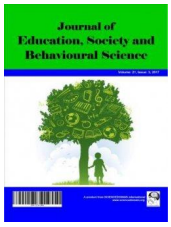

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My How Cute You Are! An Examination of the Factors that Predict the Likelihood of Research Protocol Approval in a Mock Institutional Animal Care and Use Committee

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Authors' contributions

This work was carried out as a collaborative effort between both authors. Author DMC designed the study and wrote the first draft of the manuscript. Authors DMC and LLL constructed the survey instrument and participated in the data collection. The data were analyzed by author DMC. Both authors managed the literature searches. Both authors read and approved the final manuscript.

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ABSTRACT

While research suggests that the level of public support for the use of animal models in biomedical research remains high, there is considerable ambivalence driven by a variety of personal attitudes, personality traits, and misperceptions about animal research. In the present investigation, individuals within the academic community of a college - undergraduate and graduate students - were presented with a mock research proposal that varied by species. As part of a mock Institutional Animal Care and Use Committee (IACUC), the research participants received a request to review a research protocol and render a decision to either approve or reject the research proposal. In addition to a series of demographic items, the participants were queried about the perceived importance of the project, the suffering of the animals, and the amount the researcher has dissociated from the well-being of the animals. Last, the participants answered a series of items

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from a research-derived Perceptions About the Use of Animals Scale and the Emotional Intelligence Scale (EIS). Consistent with the reports of other investigators, female respondents were much less likely to approve the research protocol than male participants. Protocol approval rates varied as a function of the proposed species, with the use of certain species generally receiving less support. The ethical issues associated with the use of animals in experiments are briefly considered as well as the need for additional messaging about the role of animal research in the furtherance of biomedical research objectives.

Keywords: Animal research; animal rights; emotional intelligence; biomedical research; attitudes.

1. INTRODUCTION

Even in the 21st century, considerable disagreement remains about the role of nonhuman animals in behavioural and biomedical research as well as for other purposes [1]. While a number of arguments have been made in support of the continued use of animals for research and educational purposes, current discussions remain contentious [2,3,4]. Indeed, recent controversies brought to light by the animal rights and welfare community, have led to substantive changes in policy after intense public pressure. For example, the decision by SeaWorld to end orca breeding and phase out orca shows stemmed from the release of the documentary film Blackfish and public backlash against the theme parks [5,6].

A number of subject characteristics associated with attitudes toward animals and their use have been identified. These include age [7,8,9,10] and gender [11,12,13,14]. Of these two, gender has been a quite stable finding, with women generally holding more favourable (and protective) attitudes toward animals than men. Such attitudinal differences have often translated into overt action as evidenced by higher levels of female involvement in animal welfare and animal rights issues [15]. While past research has indicated that the ratio of female activists to their male counterparts is often as high as three to one [16,17,18; see also, 1,19 for a review), what drives this observed gender difference remains unclear [20].

Many factors influence how a given individual responds toward different animal species. The permissibility for the use of animals for research and other utilitarian purposes often differs in terms of how a given animal species under consideration is typically perceived. Animal species that are considered cute, cuddly, beautiful, or, in some cases, rare, are generally perceived in a more favourable light than species not typically described using such adjectives [21]. For example, in two studies, psychology majors and psychologists endorsed stronger opposition to invasive research that involved nonhuman primates or dogs than when the research subject was a rodent or bird [22,23]. Further, pet ownership is considered an important predictor of human concern for animal welfare [7,24].

Emotions are considered a normal and important part of human experience. While decisions about the use of animals in research involve cognitive, socio-cultural, and experiential elements, often such questions are influenced by emotion as well. Among humans, individual variation exists in terms of both the intensity and the variety of emotions experienced. Such variability extends to what a given individual considers most salient in terms of what to process [25]. Specifically, how individuals use affect-laden information that is of an intra-personal (e.g., management of one's own emotions) or interpersonal (e.g., managing the emotions of others) nature is highly variable. As a consequence, some individuals are more adept at perceiving, communicating, and using emotions [26]. Based on the framework developed by Mayer and Salovey [26], Schutte and colleagues created a brief self-report measure of emotional intelligence (EI), designed as a simple self-report measure of global EI [27]. While EI is primarily considered in the context of human interaction, it would seem reasonable to consider management of one's own emotions and others in examining personal responses related to acceptance of and permissibility of using animals in biomedical research.

The purpose of the present investigation was to explore which variables were related to participant decisions in a mock IACUC setting. Participants were required to review a research protocol that included one of four different research species. In doing so, the goal was to determine how consideration of a hypothetical research project using animals as research subjects was affected by the proposed species of

the research subject, demographic variables and subject characteristics such as age, race, and gender, the education and the emotional intelligence of the participant, as well as responses from the subscales derived from a recently developed Perceptions About the Use of Animals Scale. In addition, the potential contributions of the evaluator's perceived importance of the research project, the perceived pain and suffering of the animals, and the perceived level of researcher dissociation from the research subjects were considered.

2. METHODOLOGY

2.1 Participants

The participants consisted of 169 college students, of which 37 were male with 132 female respondents. All participants were either actively enrolled or had recently graduated from an urban mid-sized private university located in the southeastern United States. Of these, 71% identified as Caucasian/White, 12.47% as African-American or Black, 11.2% as Hispanic, with the remaining 5.3% of the participants identifying as Asian/Pacific Islander or of Indian decent. The age of the respondents ranged from approximately 18 to 54, with the modal age group (74%) identifying as between 18 and 24 years of age. The majority of the sample (69.8%, n = 118) identified as neither an animal right or animal welfare activist. Of the remaining respondents, 8.9% identified as an animal rights activist (n = 15), with 21.3% considering themselves an animal welfare activist (n = 36). As expected, the overwhelming majority (93.5%) of the respondents were raised with pet animals. All participation was voluntary, with the majority not receiving any course credit (if applicable) for participation.

2.2 Materials and Procedure

All data was collected electronically using the online data collection system, Survey Monkey (San Mateo, CA). The participants were recruited from various undergraduate classes or by student email. Survey questions included demographic information about the respondent, their personal views and feelings about the use of animals in research and for teaching purposes, and a series of items about the personal thoughts of the individual about animals and science. Written instructions were provided with each questionnaire, and the respondents the respondents were informed that their responses would remain anonymous and confidential. Last, the respondents were requested not to provide additional information or discuss the items with other respondents.

2.2.1 Design

The research design included a proposed research protocol that varied by the inclusion of one of four different nonhuman species. The species under consideration included (1) chimps, a species genetically similar to that of humans [28] (2) cats, a common pet animal that is sometimes used in research [29] (3) rats, among the most common rodent research models [29] and (4) a nonmammalian amphibian model, frogs. The species was chosen randomly for each participant by a computer algorithm as part of the Survey Monkey software. Thus, the primary experimental design and associated dependent measures consisted of an independent-samples 4 animal species design.

2.2.2 Emotional intelligence scale (EIS)

The Emotional Intelligence Scale (EIS) used in the present study consists of 33 Likert scale statements [27] derived from a model proposed by Salovey and Mayer [26]. The EIS measures differing EI domains including the use of emotions, the sharing and experience of emotions, the appraisal of emotion in self and others, and mood regulation [27].

2.2.3 Perceptions about the use of animals scale (PUAS)

The Perceptions About the Use of Animals Scale consists of a series of 22 statements about the use of animals in different situations as well as items about areas such as animal perceptions of pain, animal cognition, and self-awareness. Response alternatives were presented on a 7-point Likert scale ranging from strongly agree to strongly disagree. The items were adapted from general questions found throughout the literature as well as in internet discussions. Factor analysis suggested a four-factor solution. Factor 1 consists of a 7-item Animal Spirituality and Rights subscale, while factor 2 is a 5-item Use of Animals in Research subscale, The third and fourth factors include a five-item Animal Thought and Pain subscale and an Animal Self-Awareness and Evolution subscale, consisting of 5 items. While the preliminary results indicated that the first three factors have reasonable reliability, the reliability of the Animal Self-

Awareness and Evolution subscale suffered from marginally acceptable reliability.

2.2.4 Instructions to the research participant

Before reviewing the research proposal, all participants received the same instructions.

All institutions receiving federal funding for scientific research must have an active Institutional Animal Care and Use Committee (IACUC) to review and approve or deny all research conducted at the institution.

Pretend that you are a member of such a committee at Palm Beach Atlantic University. It is your responsibility to approve or reject research proposals submitted by members of the university community who want to use animals for research or instructional purposes in psychology, biology, etc. The proposal that follows describes an experiment, including the goals and potential benefits of the research as well as any discomfort or injury that the animals may experience. You must either approve the research or deny permission for the experiment.

It is not your job to suggest improvements in methodology and/or design. After reading the proposal, make your decision on the basis of the information given in the proposal (approve or deny) and answer all of the questions (beginning on the next page).

The proposal used in the present investigation was adapted from Herzog [30]. While the proposals reflected original submissions to a university IACUC, the proposals were updated to reflect changes in contemporary scientific research such as the use of induced pluripotent stem cells.

Professor King is working in a new and exciting research area of science, brain grafts. Induced pluripotent stem cells (also known as iPS cells or iPSCs) are a type of pluripotent stem cell that can be generated directly from adult cells (not embryos) and have the capacity to become any type of cell including neurons. Could induced pluripotent stem cells be implanted into adults who have suffered brain damage? And would these cells develop into neurons that make the proper connections and repair the damage? Dr King wants to transplant induced pluripotent stem cells from donor adult [species] into the brains of the recipient [species], specifically into the entorhinal cortex. In humans, this area is involved in Alzheimer's disease.

She proposes to use 20 adults [species] as the subjects. First, all the [species] will be subjected to surgery in the entorhinal cortex. This procedure will involve anaesthetizing the animals, opening their skulls, and removing part of the brain. After they recover, the [species] will be tested on a learning task to make sure their memory is impaired. Three months later, half of the [species] will be given transplant surgery. Adult induced pluripotent stem cells will be implanted into the entorhinal cortex of the brain-damaged [species] in the experimental group. All the [species] will then be taught a new task to test the hypothesis that the [species] with brain grafts will show improved memory and perform better than the [species] in the control group that did not get the stem cells.

Dr King argues that this research is in the exploratory stages and can only be done on animals. She notes that millions of Americans have Alzheimer's disease. She says that this research could lead to treatments that would reverse the devastating memory loss that human Alzheimer's victims suffer.

2.2.5 Data analysis plan

In order to examine the associations between the nominal-scaled variables, a series of chi-squared tests of independence were used. Following detection of a significant association, the column proportions were tested using z-tests with Bonferroni corrections. Interval- and ratio-scaled measures were considered as they related to the approval decision of each respondent using point-biserial correlations. In order to examine the effect of species on the putative variables that may drive the approval decision, one-way ANOVAs and, where needed, multiple comparisons tests using Tukey $_{HSD}$ were used [31]. Last, two logistic regression analyses were performed to determine the predictive utility of gender and EQ or the role of science in protocol approval.

3. RESULTS

Consideration of the demographic characteristics of the respondents and approval decision revealed the following. First, as expected, a chi-square test revealed that gender and the approval decision were related, $\chi 2(1, N = 169) = 20.47$, $P < .001$, $\Phi_C = .348$. While both males

and females were more likely to approve the protocol than reject it, the proportion of approval for males (100%) was significantly higher than that of females (61.4%). In addition, approval proportions differed by the race of the respondent, $\chi 2(3, N = 169) = 57.63$, $P < .001$, $\Phi_C = .584$. The proportions approving the protocol were comparable among the white (73.3%), black (95.2%), and other racial groups (100%). Conversely, none of the Hispanic respondents approved the protocol. Last, prior pet ownership was related to protocol approval decision, $\chi 2(1, N = 169) = 5.09$, $P = .024$. While 69.8% of the sample approved the protocol, those raised with a pet were more divided (67.7% approved) than those not raised with pets (100% approved).

When level of animal activism was considered, an association between it and approval decision emerge, $\chi 2(2, N = 169) = 38.12$, $P < .001$, $\Phi_C = .475$. Unsurprisingly, being an animal rights activist was associated with a complete repudiation of the research protocol (i.e., 0% approved the protocol). Conversely, those who considered themselves to be welfare activists or neither rights or welfare activists had similar approval proportions (77.8% vs. 76.3%).

3.1 The Role of the Proposed Species

In addition, a significant association between proposed research species and protocol approval was found, $\chi 2(3, N = 169) = 10.80$, $P = .013$, $\Phi_C = .253$, with approval levels similar for cats (77.8%), rats (78.2%), and frogs (75%) and considerably lower for chimps (52%). Subsequent pairwise comparisons of the column proportions revealed that approval rates for chimps were significantly lower than that for the three other research species.

3.2 Emotional Intelligence (EQ)

One goal of the present research was to examine the role of EQ (a subject characteristic), on the protocol approval decision. The predicted correlation between protocol decision and emotional intelligence was not found, $r_{ob}(167) = -.16$, $P = .054$, two-tailed test. However, given that gender and protocol decision were related, the relationship between protocol decision and emotional intelligence was considered separately for male and female respondents. Since all of the male respondents approved the protocol, calculating the correlation was not possible. For female respondents, however, a negative correlation was found, $r_{ob}(130) = -.27$, $P = .004$. Thus, female respondents with higher EQ scores were less likely to approve the research protocol.

Following the examination of the association between the various demographic characteristics or proposed species and protocol approval decision, the relationship between the protocol approval decision and various issue-related metrics were explored. First, a significant positive correlation between the perceived importance of the research protocol and the approval decision was found, $r_{ob}(167) = .34$, $P < .001$, suggesting that the higher the perceived importance of the research protocol, the more likely that the project was approved. Conversely, negative correlations between approval decision and perceived animal pain and suffering, $r_{ob}(167) = -.53$, $P < .001$, or perceived researcher dissociation, $r_{ob}(167) = -.29$, $P < .001$, were found. Therefore, greater levels of perceived animal suffering were correlated with lower levels of approval. Perceived levels of research dissociation informed the approval decision as well, with higher levels associated with lower levels of protocol approval. Nonetheless, these two ratings were not correlated, $r_{ob}(167) = .12$, $P > .10$.

The relationship between protocol approval decision and the subscales of the PUAS revealed the following. A correlation between the perceived importance of using animals in research and protocol approval was found, $r_{ob}(153) = .37$, $P < .001$. Here, more favourable attitudes toward the value of animals in research activities are associated with a favourable protocol approval decision. Nonetheless, when animal cognition, including perceptions of pain, are considered, the correlation between this scale and approval decision was nonsignificant.

Following the examination of the relationship between the variables discussed above and research protocol decision, the effect of species on different measures associated with the approval process was explored. The results are presented in Fig. 1. First, the importance of the project differed depending on the proposed species, $F(3, 165) = 7.53$, $P < .001$, $\eta^2_p = .120$. Subsequent post hoc consideration of the means using Fisher's LSD revealed that the respondents considered the project significantly less important if chimps were the proposed subjects than if the protocol prosed using cats, rats, or frogs. The rated importance of the project was similar across the remaining three species.

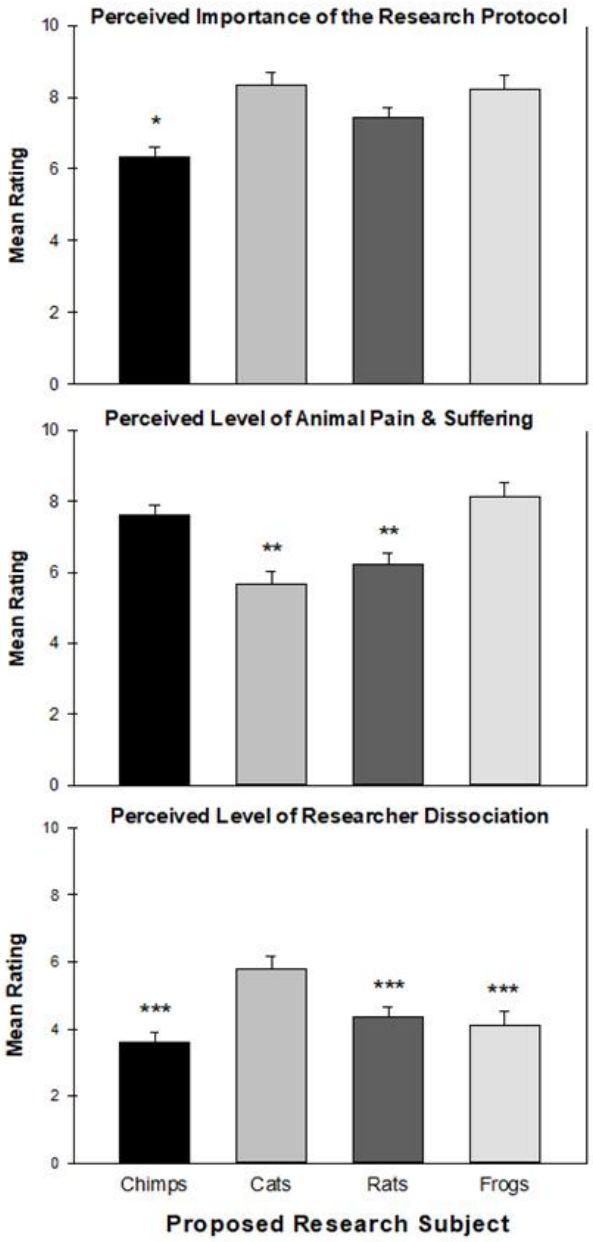

Fig. 1. Perceived importance of the research protocol, level of animal pain and suffering and level of research dissociation as a function of the type of species

*Standard errors are represented as the error bars in each column. *The mean is significantly different from that of the cat, rat, or frog groups (P < .05). **Significantly different from that of the chimp and frog groups. ***Significantly different from the cat group*

Depending on the proposed species, differences in perceived pain and suffering were observed, $F(3, 165) = 10.43$, $P < .001$, $\eta^2_p = .159$. The perceived pain and suffering of chimp subjects was significantly higher than that of protocols with cats or rat as subjects but oddly comparable to the ratings with frogs as research subjects (See Fig. 1). In fact, the frog ratings were significantly higher than that of cat or rat proposals but the latter two were comparable to one another.

When researcher dissociation from the experience of the animals was considered the

following emerged. Once again, the proposed species mattered, $F(3, 165) = 7.19$, $P < .001$, $\eta^2_p = .116$ (see Fig. 1). Subsequent examination of the means revealed a significantly lower level of perceived researcher dissociation when chimps were a part of the proposal than when cats were the proposed research subjects. Thus, the respondents perceived significantly higher levels of researcher dissociation when cats were the proposed subjects, a finding that extended to rats and frogs as well.

Since a primary goal of the research was to examine the role of EQ and gender, as well as separately the role of different aspects of an appreciation for scientific inquiry on the decision-making process, two logistic regression analyses were performed. The results are presented in Tables 1 and 2.

A test of the resulting final fitted model versus an intercept-only model was statistically significant, $\chi^2(2) = 41.46$, $P < .001$, Nagelkerke $R^2 = 0.338$. The model was able to correctly classify 88.5% (n = 104) of protocol approvals and 25.5% (n = 47) of protocols that were denied with an overall accuracy of 68.9%. Further information concerning the results of the bivariate logistic regression including logistic regression coefficients, Wald test, and odds ratios, can be found in Table 1. Considered jointly, only EQ made a significant contribution to the equation.

Last, consideration of the role of science in the decision process revealed the following. As seen in Table 2, the importance of science to the school curriculum and science to knowledge, in general, were both predictive, while the importance of science in the daily life of the respondent was not. Here, the final fitted model versus a model with intercept only was statistically significant, $\chi^2(3) = 8.64$, $P = .034$, Nagelkerke $R^2 = 0.071$. The model was able to correctly classify 93.2% (n = 118) of protocol approvals and 23.5% (n = 41) of protocols that were denied with an overall accuracy of 72.2%.

4. DISCUSSION

Generally, the level of acceptance for the use of animals in research is higher among those with higher levels of education [8,32,33,34] although other investigators have found the opposite to be true [22,23]. While there is considerable variability in attitudes, lower levels of education are correlated with higher concern for animal welfare [35,36,37]. Among college students, the academic major is associated with the degree of acceptance of animal research [12,38,39]. A similar finding has been reported when academic rank was examined [40]. Perhaps unsurprisingly, those majoring in the sciences see animal research in a more favourable light than those in the humanities [12,38,39]. Nonetheless, it has been pointed out students may well seek a major consistent with their belief system and values, choosing a curriculum where animal research is not an integral part of the major [40].

Like most attitudes held by the general public, personal views are not static but vary considerably across time. For example, while at

Table 1. Logistic regression predicting the protocol decision on the basis of gender and emotional intelligence (EQ)

Predictor	*B*	Wald χ^2	*P*	Odds ratio	CI
Gender	21.18	0.00	*n.s.*	0.00	0.00-0.00
EQ	-.064	7.58	< .001	.938	.896-.982

Note. B = unstandardized partial regression coefficient, CI = confidence interval. Dependent variable was the decision concerning the protocol (1 = Yes, 0 = No). Independent variables: gender (0 = female, 1 = male) and emotional intelligence

Table 2. Logistic regression predicting the protocol decision on the basis of gender and emotional intelligence (EQ)]

Predictor	*B*	Wald χ^2	*p*	Odds ratio	CI
Curriculum[a]	.559	6.81	< .01	1.75	1.15-2.66
Knowledge[b]	-.553	7.08	< .01	.575	.38-.865
Life[c]	-.030	0.08	*n.s.*	.971	.784-1.20

Note. B = unstandardized partial regression coefficient, CI = confidence interval. Dependent variable was the decision concerning the protocol (1 = Yes, 0 = No). Independent variables: [a]How important do you think science is to the school curriculum? [b]How important do you think science is to your knowledge in general? [c]How important do you think science is in your daily life? 1 = Extremely important to 10 = Totally unimportant

the turn of the millennium 65% of Americans considered biomedical testing on animals permissible with 26% considering it morally wrong only a slight majority of Americans (51%) still consider biomedical testing on animals acceptable. Among those under the age of 50, support drops to 45% [41]. However, in addition to societal influences, current events can shift attitudes toward the use of animals for research purposes. Here, reports of a recent pandemic about Ebola were associated with a 12-point increase in the favorability of the use of animal models [42].

Recent research reported by Metzger [43] suggested that the general public is uninformed about the contemporary regulatory process implemented to protect animals used in research. This result is consistent with research reported more than 20 years ago [23]. Further, educating people about federal regulations that protect nonhuman animal research subjects, ameliorates concerns about those contemporary research practices [43]. Conversely, in other research [44], the type of species – rats or dogs – influenced the acceptability of a research scenario but education about the Animal Welfare Act failed influenced the acceptance of animal research models.

Support for the contention that animal models have produced advances in the biomedical arena as well as behavioural research is compelling [45,46,47,48]. Further, 94 of 106 Nobel Prizes in Physiology or Medicine were for work where animals were considered integral in advancing the research process [49]. Unsurprisingly, the use of nonhuman animals in research is big business [50].

Recognizing this, public concern about the use of animals for instrumental purposes including biomedical research remains substantial [51]. For example, the results of one recent survey revealed that 33% of people are very concerned about animals used for research purposes, a proportion that is considerably higher than the 21% who held a similar level of concern for zoo animals. In addition, 32% of those polled believe in equal rights for humans and animals, a 7% increase from a previous survey performed seven years earlier [51]. Not surprisingly, the attitudes that inform personal positions about the use of animals in research and experimentation are multidimensional in nature [33], an observation that is supported by the present results as well as that of others [7,8,9,10,12,13,14,52,53].

Cognizant of the issues discussed above ~~this~~, it is important to expose various stakeholders to relevant information including the “three Rs” of animal research – refinement, reduction, and replacement. Armed with such knowledge, concerned individuals may hold not only fewer false beliefs [33,54], but also possess a deeper appreciation and more positive views about animal research [34,38,40,55]. Naturally not all research is of equal value and this includes research using animal models. Nonetheless, when appropriate research design principles and statistical analyses are brought to bear and implemented, animal research still appears still to be of value in the advancement of theory as well as in practice [55]. Here, however, effective communication is key. As noted by others [55], while useful, science education may have little impact on individual perceptions of research with animals [56]. Nonetheless, the results of Gabriel and colleagues [40] are promising.

To reiterate, as is true of most societal issues, the concerns that surround the use of animals for research purposes are complex and include legal, financial, moral, and ethical considerations [57,58,59,60,61,62,63]. While the competing narratives cannot be settled here, there are guiding principles that may prove valuable in such discussions. First, by the very nature of the empirical research process, all biomedical, pharmacological, and even behavioural knowledge is cumulative. Ideally, the data derived from animal models are considered in conjunction with data using tissue models, computer modelling, and data collected using human subjects [55]. Therefore, justifications for the use of animals - especially protocols where suffering often leads to death - requires the examination of two main considerations. According to Carbone [55] the first consideration involves human benefit derived from harm produced to animals. Here, the considerations include a moral justification, often referred to as the speciesism justification. Second, and of equal import, proposals involving animal subjects must involve a reasonable expectation that the project will produce empirically valid knowledge - knowledge that cannot be ethically obtained in other ways - that is useful in furthering our understanding of human illness and disease process as well as potential treatments. This latter consideration is often referred to as utility

justifications [55; see also, 56,64]. Ideally, an effective IACUC incorporates these as part of the review process.

5. CONCLUSION

Consistent with other research, female respondents were much less accepting of the research protocols than males. With the noteworthy exception of Hispanic individuals, the rates of approval for the protocol were similar across the racial or ethnic background. EQ influenced the decision-making of the respondents, but only in females. Protocol approval rates varied by the proposed species, with the use of chimps - but oddly not cats - generally receiving less support. Perceived level of pain and suffering, perceived researcher dissociation from the effects of the protocol on the research animals, and perceived importance of the research were associated with decisions as well. Last, an appreciation for the role of scientific inquiry in the advancement of knowledge was predictive of protocol approval.

CONSENT

The present study was conducted after obtaining ethical approval from the Institutional Review Board of Palm Beach Atlantic University. first author`s institution where the study was conducted. Information and consent, as well as contact information, were available at the survey website. All participants were free to decline participation or to withdraw at any point without penalty. All responses were anonymous.

COMPETING INTERESTS

Authors have declared that no competing interests exist.

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