body from your unfeeling and unaware body after death is inherent in every cognizant human being. It is a natural response to be wary of your body lying fully exposed and being dissected, completely at another's mercy. Therefore, willingness to consider whole body donation concerns tendencies of the human race, rather than of specific cultures. For these reasons, I have reviewed and included studies conducted across the globe and believe they are entirely justifiable for comparison with the results from Missouri Southern State University in Joplin, Missouri.

Upon searching "willingness for whole body donation" or simply "whole body donation" for review of the literature, I was provided with a wealth of research studies and information on the topic. This allowed me to develop an understanding of the research that has been conducted. While nearly every study commented on an insufficient number of whole body donations to meet the need for cadavers, no such numbers or statistics to back the claims were found. It appears problematic to assert a claim that has been repeatedly stated without significant numerical reference to support it, and to then inherit and claim as truth. Through evaluation of willingness, several studies illustrated the relative lack of willingness by the general public to become whole body donors. One can conclude from these recurrent findings that a lack of willingness for the donation certainly goes hand in hand with a lack of sufficient whole body donors; however, there is no tangible evidence to support this supposed knowledge that I have found.

Whole body donation serves to further medical knowledge and, ultimately, improve healthcare in an infinite number of ways. This donation is the selfless act of giving one's body after passing; the donated post-mortem body is then referred to as a cadaver. There are various ways for a cadaver to be utilized by members of the medical community to either directly or indirectly improve the care of another patient: autopsies, surgical practice, or cadaveric

dissection for the learning of anatomy. *Stiff: The Curious Lives of Human Cadavers*, written by Mary Roach (2004), dives into the practical uses of human cadavers and gives many examples of their use beyond science. She also explores their use in improvement of warfare safety, automobile and airplane safety through crash testing, and other applications. She begins by giving a history of cadaver usage in anatomy education dating back as early as 300 B.C. Egypt. During that time, the dead were cut open merely for exploration and bewilderment, as opposed to the educational purposes they serve now. More importantly, her book serves to illustrate the meaningful uses of cadavers for the betterment of science and improvement of medicine through research and education. This novel is the basis of my initial assertion that cadavers are of monumental importance for the improvement of medicine, supplemented by my own experience with their usefulness.

While their importance is publicly known, there is no overwhelming sense of joy or even popular approval with the idea of the donation. A substantial amount of research currently exists that comments on the shortage of whole body cadaveric donations worldwide. This is somewhat startling when considering that whole body donation numbers have plateaued—despite a rise in the world's population. While few founded studies have directly relayed number values regarding these stated facts, every study gathered in my research reports this issue. Harrington and Sayre note there were only six whole body donations per 1,000 deaths in the year 2004 in the United States (2006), a year with about 2.4 million deaths. One could extrapolate as I did that with a total of 171 medical schools in the United States and a low estimated need of 30 cadavers at each school per year, at least 5,130 donors would be needed yearly for medical student education alone – this is not including cadavers for the numerous other purposes in the medical field, let alone avenues of research and development beyond medicine. Compounding the issue is

that the world expects and demands practiced, expert physicians. Research shows that cadaveric dissection results in physicians being better prepared and having a higher confidence in their field or practice, further demonstrating the need for these donations. Therefore, an avenue of research on whole body donation has explored the opinion of medical students and professionals.

A recent study conducted in Ireland by Green, Bowden, Molony, Burke, Felle, and Dudeney (2014) prompted the issue that although the United States has experienced population growth since 1995, there has been no remarkable increase in whole body donation in that time, though no direct number values were provided. Adding to their concern and increasing the need for more cadavers is the swift rise in medical students in the past twenty years. Their goal was to assess medical professionals' opinion of whole body donation, both during their time in dissection in medical school and their current opinion as they practice. They found that a physician's increase in approval of whole body donation is correlated with increased time in the medical field after medical school. This finding is important in understanding that although cadaveric dissection may decrease willingness for whole body donation, time after cadaveric dissection is an important factor to consider when assessing whole body donation willingness of those who have participated in dissection.

Another study in Ireland conducted by Cahill and Ettarh (2008) was the first to explore the opinion of medical students on whole body donation. The survey was given to medical students in three intervals: prior to cadaver dissection exposure, after their first dissection period, and nine weeks after their initial dissection exposure. They found that compared to the general population, medical students have a higher rate of willingness for whole body donation; meanwhile, the actual experience with cadaveric dissection results in a significant decrease in willingness for whole body donation. Cahill and Ettarh's assessment of students' acceptance of

whole body donation by a stranger did not vary significantly throughout cadaver dissection exposure. However, there was a very significant drop in willingness to register as a whole body donor themselves and a decrease in willingness to encourage a family member for this type of donation. These findings were also revealed in a similar study conducted in Australia with chiropractic students who participated in cadaveric dissection (Alexander 2014). The researchers assert that medical professionals should be the first to educate their patients and the public on whole body donation. Results such as this have pertinent implications if we hope to raise whole body donation numbers.

Several studies have found a correlation between experience in cadaveric dissection and decreased willingness to register oneself as a whole body donor, as well as to recommend a family member for this donation. A Nigerian study conducted by researchers Anywanwu and Obikili (2012) revealed that less than one fourth of the surveyed anatomists from area medical schools would consider whole body donation. The same was found in a Dutch study that surveyed anatomists and found just one fourth of them would consider the donation (Bolt 2012). A later study conducted by Anywanwu, Obikili, and additional researcher Agu (2014) further explored their 2012 findings through surveying students and professionals with a varying degree of exposure to cadaveric dissection. They found that respondents with no exposure to dissection had increased willingness to consider whole body donation. They also found that exposure to the cadaveric dissection room without active dissection of the cadavers had the lowest willingness for whole body donation of all the groups.

A number of proposed explanations have resulted from these findings relating dissection and willingness for the donation. One such explanation is negative perceptions of the dissecting due to disrespect of the cadavers (Anywanwu 2014). The critical detail from this assessment is

that, although we are aware of the need for increased education on whole body donation, the medical professionals who are the first to educate about this donation are themselves unwilling to register. This may negate the general argument that increased knowledge about the usefulness of cadaveric dissection should increase willingness for whole body donation. However, I propose that another aspect of cadaveric education is equally important for evaluation of willingness to donate—participation in a cadaver-based Anatomy course. In this course, students experience firsthand the benefits of learning about the human body and its anatomy from a prosected cadaver, without dissecting the cadaver themselves. It could be concluded that mutilation and dissection of the cadaver itself leads one to be unwilling for this donation, while understanding the benefits and learning from it does the opposite. In my analysis, survey respondents were therefore assessed for both participation in cadaver-based Anatomy, in which a prosected cadaver is utilized for education, and participation in Advanced Human Dissection, through which students learn anatomy while dissecting a cadaver.

As for the general public, research has shown that less formal education, being in a certain age bracket, race, and religion have strong correlations with decreased willingness for the donation. Boulware, Ratner, Sosa, Cooper, LaVeist, and Powe (2002) implemented a randomized phone survey study in the state of Maryland, focusing on elements including willingness for organ and whole body donations, and the demographic factors of those groups unwilling to undergo either organ or whole body donation. They found that there are different factors associated with unwillingness for the two donations. Mistrust in hospitals was significantly related to disapproval of both types of donation. Discrimination beliefs were also correlated with unwillingness for organ donation. In particular, a disapproval of whole body donation was attributed to a myriad of factors—religion and spirituality, lack of secure

employment, race, and increase in age. Race was the most significant factor, with African Americans being less willing for the donation than Caucasians due to discrimination beliefs and mistrust in hospitals. An increase in religious practices was attributed to the desire to have a funeral and burial, as well as a belief of the afterlife, resulting in a decreased willingness for whole body donation. The study determined the different factors associated with the two types of donations, and thus asserted that efforts to improve their donation rates should be allocated differently.

Numerous research studies have assessed the demographic factors that play into a person's willingness for whole body donation. Studies have attempted to pinpoint these groups that are most likely to donate. Researchers Halou, Chalkias, Mystrioti, Iacovidou, Vasileiou, and Xanthos (2013) had a goal of examining the demographic characteristics of those willing to donate in Greece, as well as reaching an overall conclusion about Greece's acceptance of whole body donation. They point out that there is a worldwide shortage of cadaveric donations, including in Greece. Through a survey questionnaire implemented in five major cities, they determined that certain demographics indicated a person's willingness for body donation. These included family income, education level, secure employment, and one or more medical conditions in the life of the respondent. Lack of secure employment and decreased income could illustrate that the respondent has more pertinent concerns than considering donating to help others. The same explanation could be applied to the respondent having chronic, debilitating conditions or illnesses affecting him/her or a family member. The researchers also found a correlation between strong religious beliefs and unwillingness to donate whole bodies to science, which has previously been found and explained as the desire to be buried in a casket and a belief of the afterlife. This study serves to illustrate a more recent conclusion regarding religion and

other pertinent demographic factors that are significant with decreased willingness for this donation. Researchers McClea and Stringer (2010) identified whole body donors who donated their bodies to a medical school in New Zealand. They found that the average age at the time of registering to become a whole body donor was 50 years of age. They note that few donors were in the health care profession, and none were physicians. Reasons for becoming a whole body donor were reported to primarily be for the purpose of increasing medical science and education.

Most recently in the United States, the groups of people willing for this donation are white males or females of older age with some post-high school education (Asad 2014). In order to increase donation numbers and fulfill the growing need for cadaveric donation, it has been recognized that education and awareness of this donation must begin in earlier age groups in order to improve willingness at younger ages. We also know that of those who register for whole body donation, they do so mainly for altruistic reasons such as the desire to help people, as well as to bring meaning to their life after death (Boulware 2014). Occasionally we find that donors register for monetary reasons, such as avoiding funeral costs. However, most all populations surveyed are opposed to ideas of monetary gifts in exchange for this donation (Boulware 2014). No explanation has been given for this finding; however, it could be for reasons similar to opposition for monetary exchange for other types of donations such as organ donation. Such donations may possibly be viewed as selfless—giving acts that would mean less if they were to gain from their donation.

A recent study conducted by Larna, Mcquone, Schober, Loukas, and Terrell (2015) in Erie, Pennsylvania assessed the study population's willingness for whole body donation, as well as the respondents' perceptions of what whole body donation entails. They found that the respondents were willing to consider the donation and reported understanding the importance of

the donation, but did not possess knowledge regarding steps involved in registering as a whole body donor or what will happen to the donor's body after the donation. The authors suggest that a lack of understanding regarding the process of whole body donation could play a role in the relative shortage of whole body donations. This study investigated the concept that, possibly, an assessment of explanations for the lack of adequate donation numbers is equally important as identifying demographics and factors associated with willingness for the donation.

Bolt, Venbrux, Eisinga, Kuks, Veening, and Gerrits (2010) sought explanation for the unique rise in whole body donation in the Netherlands. Bolt and authors would later report in an additional study (2012-2013) that around that time there were 16,000 living registered body donors, making up 0.1% of the population. This number was founded by considering the number of donors registering in previous years who are still living. They estimated at the time about 650 body donations were needed per year in their country. The initial study (Bolt et al 2010) surveyed nearly 1,000 registered donors in the Netherlands in an attempt to describe the motives for increased donation acceptance and to explain the rise in numbers. They found that although a majority of donors desire to bring meaning to their life by providing their body for use after death, a significant majority of respondents also had a negative connotation associated with funerals. Furthermore, less than 10% registered due to monetary issues that would cause them to choose this alternative over a funeral or burial. Contrary to what was perceived beforehand, this study found that donors register for personal benefit rather than altruistic reasons alone. Inclusion of this study allows one to recognize that although it is the exception to the rule, whole body donation has seen an increase in willingness elsewhere in the world. This leads one to speculate that through the same education and subsequent change in opinion in the Netherlands, it is

logical to assume the United States could see an increase in whole body donation willingness as well.

Another factor shown to correlate with increased willingness for whole body donation is being an organ donor. An early study conducted by researcher Sanner (1994) surveyed a large sample of the population in Sweden in order to determine the public's willingness for post-mortem autopsy, organ donation and whole body donation. The most vital finding of the study found that most of those who were willing to participate in whole body donation were also willing to participate in organ donation. The study also found that in order to further medical knowledge and research regarding causes of death, this population was more likely to be willing for an autopsy to be conducted on their body after death. This has important implications in considering populations inclined to participate in whole body donation. Those who are previous organ donors or are accepting of organ donation will most likely also be keen on whole body donation.

Another study published by Sanner (1997) focused specifically on the opinions of those who are known bone marrow donors with various donations and post-mortem procedures. Nearly one quarter of bone marrow donor respondents expressed willingness for whole body donation. Overall, the donors were more accepting of all bodily donations than those who were not already bone marrow donors. No significant explanation for the findings was given; however, the common explanation for this finding is those who are willing to give to others while alive will most likely be willing to donate after death.

Meanwhile, the same has not been assessed with blood and plasma donors. These donations require less commitment from an individual than donating organs or bone marrow, and therefore, would comprise a different group of people who are willing to give during life. As

they are the two most fundamental donations that allow a person to contribute to others with the least consequence to the donor, it is necessary to deduce from these factors how they play into willingness for whole body donation. This study explores the possibility of correlations between being a blood or plasma donor and being willing for whole body donation. It takes the known research one step further into the process of determining what groups and lifestyle factors play into willingness for whole body donation, thus uncovering possible stepping-stones to improving the population's willingness for donation. Increased education of whole body donation could be met with higher approval and willingness if it first begins with education on blood and plasma donation. Later, those who are willing to participate in these basic donations could be more receptive to education on the importance of whole body donation.

Research that most directly contributed to this study is a cross-sectional survey implemented in India by Ranjan, Jain, and Jha (2014). Similar to previous studies, their survey aimed to determine the characteristics of whole body donors. However, this research focused on a study population with recent hospital exposure. They found that religion, age, and lower education had significant associations with decreased willingness for this donation. They also concluded from their results that patients with increased length of hospital stays showed increased willingness for whole body donation. Ranjan, Jain, and Jha vaguely attributed this relationship to patients' exposure to the value and benefit of the donation, yet no further explanation was provided. Guidelines and procedures for improving whole body donation willingness were suggested. The authors included both blood and organ donation as factors needing assessment of willingness for whole body donation. Those factors are a significant portion of what my research is aiming to assess. This study explores these factors, as well as

participation in cadaver-based Anatomy, in order to reach conclusions regarding these variables and their relationships with willingness for whole body donation.

### **Survey Development and Administration**

The basis of this study utilizes a survey and depends on accurate, truthful responses by the study sample. The survey (see Appendix A) consists of mostly yes or no questions, as well as one short answer question and demographic inquiries such as gender and age. Some of the questions include assessing for academic major, year in school, blood and plasma donation history, participation in cadaver-based Anatomy, participation in Advanced Human Dissection, awareness of whole body donation, and willingness for whole body donation. Respondents were prompted to explain why he or she is willing or unwilling for this donation. An experimental design committee helped to develop this questionnaire that is sociologically precise, statistically testable, and biologically appropriate. This committee is made up of Human Dissection and Anatomy professor Dr. Alla Barry, Biology professor Emeritus Dr. James Jackson, Biology professor Jason Willand, and Sociology professor Dr. Jill Greer. The survey was prepared and gained exempt IRB approval, determined so by the involvement of non-vulnerable subjects, the level of risk to subjects, and the type of research activity being conducted. The survey was implemented on campus at Missouri Southern in the spring 2015 semester with agreement by professors and participation from their classes, through which the surveys were handed out to students and completed during various class times.

The population of this study is made up of both previous and current students at Missouri Southern State University. There is no specificity on age, gender, race, major, or any other factor that would prevent one from participating. Students who are known to have previously

taken a cadaver-based Anatomy course at Missouri Southern were approached or contacted for participation in the study. Similarly, those who are no longer students at Missouri Southern State University were contacted through email and social networks for voluntary participation. In addition, randomly selected classes of non-science affiliation that included students who are unlikely to have taken Anatomy were approached for participation. These included Finance, Honors Program, and Education classes. The resulting acquired sample includes a total of 261 responses to represent the study population; 141 students responded as not having taken cadaver-based Anatomy, and 120 responded as having taken cadaver-based Anatomy.

### **Statistical Analysis**

After completing the collection of survey responses, analysis began with inputting all responses into an Excel spread sheet by question category. Each response was then coded for appropriate de-identification, i.e. male=1 female=2. Several open-ended demographic responses were placed into categories for better viewing of the responses and statistical analysis. For example, age was coded into four categories: 1 being less than or equal to 20 years of age, 2 being 21-25 years of age, 3 being 26-30 years of age, and 4 as being greater than thirty years of age. The same was done for responses to an open-ended question prompting the respondent to write his or her major (Table 1). The second step of analysis was to derive the main findings associated with the raw data as a whole. Statistical evaluation of the data then followed in order to reach statistically significant conclusions for discussion. This was done through an Excel statistical analysis program that allowed for comparison of the categories. Further statistical tests, univariate analysis of variance (ANOVA) and Chi-Square, were run through Statistical Program for the Social Sciences (SPSS).

**Table 1:** College major groups

Group	Major	Number of respondents
1	<u>Pre-Professional/Clinical</u> Pre-medicine Pre-dental Pre-Physical Therapy Pre-Physician Assistant Pre-Pharmacy Pre-Veterinarian	n=34
2	Nursing	n=54
3	<u>Physical Sciences/Non-Clinical</u> Biology Biochemistry Environmental Health and Safety Biomedical Science	n=60
4	<u>Health Sciences</u> Health Promotion and Wellness Kinesiology Health Science Dental Hygiene Radiology Medical Technician	n=20
5	Mathematics Physics Engineering	n=2
6	<u>School of Education</u> Elementary Education High School Education English Education Physical Education Foreign Language Education	n=32
7	<u>Social Sciences</u> Communications Public Relations Human Resources Psychology Sociology Foreign Language International Studies Criminal Justice	n=8

**Table 1 Continued**

8	<u>School of Business</u> Accounting Finance Human Resources Management Business Economics Marketing Management Computer Information Systems Computer Forensics	n=36
9	<u>Arts and General Studies</u> Writing Art General Studies Undecided	n=7
10	<u>Dual Majors</u> Any combination of two of the above categories	n=8

**Results**

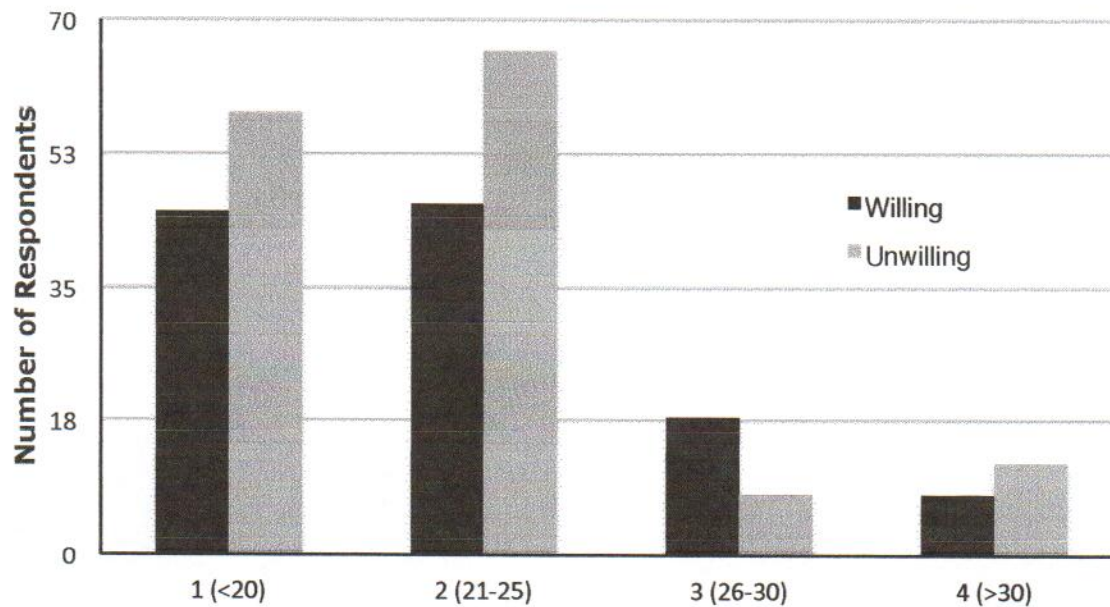
Initial data analyses are as follows: the average age of respondents is 22.64 years, with a range from 18-50 years of age. Concerning gender, 87 or 33.3% of respondents identified as being male while 174 or 66.7% identified as being female. Regarding grade level, 6.9% identified as freshman, 19.9% as sophomores, 31.4% as juniors, 36% as seniors, 4.6% as graduated, and 1.15% as previously graduated but currently seniors pursuing a different degree. As far as those who have taken cadaver-based Anatomy, this makes up 45.9% of respondents while 54.1% of respondents indicated they have not taken cadaver-based Anatomy. About 9% of the 261 respondents identified as having taken Advanced Human Dissection in the past, and their responses were analyzed for comparison to those who have not taken the Dissection course.

Pertaining to whole body donation, 70% of respondents indicated they are aware of the donation. Whether or not they were aware of the donation prior to the survey, after being given a

sentence on the purpose of whole body donation 95.4% of all respondents believed that whole body donation is important to society. Furthermore, preliminary willingness results show that 39.4% of respondents identified as being either mildly or strongly willing for whole body donation, 20.3% as undecided, and 40.22% being mildly or strongly unwilling for this donation. The total mean for ranking of willingness was 2.95, on a Likert scale that listed 1 as being strongly unwilling and 5 as being strongly willing. In regards to monetary compensation, 53.25% of respondents marked they would be more willing for the donation should their descendants receive monetary compensation for their body donation. These findings were compared with other categories to determine whether there is any significance in correlation with other factors assessed.

Statistical analysis revealed that being aware of whole body donation prior to the survey was not significant with an increase in believing that whole body donation is important to society. Awareness of the donation was, however, found to be nearly significant with an increase in willingness to consider whole body donation ( $p=0.058$ ). Awareness was not found to be significant with an increase in ranking of willingness ( $p=0.333$ ). Participation in cadaver-based anatomy was not significant with an increased willingness for whole body donation ( $p=0.072$ ) (Figure 3), or with increased ranking of willingness for the donation ( $p=0.689$ ). Participation in cadaver-based anatomy and increase in age were found to be collectively significant with increased ranking of willingness for the donation ( $p=0.026$ ), though age alone was not significant with an increased willingness ( $p=0.068$ ). Figure 1 illustrates willingness by age grouping, with respondents of ages 26-30 being the only age group with more respondents identifying as willing for the donation than unwilling. Reasoning behind this finding may be attributed to perhaps having thought about death and dying more so than the younger age groups, while the eldest age

range may be more likely to have a spouse or family and therefore would have taken into consideration what their family would desire after they pass. One could hypothesize that an increase in respondents of higher age could more appropriately represent the willingness of respondents in those older age groups.

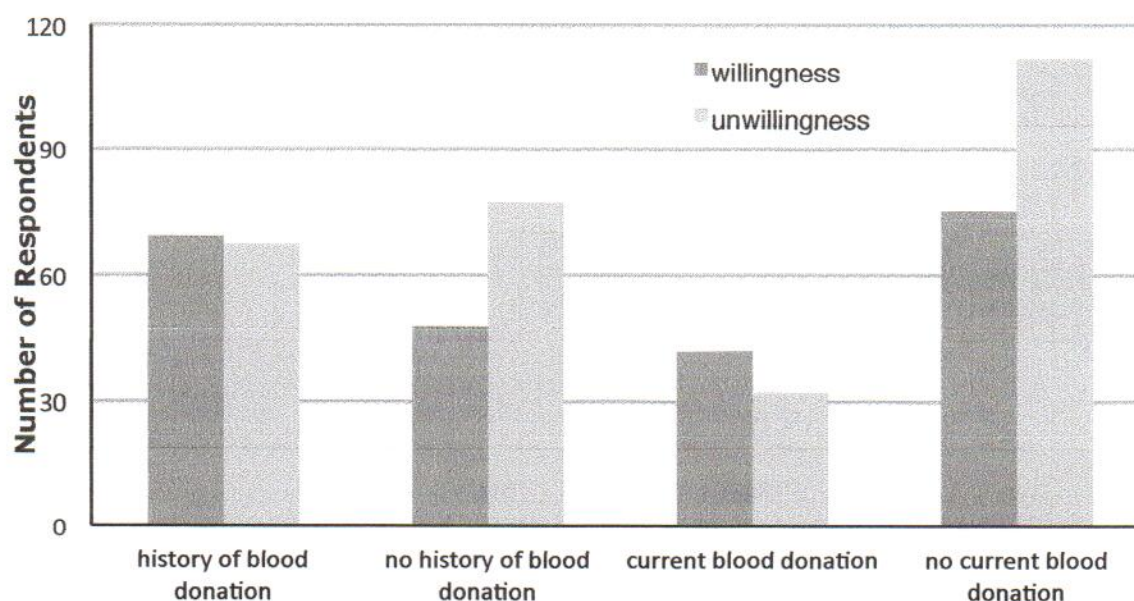


**Figure 1:** Associations between age and willingness for whole body donation

Having a history of plasma donation was found to be significant with an increase in willingness ( $p=0.02$ ), while being a current plasma donor was not significant with increased willingness ( $p=0.338$ ) (Table 2). Both having a history of blood donation and being a current blood donor were significant with an increase in willingness to consider the donation ( $p=0.045$  and  $p=0.015$ , respectively) (Table 2) (Figure 2).

	History of Blood Donation		History of Plasma Donation		Current Blood Donor		Current Plasma Donor	
	Yes	No	Yes	No	Yes	No	Yes	No
Willing	69	48	29	88	42	75	12	105
Unwilling	67	77	15	129	32	112	10	134
P-value	P=0.045		P=0.002		P=0.015		P=0.338	

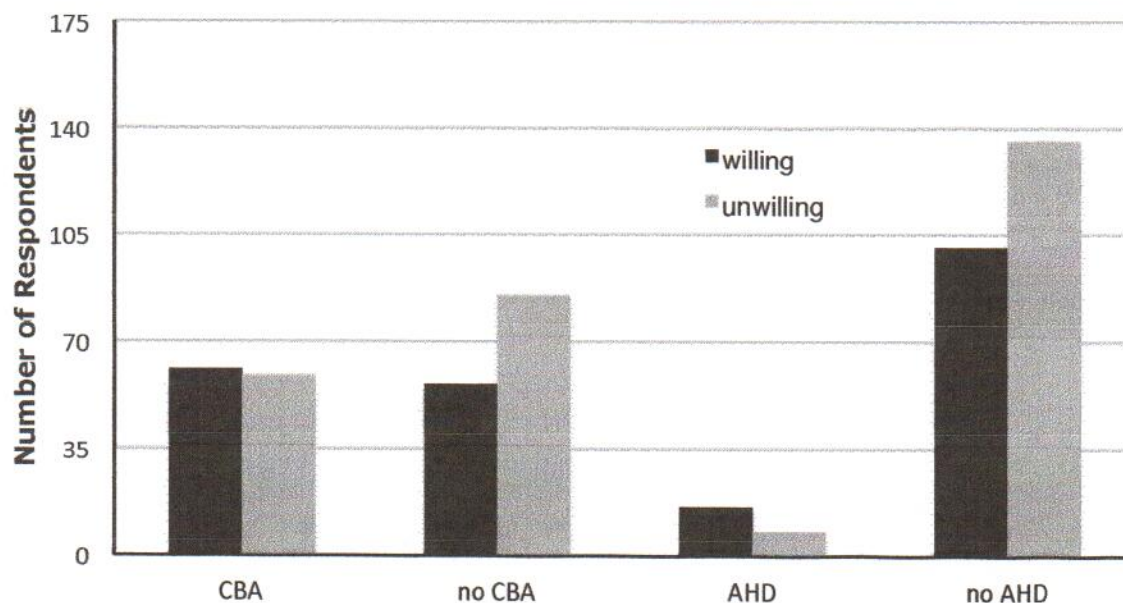
**Table 2:** Blood and plasma donations; associations with willingness for whole body donation



**Figure 2:** Blood donation and associations with willingness for whole body donation

It was also found that participation in cadaveric dissection through the Advanced Human Dissection course was significant with an increase in willingness for whole body donation ( $p=0.024$ ) (Figure 3). Participation in this dissection course was also found to be significant with an increase in ranking of willingness for the donation ( $p=0.014$ ), with an average ranking of willingness of 3.67 versus the entire survey population that had an average of 2.95. Additional statistics show that having identified as an organ donor on one's drivers license identification

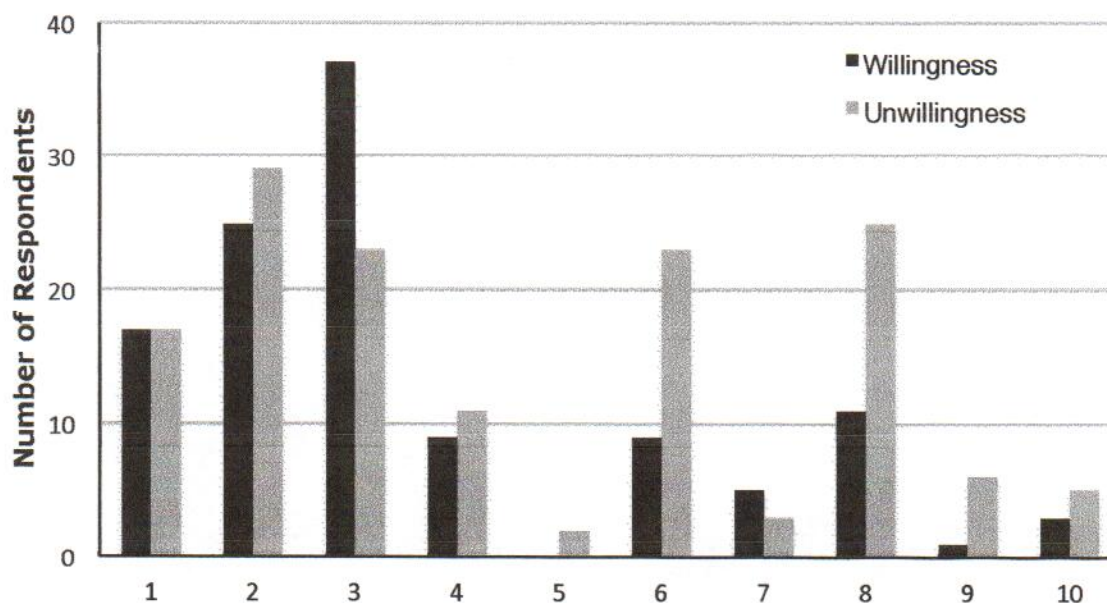
card was significant with an increase in ranking of willingness ( $p=0.00$ ). Increased ranking of willingness was also significant with identifying as being more willing for whole body donation if their descendants were to receive monetary compensation in exchange ( $p=0.00$ ).



**Figure 3:** Participation in cadaver-based Anatomy (CBA) and Advanced Human Dissection (AHD); associations with willingness for whole body donation

Neither year in school nor groupings of majors was significant with increased ranking of willingness for whole body donation. The two groupings of majors with the highest mean ranking of willingness for whole body donation were Physical Science (mean=3.20) and Social Sciences (mean=3.25) students. However, major was found to be significant with increased willingness to consider the donation ( $p=0.023$ ) (Figure 4). It is worth noting that due to the unequal distribution of respondents between majors, eight of the twenty cells in a comparison of college major and willingness had an expected count less than 5. Although the finding is significant for an increase in willingness for whole body donation, the statistical power becomes

suspect when several categories have a small sample size. Meanwhile, year in school was not found to be significant with an increase in willingness for the donation ( $p=0.258$ ). It was noted that identifying as either a senior or graduated were the only two groups that had more respondents identify as willing for whole body donation than unwilling for the donation.



**Figure 4:** Associations between major and willingness for whole body donation

### Discussion

Statistical results reveal that participation in blood and plasma donations are significantly associated with an increase in willingness to consider whole body donation. The same was found with being an organ donor on drivers license ID and an increase in willingness. These findings indicate that participation in these basic donations is significant with willingness to continue giving to others. It could also indicate that it takes a certain type of person to be willing for donation of any kind, and/or that one who donates could be more willing for several other types

of donations. This has important implications when identifying groups of people that will be more willing to participate in donation. Perhaps knowing this, gearing education on whole body donation towards existing donors would be met with more receptiveness and willingness for the donation.

There was no significant association with either an increase or decrease in willingness for the donation and participation in an Anatomy course with a prosected cadaver. However, significance for the combination of increase in age and participation in cadaver-based Anatomy with an increase in willingness for the donation could indicate a maturity factor involved. As mentioned in previous studies, willingness for whole body donation after cadaveric dissection is largely based on experience with the dissection and respect given to the cadavers. Perhaps this explanation could be applicable to participation in Anatomy; those of older age, who likely have increased maturity and therefore may give more respect to the cadavers, were found to have increased willingness for the donation. An interesting finding from this study was that participation in Advanced Human Dissection showed a significant increase in willingness for the donation. The relatively small sample of respondents who indicated as having taken this course ( $n=24$ ) relative to the entire study population ( $n=261$ ) makes the statistical power of this result less powerful. However, it should be noted that these students represent a comparatively small portion of the Missouri Southern State University student population, and therefore this value is an appropriate fraction of the total number of respondents for the purpose of this study. The finding is contradictory to previous research discussed, which found that participation in cadaveric dissection has been found significant in association with a decrease in willingness.

Although explanation of willingness from this survey cannot feasibly be evaluated statistically, several of the respondents' explanations are noteworthy and have been included for

reference as direct quotations (Appendix B). In general, review of all responses suggests that the majority of explanations for willingness included the desire to help others, wanting to aid in advancing science, and having no use for their body after death. Of all respondents who indicated as being unwilling for the donation, the majority of their reasoning included religious beliefs, discomfort with the idea, considering their family's desires, and a lack of knowledge regarding the donation. The population of respondents who identified as having taken cadaver-based Anatomy and were willing for the donation gave a myriad of reasons associated with their experience in dissection. A few of the written reasons are as follows: aware of the importance, desire to help others, aid in advancing medicine, appreciation of whole body donors and desire to 'pay it forward,' and personal benefit from whole body donation as a learning tool. Of those who have taken the course and indicated being unwilling, reasons included: desire to specify what the body would be used for, inability to have a funeral, family disapproval, and distaste with having their body dismembered. These explanations should be considered important for deducing factors associated with participation in the dissection that can be correlated with one having increased or decreased willingness for the donation.

It was noted that two of the 261 survey respondents identified in their explanation of willingness as already having registered as whole body donors. One of the respondents indicated as having taken both cadaver-based Anatomy and Advanced Human Dissection, while the other respondent indicated he or she had not taken either course. Both marked as having donated blood and plasma in the past. Neither respondent would have been more willing for the donation if his or her descendants would receive monetary compensation for the donation.

These findings add to the current knowledge regarding overall willingness for whole body donation and identify additional factors that are significant with an increase in willingness.

Supplementary studies of other, larger populations are recommended to further explore these findings. Numerous studies have mentioned the shortage of whole body donation numbers relative to the number of cadavers needed; however, few studies provide insight as to how we can hope to improve these numbers. I suggest that surveying for reasons related to willingness or unwillingness for the donation is an avenue of whole body donation where further exploration is needed. Though this was assessed in this study with respondents being prompted to elaborate on their ranking of willingness, this type of response is not reliable for statistical assessment. Beyond simply identifying demographics and factors that are significantly correlated with an increase or decrease in willingness for whole body donation, efforts should be made to better elucidate the reasons behind either willingness or unwillingness. Possible solutions could then be provided based on those findings. Education on the process and what it truly means to be a whole body donor, for example, could be expected to improve willingness as it has been found that many are willing to consider the donation, however, they have little to no knowledge about registering oneself as a whole body donor.

Based on the results from this study, I would suggest improvement of knowledge beyond just recognition of the term “whole body donation.” As indicated, many have awareness of whole body donation and nearly all feel that this donation is important to society. Almost 40% of respondents indicated as being willing for the donation, and another 20% as being undecided. However, I would argue that a very small portion of those respondents are aware of what it means to be a whole body donor and how to actually register and become a whole body donor. I assert that increased knowledge of the resources available is necessary to provide an improvement in not only willingness for the donation, but also the number of registered whole body donors, as willingness to consider the donation does not necessarily equate to becoming a

whole body donor. Education on the realities of the donation process and how one can register to become a whole body donor can be implemented through direct person-to-person contact and informative discussion in donation clinics, hospice environments, nursing home facilities, and situations throughout the community.

### **Reflection**

The fact that such a wealth of research is being conducted on factors associated with willingness for whole body donation shows the dire need for assessment of willingness. There would not be such an emphasis placed on identification of factors associated with willingness for the donation if there were an adequate number of donors to fulfill the need for cadavers. While I have come to understand this reiterated concept as fact, I understand the implications that come with making an assertion without tangible evidence to support it. My rationale would be that the evidence stems from previous assertions from professional researchers on the topic. I remain convinced that improvement in this notion, with statistical values to support the claims that whole body donation numbers are not meeting the demand, is essential. Though after conducting my own research on the topic and gathering previous information, I have come to understand the difficulties in gathering such statistical data. For instance, each medical school or university in Missouri has their own whole body donation program through which donors can register. Hence, it is difficult to determine how many whole body donors are registered in the state of Missouri, let alone the entire country.

As with any research study, evaluation of results and outcomes can lead the researcher to contemplate aspects of the study that could have been done better. Should I have the chance to conduct this research again, or if someone else were to repeat this study, I would first suggest a

few modifications be made to the survey. The benefit of open-ended questions is to allow for the respondent to answer openly without being forced to identify with one of a number of pre-assigned categories to choose from. However, these types of questions are difficult to assess statistically. An example of this would be assessing for college major. As respondents were prompted to write in their major, the result was more than one hundred variations of majors across campus. This makes the responses very difficult to place into categories and appropriately group for use as coded data to statistically analyze. I assert that this is a downfall of that assessed factor, as the majors could have been coded any number of different ways and resulted in different statistical significance. While I believe the majors have been adequately categorized in this study based on area of study, looking at the results allows me to believe they could have been grouped differently for better evaluation. For example, each individual category in the sciences was grouped individually with the consideration that emphasis on learning from human cadavers is different for each of the sciences. In retrospect, less specific grouping of these majors would have given better representation in comparison to the other majors across campus that were grouped rather generally. In addition, for statistical purposes the majors could have been grouped more generally throughout, to give a more equal number of respondents in each.

Another example of the open-ended question difficulty is the respondents' short answer response for explanation of their ranked willingness. Prior to survey administration, giving a list of options to this particular question was purposefully avoided with the intention of preventing respondents from being given ideas to associate with their thoughts and opinions on the donation. Though this is extremely interesting and allows for insight into justifications behind both willingness and unwillingness, there is no adequate way to categorize these responses for utilization in statistical analysis. I assert that reasoning behind willingness or unwillingness for

whole body donation is an important facet for assessment, however I now realize the difficulties behind drawing conclusions based on the explanation given. Perhaps a more exhaustive list of multiple-choice options would suffice for general reasons that respondents could choose from. After review of the explanations given, this list could include: religious beliefs, family's desires, discomfort with the idea, awareness of the importance of the donation, the desire to help others, and the desire to aid in medical advancements, among numerous others. This list could continue on indefinitely, and likely would still lack a sufficient number of responses for a respondent to appropriately identify with. However, an area of improvement or change would be to make all questions have a list of possible answers, therefore providing for more definitive and accessible answers for statistical analysis.

As for actual survey implementation, I feel that there would be no "too large" of a sample size in this study. Increasing the sample size used to represent the study population would give for more statistical relevance of the data and likely give better statistical power. For example, an increase in the sample size would, even by chance, result in better distribution of the college majors across campus for better representation of the study population. Another aspect of college major that could be improved is the disproportion of sample size between each major. As discussed previously, college major was significantly associated with willingness for the donation, however, it was noted that several groups had small sample sizes and therefore the significance should be taken with caution. An avenue for improvement would be taking into consideration the types of students surveyed and which area of campus and subsequent majors could be better represented in the study with participation.

As illustrated in the introduction, development of this thesis was largely based on my review of the literature. I ascertained that studies on the topic were largely survey-based with

random sampling of a given population, and found such a method would be appropriate in the college setting. Initially, I began with the plan to assess Missouri Southern State University's overall willingness for the donation and to pinpoint demographic factors correlated with willingness or unwillingness for the donation. Previous research has shown significant associations between religious beliefs and unwillingness for whole body donation and has explored the possible explanations. Being that Missouri Southern is located in the "bible belt" region of America I was intrigued to assess this population in that regard. However, after completion of my literature review I ultimately decided to attempt to provide new findings to the already vast amount of information and knowledge regarding factors associated with willingness. This led me to incorporate additional factors that had seemingly not been assessed in correlation with willingness, resulting in the factors under assessment in this study.

Those considering whole body donation will find a plethora of informative sites through a simple internet search. There are a myriad of organizations one can register through to become a whole body donor, including universities as well as programs developed specifically for whole body donation. It is worth noting that donors cannot always elect to direct their donation to a certain destination, depending on the organization one registers through. In effect, when one makes this donation his or her body may be utilized for one of many purposes. This is why some respondents expressed the reason behind their unwillingness to donate as an inability to decide where their body would go and what it would be used for. Specifically, one respondent stated his or her desire not to be left out in a field to rot, a practice for use in forensics research and studying the timeline of bodily decay under various conditions. Registering through a medical university program, however, ensures that the gracious donors' bodies are utilized as cadavers for educational purposes such as the courses described in this research study.

My own participation in Advanced Human Dissection has given me a unique view as a researcher on the topic. I find myself empathizing with nearly all justifications, both willing and unwilling, for the donation. I am aware of the donation and fully comprehend the usefulness and importance of the donation. I have learned firsthand how the donation makes an impact on the lives of those who are fortunate enough to utilize cadavers for education, resulting in tremendous gratitude for those who have surrendered their bodies to dissection. I also comprehend, and have witnessed, the unfortunate disrespect the donors can receive as cadavers for dissection, often in the form of making jokes at the expense of the cadaver in order to make the dissector more comfortable in this intimate situation. I can appreciate the desire to have a funeral and to be buried, rather than to be cremated and returned to your loved ones after you have fulfilled your purpose as a whole body donor. Even still, I find myself very willing to become a whole body donor and support it as a crucially important donation with an infinite number of benefits to mankind. I believe I myself would register through a medical university in order to ensure my donation will be used to benefit the future of medicine, as that is where my passion lies.

I would like to take this time in closing to express tremendous gratitude toward the cadavers who have been involved in my education, and give my sincerest of thanks and admiration to whole body donors across the world.

### References

- Alexander, M, M Marten, E Stewart, S Serafin, and G Strkalj. 2014. Attitudes of Australian chiropractic students toward whole body donation: a cross-sectional study. *Anatomical Sciences Education*, 7(2): 117-23. Web. 11 March 2015.
- Anteby, M, F Garip, PV Martorana, and S Lozanoff. 2012. Individuals' decision to co donate or donate alone: an archival study of married whole body donors in Hawaii. *PLoS One*, 7(8): e42673. Web. 21 Sept. 2014.
- Anyanwu, E and E Obikili. 2012. Dissecting the dissectors: knowledge, attitude, and practice of body bequests by Nigerian anatomists. *Anatomical Sciences Education*, 5(6): 347-53. Web. 11 March 2015.
- Anyanwu, E, E Obikili, and A Agu. 2014. The dissection room experience: a factor in the choice of organ donation and whole body donation - a Nigerian survey. *Anatomical Sciences Education*, 7(1): 56-63. Web. 11 March 2015.
- Asad, AL, M Ateby, and F Garip. 2014. Who donates their bodies to science? The combined role of gender and migration status among California whole body donors. *Social Science Medicine*, 106: 53-8. Web. 9 Sept. 2014.
- Bolt, S, E Venbrux, R Eisinga, and P Gerrits. 2012. Anatomist on the dissecting table? Dutch anatomical professionals' views on body donation. *Clinical Anatomy*, 25(2): 168-75. Web. 11 March 2015.
- Bolt, S, E Venbrux, R Eisinga, JBM Kuks, JG Veening, and PO Gerrits. 2010. Motivation for body donation to science: more than an altruistic act. *Annals of Anatomy*, 192(2): 70-4. Web. 9 Sept. 2014.
- Bolt, S, R Eisinga, M Altena, E Venbrux, and PO Gerrits. 2012-2013. Over my dead

- body: body donation and the rise in donor registrations in The Netherlands. *Omega (Wesport)*, 66(1): 55-77. Web. 9 Sept. 2014.
- Boulware, LE, LE Ratner, LA Cooper, TA Laeist, and NR Powe. 2004. Whole body donation for medical science: a population-based study. *Clinical Anatomy*, 17(7) 570-7. Web. 9 Sept. 2014.
- Boulware, LE, LA Ratner, JA Sosa, LA Cooper, TA LaVeist, and NR Powe. 2002. Determinants of willingness to donate living related and cadaveric organs: identifying opportunities for intervention. *Transplantation*, 73(10): 1683-91. Web. 9 Sept. 2014.
- Boulware, LE, MU Troll, NY Wang, and NR Powe. 2006. Public attitudes toward incentives for organ donation: a national study of different racial/ethnic and income groups. *American Journal of Transplantation*, 6(11): 2774-85. Web. 9 Sept. 2014.
- Christensen, AM. 2006. Moral considerations in body donation for scientific research: a unique look at the University of Tennessee's anthropological research facility. *Bioethics*, 20(3): 136-45. Web. 9 Sept. 2014.
- Green, C, D Bowden, D Molony, N Burke, P Felle, and S Dudeney. 2014. Attitudes of the medical profession to whole body and organ donation. *Surgeon*, 12(2): 73-7. Web. 9 Sept. 2014.
- Green, JRT. 2003. Effects of detailed information about dissection on intentions to bequeath bodies for use in teaching and research. *Journal of Anatomy*, 202(5): 475-7. Web. 21 Sept. 2014.
- Halou, H, A Chalkias, D Mystrioti D, N Iacovidou, PV Vasileiou, and T Xanthos. 2013.

- Evaluation of the willingness for cadaveric donation in Greece: a population-based study. *Anatomical Sciences Education*, 6(1): 48-55. Web. 9 Sept. 2014.
- Harrington, D and E Sayre. 2006. Paying for bodies, but not for organs. *Regulation*, 29(4): 14-9. Web. 20 April 2015.
- Larner, S, B Mcquone, J Schober, M Loukas, and M Terrell. 2015. Perceptions of the living dead: an assessment of knowledge and opinions about whole body donation, its process, and willingness to become cadaveric donors in Pennsylvania. *Clinical Anatomy*, Doi: 10.1002/ca.22516. Web ahead of print. PubMed. 11 March 2015.
- McClea, K and M Stringer. 2010. The profile of body donors at the Otago School of Medical Sciences – has it changed? *New Zealand Medical Journal*, 123(1312): 9-17. Web. 11 March 2015.
- Ranjan, Rajiv, A Jain, and K Jha. 2014. Evaluation of awareness of voluntary body donation among hospital visiting population in Ujjain, India. *International Journal of Medical and Applied Sciences*, 3(1): 116-21. Web. 23 Sept. 2014.
- Richardson, R and B Hurwits. 1995. Donors' attitudes towards body donation for dissection. *Lancet*, 346(8970): 277-9. Web. 9 Sept. 2014.
- Roach, Mary. 2004. *Stiff : the curious lives of human cadavers*. Print.
- Sanner, M. 1994. A comparison of public attitudes toward autopsy, organ donation, and anatomic dissection: a Swedish survey. *The Journal of the American Medical Association*, 271(4): 284-8. Web. 24 Sept. 2014.
- Sanner, M. 1994. Attitudes toward organ donation and transplantation. A model for understanding reactions to medical procedures after death. *Social Science Medicine*, 38(8): 1141-52. Web. 21 Sept. 2014.

Sanner, MA. 1997. Registered bone marrow donors' views on bodily donations. *Bone Marrow Transplant*, 19(1): 67-76. Web. 9 Sept. 2014.

**APPENDIX A**

Donation Analysis Survey  
Danielle Severns  
Spring 2015 Semester

*Disclaimer: All responses on this questionnaire are treated with confidentiality. You are requested not to include your name anywhere on the questionnaire.*

What is your gender? Circle one: Male Female

What is your age? \_\_\_\_\_

What year are you in school?

Circle one: FRESHMAN SOPHOMORE JUNIOR SENIOR GRADUATED

What is your major? \_\_\_\_\_  
(If graduated, what was your major?)

If graduated, what is your current occupation? \_\_\_\_\_

1. Have you taken an Advanced Human Dissection course, either through Missouri Southern or elsewhere? Circle one: YES NO
2. Have you taken a cadaver-based Anatomy course, either through Missouri Southern or elsewhere? Circle one: YES NO
3. Have you indicated on your driver's license ID as being an organ donor? Circle one: YES NO
4. Are you currently a blood donor? Circle one: YES NO  
Have you ever donated blood in the past? Circle one: YES NO
5. Are you currently a plasma donor? Circle one: YES NO  
Have you ever donated plasma in the past? Circle one: YES NO
6. Are you aware of whole body donation? Circle one: YES NO

**FLIP OVER TO PAGE 2**

Whole body donation is the donation of a person's entire body after death, for the purpose of use in scientific education and research.

7. Would you be willing to register as a whole body donor?

Circle one: YES NO

8. How would you rank your willingness to register as a whole body donor?

Circle one: 1 strongly unwilling  
2 mildly unwilling  
3 undecided  
4 mildly willing  
5 strongly willing

9. Give a short explanation for the ranking of your willingness in question #8.

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10. Would you be any more willing for this donation if your family/descendants were to receive monetary compensation in exchange for your donation?

Circle one: YES NO

**END OF SURVEY**

*Thank you for your participation.*

## APPENDIX B

### Explanations of willingness and unwillingness for whole body donation

#### Willing

“Having worked in the field and taken the dissection class, I’m aware of the importance of whole body donation.”

“After I’ve passed away, I know I don’t need my body anymore. If it could help others live or lead to new medical advancements, I would definitely do it.”

“I have personally benefitted from whole body donation. Cadaver dissection is an invaluable learning tool.”

“Having access to a cadaver in undergraduate and in graduate school has been of huge benefit and advantage to my education. I am appreciative of the whole body donors and I hope to one day pay it forward.”

“I believe my body is only a vessel and my soul is what matters.”

“People who donate their whole bodies to the anthropological body farm on TV have helped investigators better understand body decomposition for murder victims, I want to do that!”

“I want to help others while on this Earth and even when I pass.”

“As a graduate with intentions of going to medical school, I want to be able to train the next generation through my gift.”

“As a Christian I don’t believe I need my body in any capacity after death.”

“I am on the fence about it. I know how important it is. I guess it makes me nervous to think about dying.”

“Necessary for the progression of human and health sciences.”

“Don’t really want cut in half but it would be for a good cause.”

“It saves lives.”

“I have learned from a cadaver but I would have to see what my family would also want.”

#### Unwilling

“I would not donate my body or my parents’ bodies for whole body donation. I know too much!”

“After those (dissection) experiences, is it a hard choice to make that carries much weight. I don’t think I want my body dismembered and skinned.”

“I would want to know my body was being used for scientific advances or education, not a crash dummy or training exercises for canines to find you in the middle of the desert.”

“The only way I would consider donating my body is if I were able to specify what it would be used for.”

“Low self-esteem.”

“I have children who might want to cremate and save ashes as our usual tradition.”

“Being only 18, it makes the decision somewhat difficult. However, in the future I think I would be more likely to consider a whole body donation.”

“It just scares me. I know I would be deceased but I just don’t like the thought of it.”

“I would be a little hesitant about donating my body more because of my family than anything. I don’t know how they’d react to not being able to bury their daughter’s body.”

“I still feel emotional attachment to my own body.”

“I would donate parts but not whole.”

“My religious beliefs would prevent this.”

“It is disturbing for me to think of my body getting poked, prodded, and examined after I am dead.”

“I think the process of burying the body and seeing the body to say good bye is important for acceptance and for the grieving process.”

“I do not feel comfortable with others viewing and seeing my body after death.”

“I’m not ready to think about my body after death or dying yet.”

“I am not trying to be a lab experiment.”

“I would only donate my body if I happen to develop an extremely rare condition or disease.”

“I would prefer to donate my organs to someone who needs them, which I could not do and also be a whole body donor.”

“The idea of being harassed after my death makes me uncomfortable.”

“I have not really thought about it and would need to know more to make a decision.”

“I feel that is a decision to make later on in life, not right now.”

“I believe after death the remains of my body should be left with my children for their choosing what to do to help them move on.”