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# Understanding Public Attitudes to Clinical Xenotransplantation

*Barrie R. Cassileth, John P. Remensnyder, Greg Koski, Owen S. Surman and A. Benedict Cosimi*

A potential solution to the increasing organ donor shortage is xenotransplantation. The first significant clinical trials of animal-to-human transplants began in the 1960s.<sup>1</sup> These efforts primarily utilized donor organs from closely-related species, including the baboon and chimpanzee, with most procedures performed in the US and South Africa.

More recent trials have been extended to the use of porcine tissues. These include fetal pig neural cell implants for Parkinson's disease, porcine skin grafts for temporary coverage of severe burns, porcine pancreatic islets, and others. To date, there has been no clinically successful whole organ transplant from pig to human.

Many scientists are optimistic about overcoming the immunologic barriers to successful xenotransplantation<sup>2-4</sup> and about the future of xenotransplantation itself.<sup>2-5</sup> However, because of the currently unsolved rejection problem, further clinical trials of whole organ porcine xenografts probably are several years away.

Nevertheless, public understanding and approval are important issues about which varying conclusions have been reported.<sup>6-10</sup> We sought to address these issues with a nationwide survey, commissioned and supported by the Xenotransplantation Advisory Committee of the Massachusetts General Hospital.

## Materials and Methods

We conducted a national, random digit-dialed telephone survey to determine public attitudes about xenotransplantation. The survey included households in the continental US, with an over-sampling of the New England region because it is the region served by the authors' institution. Anonymous interviews were conducted with one

randomly selected, English-speaking adult, aged 18 or over, in each participating household.

Thirty questions in five primary topic areas included: understanding of and attitudes toward human organ transplantation; familiarity with animal-to-human organ transplants; attitudes toward and willingness to accept an animal organ transplant; anticipated personal reactions to receipt of an animal organ; and sources of past and preferred information. The survey also included eight demographic items: gender, age, education, experience with organ transplantation, ethnicity, religiosity, religious background, and location by state.

Questions about human organ donation were included to enable comparisons with remaining survey issues and with survey results concerning allograft transplants. Most survey questions were open-ended and responses were categorized later for analysis.

A sample size of 500 was planned to allow for estimates with a 95% confidence interval for the national sample of  $\pm 5\%$  and for New England of  $\pm 10\%$ . It also permitted comparisons between two groups of similar size ( $n \approx 200$  each) with a 0.05 significance level of differences in proportions of 10%. Comparisons between New England and the rest of the country required 12% differences in proportions to be significant at the 0.05 level.

## Results

We completed a total of 501 interviews—101 in New England and 400 in the rest of the country. The overall response rate was 70.5%. Demographics of the subjects surveyed are summarized in Table 1.

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Table 1 | **DEMOGRAPHIC CHARACTERISTICS OF SUBJECTS SURVEYED**

	NUMBER	PERCENT
<b>GENDER</b>		
Male	213	42.5
Female	288	57.5
<b>AGE</b>		
18-44	276	55.6
45-64	150	30.1
> 65	71	14.4
<b>ETHNICITY</b>		
White	393	79.4
Black	49	9.8
Hispanic	36	7.1
Asian	8	1.6
Native American	6	1.3
<b>EDUCATION LEVEL</b>		
High School	51	10.2
<High School	169	33.8
College	225	44.9
Graduate School	55	11.1
<b>RELIGIOSITY</b>		
Very	169	34.3
Somewhat	276	56.1
None	47	9.6
<b>GEOGRAPHY</b>		
New England	101	20.0
Other	400	80.0

More recent trials have been extended to the use of ... pig neural cell implants for Parkinson's disease, porcine skin grafts for temporary coverage of severe burns, porcine pancreatic islets, and others.

Most respondents (91%) were aware of the need for more organ donations, but only 60% expressed willingness to donate their own organs after death. Less than half (43%) would donate a close relative's organs after death. An additional 27% would do so if they knew the relative would have concurred. Although aware of the need for more organ donations, those surveyed had little knowledge of the actual number of organ donations per year in the United States. Forty-one percent said they did not know, and other guesses ranged from only 50 to as great as 8,000,000. Only 6% said 20,000, which is the correct number, and, only 16% guessed between 10,000 and 30,000.

A majority of respondents (84%) were familiar with the idea of animal-to-human transplantation. Most had learned about it from television news (69%), newspapers magazines and/or radio (44%). Almost half (47%) of subjects held "mainly positive" views about xenotransplantation, while 39% had negative feelings about it, and 14% were uncertain.

Asked what they see as positive about transplanting animal organs into people, 19% found "nothing positive", but 39% believed it will save lives, and 20% pointed to the increased number of organs that would be made available. Negative features mentioned included fear that it would not work and the possibility of transmission of disease (30%). Other negative reactions included the conviction that animal-to-human transplantation was immoral or unnatural (17%) and concerns about animal rights (14%). These numbers contrasted with attitudes towards "current use of animal heart valves", of which 82% of respondents approved.

Over half (54%) of people surveyed indicated that they would want an animal organ if they would die without one; 12% indicated a qualified "yes" (for example, "if previously successful"); 23% would refuse, and the rest were uncertain. In contrast, 88% were willing to receive an artificial heart or other organ.

Table 2 | FACTORS ASSOCIATED WITH ACCEPTANCE OF XENOTRANSPLANTATION

	FAVOR	OPPOSED
AGE:	Younger	> 65
EDUCATION:	Higher	Less
ETHNICITY:	White	Non-White
RELIGIOSITY:	Less	More
HEALTH STATUS:	Potential recipient	Healthy
GENDER:	Male	Female

Over half (54%) of people surveyed indicated that they would want an animal organ if they would die without one. . .

Respondents were also asked for their opinions of the best way to correct the shortage of donated human organs. Nine percent suggested using animals; 58% recommended educating the public and encouraging donations. Respondents were almost evenly divided in wanting and not wanting to know more about organ transplantation (48% versus 47%). Respondents who wanted to know more preferred that the information come from doctors, hospitals and other medical sources (65%), the National Institutes of Health (30%), other government agencies (18%), and educational sources, such as books and public television (15%).

There were significant ethnic, geographic and demographic differences in responses (Table 2). Half of the Black respondents would not donate their organs after death, compared to 19.7% of white respondents and 18.5% of “others” ( $p < 0.0001$ ). At the same time, 10.2% of Blacks compared to 2.6% of whites and 5.5% of others believed there is now a sufficient supply of donated organs ( $p < 0.05$ ). People over age 64 were less willing than younger groups to donate their organs ( $p < 0.0001$ ). Those most familiar with animal-to-human transplantation were in the middle age category (45-64 years), had at least a high school education ( $p = 0.023$ ), and were white ( $p = 0.005$ ). Non-whites, however, were more likely to want additional information about xenotransplantation ( $p = 0.04$ ).

New Englanders were more likely to have mainly positive feelings about animal organ transplantation than were those in other regions of the U.S. (67.3% vs. 46.0%;  $p = 0.001$ ). They were also more willing to accept animal organ transplants (69.3% vs. 53.8%;  $p = 0.014$ ). Greater percentages of New Englanders, as compared with respondents from the rest of the country, were white (95% vs. 78%;  $p = 0.002$ ) and Roman Catholic (52% vs 27.5%;  $p = 0.0001$ ). They were less likely to consider themselves “very religious” (14.7% vs. 35.4%;  $p = 0.0001$ ).

**Comment**

Our respondents’ attitudes about organ donation indicated broad public support for organ donation, but displayed a paradoxical lack of consistency between attitude and behavior. Ninety-one percent of people in our survey understood the need for more organ donations, but only 60% were willing to donate their own organs after death.

It is clear that attitudes vary according to how questions are posed and by the context in which a survey is conducted. In addition, it is likely that the level of knowledge is equally varied, and that this contributes to attitudes and acceptance. That more people accept human as opposed to animal organ transplantation undoubtedly reflects greater familiarity with the former and its established success rates. In contrast, even short-term survival following transplantation of xenogeneic organs remains to be achieved. Thus, xenotransplantation remains a procedure with a risk-benefit ratio that is still evolving. Not surprisingly, this contributes to evaluation difficulties.

The concern that many people would anticipate negative changes in self-worth or body-image after receiving a xenotransplant was not supported by our data. Only 7% of those willing to accept an animal organ predicted that they would feel strange or unnatural. Moreover, as with allotransplantation, after which 93% would discuss receipt of the human organ with family and friends, a strong majority (81%) would discuss receipt of an animal organ. This suggests that most potential recipients would not experience embarrassment or fear of being ostracized following transplantation of a xenogeneic organ.

Our respondents expressed concern about the possibility of disease transmission and optimism about the lifesaving potential of xenotransplantation. The World Health Organization and other authorities in the field have urged additional public information and debate. As the research base expands in preparation

for eventual clinical trials, the provision of information will increase public familiarity with the potential as well as with the known problems of xenotransplantation, aspects of which will form the basis for informed consent in future xenotransplantation clinical trials. Data reported here suggest that, just as most respondents approve of the current and known use of animal heart valves, they will come to accept with greater equanimity the transplantation of animal organs once it is established that the procedure can be performed with predictable success rates.

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