An overview of surveys on how people view animal experimentation: some factors that may influence the outcome

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Many factors may influence the outcome of surveys on how people view the use of animals in research. Some aspects are related to the instrument used, whereas others are related to the characteristics of the respondents. Conducted in Western countries, the study is primarily a review of 56 surveys targeting scientists, students, and the public. Surveys were obtained from searching online databases and reference lists, or directly from authors whose surveys were not otherwise available. Factors related to the instrument listed include the questionnaire used and wording of questions. Factors related to the respondent include age, gender, upbringing, religion, knowledge, education, and practical experience. Results demonstrate that there was great discrepancy in acceptance/opposition estimations reported in different surveys. It is concluded that interpretation and comparison of results from different surveys should be made with caution.

1. Introduction

Moral views on human exploitation and uses of animals have been discussed for many years. A large number of surveys have been conducted to elucidate peoples' perception of these issues. Until the past two decades, surveys measuring opinion, attitudes, or beliefs were not predominantly focused on the use of animals in research. Instead, they concentrated on issues such as conservation, hunting, and companion animals. Unlike a recent overview of the "attitudes of Americans toward the treatment and moral status of nonhuman animals," this investigation scrutinizes surveys from all parts of the world, and focuses exclusively on attitudes to human use of animals as research tools.[1]

Public views range from complete abolition to strong support of this use of animals. Scientists using animals in research may reasonable be supportive compared to the public. In addition, there may be a discrepancy between what the scientists consider an essential tool for development of treatments for human disease and what the public feels is morally acceptable.

Few surveys have used identical questions; sampling methods and data are often presented by incompatible standards (Table 1).[2–57] This implies that few direct comparisons of survey results can be made across time or geographical regions. Results of these surveys,

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however, also suggest that many factors may influence attitudes and affect support/opposition to the use of animals in research.

The purpose of the study was to review surveys on the moral views of the use of animals in research, and to present and discuss some factors that may influence survey outcome. The factors that may affect outcome of surveys are both related to the instrument used and to the respondent. The following list of factors is not intended to include all factors that may have influenced the answers given to questions associated with the use of animals in research since some that have been measured may only be relevant in one or a few studies. The databases Biological Abstracts, Medline, PsycINFO, Science Citation Index, Sociological Abstracts, and Zoological Record were searched, surveys from reference lists were investigated, and authors of publications not available in Scandinavian libraries were contacted. Only surveys for which we could obtain a full copy were included. References examined are listed in Table 1. We did not have access to all questionnaire instruments used, but included questions that were phrased with some element of moral justification of use of animals in research that could be extracted from the text. Only surveys of the public, university students, and scientists were included in study. In addition to the references used in the present study, we are well aware that there are a number of other polls published in newspapers, magazines, or elsewhere with very little information given apart from mere percentages in favor of or opposed to the use of animals in research. Methodological differences with different survey techniques and instruments were not examined in depth. Unpaired t-tests were used to compare means, and Pearson correlation coefficients were used to measure associations.

2. Factors related to the instrument

The questionnaire

There are a number of different ways to construct questions and response scales, and they tend to differ between the surveys presented in Table 1. The problems of comparing different survey results may be exemplified by the fact that it is difficult to compare nominal and ordinal scales for internal consistency using Cronbach's alpha since this requires at least ordinal data.[58] These measures may also be affected by the number of points used in the response scale. Perhaps the most important factor influencing the responses is how questions were phrased and what kind of background information, if any, the respondents were given. Informing the respondents of research rationales, and the goal and the nature of the actual experiments may influence attitudes to animal experimentation. Although all questions cited in Table 1 have some element of "moral justification," the exact phrasing tends to differ between surveys. Two questions that might seem similar can trigger different respondent inclinations and attitudes, producing sometimes remarkably different answers. Or two questions with essentially the same cues but that do or do not force respondents to choose between alternatives can have the same effect.[59] Negative wording of statements may avoid acquiescence response bias, but since there were very few questions worded negatively in the sample it was not possible to investigate this further. As shown in Table 1, at least two surveys demonstrated that different phrasing of questions causes different answers within the same population.[60] Respondents may generally have a positive/negative opinion while being in favor of or opposed to some types of experiments or use of certain species.

Despite decades of research, the issue of the optimal number of response categories in rating scales is still unresolved.[61] Past research indicates conflicting views, where some favor the three-point scale while others prefer six or seven point scales. It has also been

suggested that there may be a discrepancy if the focus is views of a group or individual behavior. If the objective is to find averages of a group of people or aggregate several individual scales to produce a new scale for the individual the two or three scale points are in general acceptable.

The number of points used in the scales of surveys, using this system, is not correlated to finding animal use in research "ethically justified" if a weighted average percentage of finding animal use in research "ethically justified" per survey is considered ($r = 0.33$, NS). Similarly, the number of points used in a scale is not correlated to not finding animal use in research "ethically justified" ($r = 0.28$, NS), if one weighted average percentage per survey is considered. There was no difference in proportion of those who opted for a middle position and the number of points used on the scale ($r = 0.12$, NS). These Pearson correlation coefficients should however not be over interpreted since many factors may affect reported estimations in surveys. Besides, the main problem with correlation is that you cannot distinguish between cause and effect.

Type of research stated, or not

The experimental procedures using animals may vary from noninvasive to those that will cause pain, distress, and lasting harm (invasive) within the same research area. This implies that medical or psychological research is very general terms. Nevertheless, the acceptance tends to be stronger for using animals in medical research than in psychological research, even though the two might not necessarily be different.[62] For instance, it has been demonstrated that there is a downward trend in the number of psychology departments that maintain animal facilities, coinciding with an upward trend in the number of neuroscience departments that have animal facilities.[63] Thus, behavioral research using animals may now be carried out in neuroscience departments, to a larger extent than previously. Interestingly, from Table 1, there does not seem to be any difference in acceptance levels reported between surveys published in medical journals, range 52–85 percent, and psychology journals, range 59–85 percent (at least in journals whose impact factor is 1).

Particular species stated, or not

The selection of species used as models for man in research may depend on many considerations, such as fidelity, predictive value, discriminative abilities, financial costs, and tradition. In recent decades, a general trend has been a gradual change from larger animals to small rodents in, for example, neuroscience and physiology. Past surveys have showed that the use of dogs, cats, and nonhuman primates will result in lower levels of support (range 32–55 percent) than those that include the use of small rodents (range 55–70 percent, Table 1). The low level of support for using cats and dogs in research is most likely because they are commonly used as pets, whereas rodents outside the laboratory may be regarded as pests. This is in line with a study that found that staff and scientists in the pharmaceutical industry and university found it psychologically more difficult to work with nonhuman primates, cats, and dogs than small rodents.[64] Nonhuman primates are perhaps often believed to be endangered species. While this is the case for some subspecies, the vast majority of primates used in research is bred in captivity and belong to non-endangered species. Because of their phylogenetic closeness to man, they are only allowed to be used in projects when phylogenetically lower-ranking species cannot be used.[65] A recent opinion poll reported that a higher proportion of medical and veterinary students in Kenya (78 percent) and Sweden (75 percent) approved of the use of nonhuman primates in research

Table 1. Surveys on the use of animals in research.

Ref no	Population	Year	Country	Number of respondents	Type of research	'Ethically justified'[a] Yes	MP[b]	No	Animal specified	Gender	Age	Education (type)
2	Public	1999	UK	949	n.a.	24	12	64	n.a.	n.a.	n.a.	n.a.
2	Public	1999	UK	1060	Med	45	15	41	n.a.	n.a.	n.a.	n.a.
3	Public	1949	US	2519	n.a.	84	8	8	n.a.	n.a.	n.a.	n.a.
4	Public	1999	UK	1014	Med	42	35	19	n.a.	n.a.	n.a.	n.a.
4	Public	1999	UK	1014	Vet med	31	48	16	n.a.	n.a.	n.a.	n.a.
4	Public	1999	UK	1014	All types	27	?	60	n.a.	n.a.	n.a.	n.a.
5	Public	1985	US	1412	Med	88	3	9	Rat	n.a.	n.a.	n.a.
5	Public	1985	US	1412	Med	77	4	19	Rabbit	n.a.	n.a.	n.a.
5	Public	1985	US	1412	Med	69	6	25	Monkey	n.a.	n.a.	n.a.
5	Public	1985	US	1412	Med	58	7	35	Cow	n.a.	n.a.	n.a.
5	Public	1985	US	1412	Med	55	5	40	Dog	n.a.	n.a.	n.a.
6	Stud	1995	UK	332	Med > Psych	?	?	?	n.a.	n.a.	n.a.	- (psych)
7	Vet stud	1993	Australia	201	n.a.	?	?	?	Dog, cat	n.a.	n.a.	NS (vet)
8	Soc, Psych, Hum stud, 1982	Australia	302	Med	37	29	34	Monkey	n.a.	n.a.	n.a.	n.a.
8	Soc, Psych, Hum stud, 1982	Australia	302	Med	32	23	45	Dog	n.a.	n.a.	n.a.	n.a.
8	Soc, Psych, Hum stud, 1982	Australia	302	Med	55	28	17	Mouse	n.a.	n.a.	n.a.	n.a.
9	Psych stud	1993	US	1055	n.a.	?	?	?	n.a.	M	NS	+ (appl sci)/ - (soc sci)
10	Transplant patients	1998	US	100	Med	90	?	?	n.a.	n.a.	n.a.	n.a.
11	Coll prof	1995	US	78	n.a.	85	?	15	n.a.	n.a.	n.a.	n.a.
11	Coll stud	1995	US	317	n.a.	74	?	26	n.a.	n.a.	n.a.	n.a.
11	Public	1995	US	226	n.a.	75	?	25	n.a.	n.a.	n.a.	n.a.
12	Public	1992	Sweden	811	Med	60	10	30	n.a.	M	NS	+ (psych)
13	Public	1999	Sweden	1002	Med	78	?	22	n.a.	M	+	+ (general)
14	Public	1992	US	495	Med	?	?	?	n.a.	M	+	n.a.
15	Public	1995	US	133	Med	74	?	?	n.a.	M	NS	n.a.
15	Public	1995	US	133	n.a.	67	?	?	n.a.	M	NS	n.a.
16	Stud	1996	US	139	n.a.	?	?	?	n.a.	M	n.a.	n.a.
17	Public	2001	Australia	1390	Med	60	?	?	n.a.	M	+	+ (general)
17	Public	2001	Bulgaria	960	Med	87	?	?	n.a.	NS	+	NS
17	Public	2001	Japan	1069	Med	50	?	?	n.a.	M	+	NS
17	Public	2001	Philippines	1176	Med	64	?	?	n.a.	NS	NS	NS
17	Public	2001	US	1189	Med	64	?	?	n.a.	M	+	+ (general)
17	Public	2001	W. Germany	891	Med	58	?	?	n.a.	M	NS	NS
18	Stud	1989	UK	> 2 000	Med > Psych	37	19	44	n.a.	M	n.a.	n.a.
19	Stud	1990	UK	257	n.a.	?	?	?	n.a.	M	NS	NS (general)
20	Psych stud	1993	UK	209	n.a.	?	?	?	n.a.	M	n.a.	NS (psych)
21	Stud	1988	US	263	n.a.	73	19	8	n.a.	M	n.a.	n.a.

22	Public	1995	UK	1037	Med	40	?	50	n.a.	n.a.	n.a.	n.a.
23	Med stud	1994	Israel	200	n.a.	59	13	28	n.a.	n.a.	n.a.	n.a.
24	Primate researchers	2001	USA	75	Med	?	?	?	Monkey	n.a.	n.a.	n.a.
24	Stud	2001	USA	111	Med	?	?	?	Monkey	n.a.	n.a.	n.a.
25	Med stud	1997	Sweden	140	Med	98	?	2	n.a.	NS	+	NS (med)
26	Stud	1999	Sweden	888	Med	85	?	?	n.a.	M	n.a.	+ (general)
27	Vet & Med stud	2000	Sweden	654	Med	94	?	?	n.a.	M	n.a.	+ (vet, med)
28	Vet & Med stud	2000	Kenya	149	Med	94	?	?	n.a.	n.a.	n.a.	n.a.
28	Vet & Med stud	2000	Kenya	149	Med	78	?	?	Monkey	n.a.	n.a.	n.a.
28	Vet & Med stud	2000	Sweden	654	Med	75	?	?	Monkey	n.a.	n.a.	n.a.
29	Stud	2000	US	328	Med	89	?	?	n.a.	n.a.	n.a.	n.a.
30	Teach stud	2002	Sweden	640	Med	44	31	25	n.a.	M	n.a.	+ (teach)
31	Medical ethicists	1993	US	120	Med	?	?	?	n.a.	M	NS	n.a.
31	Environmentalists	1993	US	114	Med	?	?	?	n.a.	M	+	- (general)
32	Public	1995	US	n.a.	Biomed	70	?	?	n.a.	n.a.	n.a.	n.a.
33	Public	1987	US	2455	n.a.	52	4	44	n.a.	M	n.a.	n.a.
34	Behav sci	1992	US	228	n.a.	82	9	9	n.a.	n.a.	n.a.	n.a.
35	Public	1999	Sweden	1100	Med	75	5	20	n.a.	M	NS	+ (general)
36	Public	1993	US	1456	Med	66	15	19	n.a.	M	n.a.	+ (general)
37	Psych stud	2001	Spain	661	Psych	66	?	?	n.a.	M	n.a.	+ (psych)
38	Nurs stud	2002	UK	15	Med	53	40	7	n.a.	n.a.	n.a.	NS
39	Account stud	1995	UK	24	Med	75	0	25	n.a.	n.a.	n.a.	n.a.
39	Dental stud	1995	UK	63	Med	78	2	11	n.a.	n.a.	n.a.	n.a.
39	Med stud	1995	UK	53	Med	87	2	6	n.a.	n.a.	n.a.	n.a.
39	Nurs stud	1995	UK	34	Med	59	12	21	n.a.	n.a.	n.a.	n.a.
40	Psych prof	2001	Brazil	19	Psych	100	0	0	n.a.	n.a.	n.a.	n.a.
41	Public	1994	US	1322	Med	66	16	18	n.a.	M.	n.a.	n.a.
41	Public	1994	Canada	2000	Human health	43	8	49	Dog, Monkey	M	n.a.	n.a.
41	Public	1994	Japan	1457	Human health	53	3	42	Dog, Monkey	M	n.a.	n.a.
41	Public	1994	Belgium	519	Human health	34	5	60	Dog, Monkey	NS	n.a.	n.a.
41	Public	1994	Denmark	504	Human health	45	2	53	Dog, Monkey	M	n.a.	n.a.
41	Public	1994	France	511	Human health	27	4	68	Dog, Monkey	M	n.a.	n.a.
41	Public	1994	Germany	1024	Human health	28	6	64	Dog, Monkey	M	n.a.	n.a.
41	Public	1994	UK	534	Human health	40	4	56	Dog, Monkey	M	n.a.	n.a.
41	Public	1994	Greece	501	Human health	55	8	36	Dog, Monkey	M	n.a.	n.a.
41	Public	1994	Ireland	499	Human health	33	12	56	Dog, Monkey	NS	n.a.	n.a.
41	Public	1994	Italy	510	Human health	32	9	59	Dog, Monkey	NS	n.a.	n.a.
41	Public	1994	Netherlands	489	Human health	50	5	45	Dog, Monkey	M	n.a.	n.a.

Table 1. continued

Ref no	Population	Year	Country	Number of respondents	Type of research	'Ethically justified'[a] Yes	MP[b]	No	Animal specified	Gender	Age	Education (type)
41	Public	1994	Portugal	500	Human health	39	17	35	Dog, Monkey	M	n.a.	n.a.
41	Public	1994	Spain	513	Human health	41	9	51	Dog, Monkey	NS	n.a.	n.a.
41	Public	1994	US	2001	Human health	53	4	42	Dog, Monkey	M	n.a.	n.a.
42	Public	1991	US	172	n.a.	?	?	17	n.a.	n.a.	n.a.	n.a.
43	Psych prof	1996	US	3982	Psych	80	6	14	n.a.	M	n.a.	+ (psych)
44	Psych stud	1996	US	1158	Psych	72	10	18	n.a.	M	n.a.	NS
45	Stud	1990	US	988	n.a.	55	29	16	n.a.	n.a.	n.a.	n.a.
46	Vet stud	1983	US	854	n.a.	79	16	5	n.a.	n.a.	n.a.	n.a.
47	Psych stud	1986	US	211	n.a.	51	44	5	n.a.	n.a.	n.a.	n.a.
48	Stud	1993	UK	211	Med	66	19	24	n.a.	n.a.	n.a.	n.a.
48	Stud	1993	UK	210	n.a.	22	21	57	ìLive animalsî	n.a.	n.a.	n.a.
49	Public	1989	US	1004	Med	58	6	36	n.a.	n.a.	n.a.	n.a.
50	Public	1985	US	n.a.	Human health	63	7	30	Dog, Monkey	M	+	+ (general)
50	Public	1988	US	2041	Human health	53	5	42	Dog, Monkey	M	+	+ (general)
50	Public	1990	US	2033	Human health	50	6	44	Dog, Monkey	M	+	+ (general)
50	Public	1992	US	2001	Human health	53	5	42	Dog, Monkey	M	+	+ (general)
50	Public	1995	US	2006	Human health	50	4	46	Dog, Monkey	M	+	+ (general)
50	Public	1997	US	996	Human health	46	3	51	Dog, Monkey	M	+	+ (general)
50	Public	1999	US	904	Human health	50	3	47	Dog, Monkey	M	+	+ (general)
50	Public	1999	US	1882	Human health	70	2	28	Mouse	M	+	+ (general)
50	Public	2001	US	1574	Human health	44	4	52	Dog, Monkey	M	+	+ (general)
50	Public	2001	US	1574	Human health	68	3	30	Mouse	M	+	NS
51	Public, sci	1988	US	589	n.a.	?	?	?	n.a.	n.a.	n.a.	n.a.
52	Diff groups	1993	US	759	n.a.	?	?	?	n.a.	n.a.	n.a.	n.a.
53	Stud	1980	Israel	126	Med	75	?	10	n.a.	n.a.	n.a.	n.a.
53	Stud	1980	Israel	126	n.a.	59	?	18	n.a.	n.a.	n.a.	n.a.
54	Psych stud	1980	US	668	Psych	?	?	?	n.a.	M	n.a.	NS (psych)
55	Psych stud	1996	US	175	Biomed	52	21	27	n.a.	NS.	n.a.	+ (psych)
56	Public	1997	UK	422	Med > non-Med	?	?	?	n.a.	NS	n.a.	n.a.
57	Psych stud	1998	US	315	Med	54	?	?	n.a.	M	n.a.	n.a.

[a] Use of ? means that it was not possible to derive percentages since other types of scales were used, percentages were not stated or no middle position was offered.
[b] MP = Middle Position

than what has been reported in past studies.[66] However, there was also a gradual increased acceptance of using phylogenetically lower-ranking species.

Word pain stated, or not

It is a common misconception that a vast majority of animals used in research suffer pain or injury. In practice, few experiments involve procedures that are painful since scientists must have a valid reason not to use anesthesia and analgesic, and many efforts have been made to introduce earlier endpoints in chronic studies for a number of years. Past surveys suggest that respondents are less likely to support animal research if the words "painful" or "death" are included in the questions than if they are not.[67] It has also been suggested that the most common type of objection among those opposed to animal experimentation was related to whether animals experience pain and suffering.[68]

3. Factors related to the respondent

Age of respondent

It has generally been reported that moral acceptance of the use of animals in research is positively associated with age (Table 1). As shown in Table 1, age ranges vary between the public, scientists, and university students; some that are classified as young in certain studies are considered old in others. It cannot be ruled out that older adults always have been more supportive than younger participants in these surveys since they will be included in the same age category whereas younger respondents will change age category. It is difficult to measure this in a cross section survey.

Gender

A lower proportion of women than men accept the use of animals in research (Table 1). Several studies have tried to explain the gender difference.[69] These explanations tend to focus on gender variations in socialization, linking more emphasis on caring, nurturing, and expressiveness to females than males.

Urban versus rural background

Rural people have a larger acceptance of human exploitation of animals than urban people.[70] People brought up in the countryside may be more accustomed to and have more knowledge of animals used for human needs than those with an urban background. This may be the explanation for the positive association with support of animal use in research. However, it has been suggested that the level of traditionalism in the countryside is decreasing and that the difference between the urban and rural way of life is waning.[71]

Religion

The importance of religion on moral views varies across geographical regions and cultures, and certain populations are far more religious than others. In addition, religions differ in their moral views on human exploitation of animals. Some religions treat certain species as ritually unclean, whereas others worship selected species. Monotheistic religions, like Christianity, Islam, and Judaism, all trust that God created man in his image and gave him dominion over

all other creatures. Buddhism and Hinduism envisage a hierarchy of organisms rather than a sharp division between man and animals. There are a number of papers reporting on religion and moral views on the use of animals in biomedical research.[72] They suggest that Judeo-Christianity is positively associated with the acceptance of the use of animals in research. They also acknowledge that there may be a difference between liberal groups and conservative groups within a religion, where the former tend to be more concerned about animal welfare than the latter. It seems reasonable to assume that this is equivalent for Islam as well. Other results indicate that Protestants and Catholics did not differ from each other in moral views on this subject, but differed significantly from Buddhists by being more supportive of animal research.[73] This is somewhat in contrast with another study, which found that a lower proportion of Catholics and persons reporting no religious affiliation accepted animal use in medical research than did Protestants.[74] Yet another study did not find any correlation between religious belief and attitude toward animal experimentation.[75]

Geographic location

It is difficult to make any interpretations from Table 1 with regard to differences in opinion between countries, since the proportions of acceptance vary between surveys conducted in the same country. Furthermore, several countries were represented only once or twice. There are only two multinational surveys that have been published using the same question(s), but since the US was the only overlapping country it is difficult to draw any conclusions.[76] However, based on the results of Table 1, it may be reasonable to assume that the level of acceptance seems to be higher in the US than in the UK. This is in concordance with acceptance of animal cloning.[77]

Confidence in science

Confidence in science is a not a well-defined factor, since people may distinguish between the concept of confidence and confidence in different fields of research. For example, the results of the fourth Eurobarometer suggest that there was an increased opposition to genetically modified food but support for medical and environmental application of biotechnology remains strong.[78] This implies that the public is capable of differentiating issues, even if they do not understand the technical details. It has been reported that attitudes toward the use of animals in research were more related to empathy toward animals than to confidence in science.[79] This result was contradicted by another survey, however, which found that confidence in science was the best predictor of attitudes to animal research. Those who opposed animal experimentation were more critical of science in general, than those who supported animal experimentation.[80] In an international comparison of 15 countries, there was an inconsistent relationship between "knowledge of scientific concepts" (based on 10 statements) and opposition to animal research.[81] Other surveys found a positive relationship between young peoples' science achievement scores and their support of animal research.[82]

Pet ownership

Pet ownership and the resulting rewarding social relationship, has generally been reported as a negative factor with regard to accepting animal use in research.[83] There also seems to be an association between having pet in childhood and greater concern for animal welfare of non-pet animals and humans.[84] It has been shown that the use of dogs and cats in research was perceived to upset owners of these species more often than veterinarians and students.[85]

Another study found that "cat and dog lovers" tend to be more anti-animal experiments.[86] A more recent survey showed that a higher proportion of cat, dog, and/or rabbit owners were opposed to the use of these three species in biomedical research than were non-owners.[87] But there was no similar association between bird and/or fish owners and acceptance of using these two groups of animals in research.

Ideological, voluntary vegetarianism

Vegetarianism has been associated with lower acceptance of the use of animals in research compared to non-vegetarianism.[88]

Environmentalism

An interest in green issues is negatively related to support of animals in research.[89] In 11 of 15 countries, concern for environmental issues were related to opposing attitudes to animal research.[90]

Education

The majority of all studies including analysis of the consequences of some form of education report a positive association between increasing educational level and acceptance of the use of animals in research (Table 1). However, there may be a difference between education level in general compared to educational level in medicine, psychology, and veterinary medicine, where use of live animals traditionally were used in the education's curricula. Along with audio-visual techniques becoming more readily available in teaching, there has been a downward trend in use of animals in both medical and psychology education in recent years.[91] Somewhat in contrast with what might be expected, there are mixed results for junior and senior psychology students. Whereas four surveys report a positive association between educational level and approval of the use of animals in research, three surveys report no difference, and one survey even report a negative association.[92] Advanced medical and veterinary education was however positively associated with approval of the use of animals in research.[93]

Knowledge

The interest and knowledge about the use of animals in research vary between different groups. Whereas some people are very interested in animal experimentation others have not formed a view prior to being questioned, answer on the basis of running tally of impressions, or respond on the basis of whatever thoughts are on the person's mind at the time of questioning.[94] If questioned again, some respondents may differ if their views are not deeply rooted. Repeated sampling of the same individuals may elucidate this, though some results suggest that respondents do not change their views.[95]

Practical experience

By definition, few lay people have practical experience working with laboratory animals. Experience of the use of animals through research or teaching is generally positively associated with acceptance of animal research.[96] Another study found a positive association between the number of laboratory science classes that the students took while in high school and later support for animal research.[97]

4. Discussion and concluding remarks

Many surveys dealing with how people view the use of animals in research have been carried out in the past decades (Table 1). Even if one may assume that the scientific quality of the surveys analyzed is reasonably good—their results can be clearly interpreted, and the surveys are comparable—it remains an open question which normative conclusions can be drawn from them.

Surveys were conducted in different parts of the world, albeit most were from English-speaking, industrialized countries. In addition to the factors described in the present study, there may be economical, social, political, and cultural differences influencing moral views on the use of animals in research between the geographical regions represented. Similar differences in interpretation apply to many attitudinal domains; therefore, it is not reasonable to assume that the same casual processes apply in different geographical contexts depending on different social realities. However, most factors listed in the present study tended to influence responses in one direction.

Some survey questions require experience that many people do not possess, such as about issues related to legislation.[98] In practice, few, if any, lay people read legal regulations pertaining to animal research, and thus responses are not based on knowledge, but something else.

Survey questions may also be perceived by respondents as being truthful when in fact they are not, for example: "Killing animals painfully when there is an alternative method available which is painless."[99] A statement like this demonstrating ignorance of legislation and practice procedures may affect the respondent's view and will not result in usable results. In addition, scientific progress may over time affect the accuracy of questions making their content irrelevant or incorrect. The results of Table 1 indicate that studies published in scientific, medical, and psychology journals tend to report higher levels of acceptance than studies published in the scientific journals of other fields, and other publications. Results of polls may be biased or interpreted differently depending of what position the authors' hold. Polls not subjected to peer review have not been subjected to external valuation of survey techniques and instruments. Therefore, it is likely that polls conducted by polling companies for special interest groups will be more biased than those published in scientific journals. Related issues were recently discussed in a paper by Herzog and Dorr.[100]

There were major differences in opinion between surveys, which may be illustrated by that a range of 27–100 percent accepted the use of animals in research, and 0–68 percent opposed this. In addition, sample sizes, which may depend on how large the total group is and what degree of precision one requires, vary between 15 and 3982. There was no correlation between acceptance/opposition and sample size. However, surveys measuring public opinion had on average twice as large sample sizes compared to those surveying other groups (1093 vs. 482, $P < 0.0001$). The former surveys often relied on some kind of probability sampling whereas the latter often used non-probability sampling. The response rate was rarely explicitly stated in surveys, but when stated levels seemed satisfactory (data not shown).

There was no correlation between acceptance of use of animals in research and year of publication, suggesting that there was no change over time. It must be emphasized though that there were hardly any surveys conducted on the use of animals in research before the 1980s. An explanation may be that the use of animals in research was not considered a controversial topic in larger segments of society prior to the 1980s.[101] This can also be reflected by the growing research interest in animal welfare related issues as counted by the number of papers published.[102] The continuous National Science Foundation surveys

reported no dramatic change in opinion between 1985 and 2001, although the proportion of opposition tended to increase.[103] However, testing series between one year and the next will rarely result in statistical changes. Small changes become interesting when they add up over longer spans of time.

Direct comparisons between cohorts of the public, students, and scientists are difficult to make since there are few surveys that have included all three groups. However, past surveys did not find any difference in attitude between the public and the scientific community.[104]

An important factor in the formation of perceptions of science using animals is the information that is available and presented. The education on ethics and attitude formation of using animals in animal research in the biomedical curricula perhaps needs to be included in other scientific disciplines as well, where the use of animals have contributed to what is being taught. Topics may, for example, include attitudes toward animals, human-animal relationship, intrinsic and instrumental value of animals, and ethical/philosophical arguments for and against the use of animals for scientific purposes. The media have a key role in collecting, interpreting and transmitting information to the public, and may serve to influence the public's views to animal experiments.[105] Animals are used in many different types of research, and most likely the future will see animals used in new areas of research (e.g. large scale clinical testing of animal organs, genetically engineered food products), which will require continuous dialogue and ethical approval of the public. There have been an increasing number of studies focusing on views toward xenotransplantation, and on the use of genetically modified animals in recent years. The results of one such survey suggest that there was no difference in opinion among students toward the use of genetically modified animals compared to the use of animals in general.[106] It is common though that new applications using animals are first met by skepticism if there is no clear understanding of the benefit. Understanding of, and strength of belief in the usefulness of new uses of laboratory animals constitute important factors governing the acceptance. By comparing different biotechnology issues from surveys, the press and technical/regulatory sources, previous results suggest that the scientific communities primarily focused on technical, research oriented issues (rational factors), while the public seemed more concerned with issues of ethics, safety and value (emotional factors).[107]

Even though there may not be an objective way to report on issues like ethics, safety, and values, there is a continuous need to inform the public in more detail about the use of animals in research, including the production and use of transgenic animals. This openness may increase confidence in science, scientists, and the regulatory system, as well as eliminate much of the controversy surrounding the use of animals in research.

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