


# Concordance of Organ Donation and Other Altruistic Behaviors Among Twins

Anne M. Huml, MD, MS<sup>1,2,3</sup>, J. Daryl Thornton, MD, MPH<sup>1,4</sup>,  
Maria Figueroa<sup>1</sup>, Katrice Cain, MA<sup>1</sup>, Jacqueline Dolata, MBA<sup>1</sup>,  
Karen Scott, MPA<sup>1</sup>, Catherine Sullivan, MS, RD, LD<sup>1</sup>,  
and Ashwini R. Sehgal, MD<sup>1,2,5,6</sup>

Progress in Transplantation  
2019, Vol. 29(3) 225-229  
© 2019, NATCO. All rights reserved.  
Article reuse guidelines:  
sagepub.com/journals-permissions  
DOI: 10.1177/1526924819853826  
journals.sagepub.com/home/pit  


## Abstract

**Introduction:** Organ donation and other altruistic behaviors may be influenced by multiple factors, such as demographic characteristics, religious beliefs, and social norms. **Research Question:** What is the role of genetic factors on altruism in identical and fraternal twin pairs? **Design:** Twins attending a twin festival (N = 296) completed an organ donation and altruistic behavior survey. **Results:** Concordance for stage of change for organ donation was 65% among identical twin pairs versus 33% among fraternal twin pairs ( $P = .004$ ). Concordance was higher among identical versus fraternal twin pairs for several altruistic behaviors, including giving directions to a stranger (63% vs 24%,  $P < .001$ ), giving money to a stranger (51% vs 29%,  $P = .048$ ), donating goods to charity (46% vs 16%,  $P = .005$ ), and offering a seat on the bus (46% vs 24%,  $P = .04$ ). **Discussion:** We conclude that genetic factors may play a role in decisions about organ donation and other altruistic behaviors.

## Keywords

organ donation, altruism, twins

## Introduction

Even though most individuals perceive organ donation positively, just over half of adults in the United States are registered organ donors.<sup>1</sup> Understanding why individuals choose to be organ donors may help to develop interventions to increase organ donation. There may be some overlap between willingness to be an organ donor, willingness to donate blood and bone marrow, and the willingness to engage in other altruistic behaviors. For example, registered bone marrow donors tend to also donate blood regularly and are frequently willing to donate kidneys after death.<sup>2</sup> Multiple factors, such as demographic characteristics, religious beliefs, and social norms, may contribute to decisions about organ donation and other altruistic behaviors.<sup>3,4</sup> Previous research suggests that genetic factors may also play a role in altruism.<sup>5-7</sup> However, these studies did not specifically examine organ donation.

## Specific Aim

We sought to examine the role of genetic factors on organ donation and other altruistic behaviors by studying twin pairs. If genetic factors contribute to altruism, we would expect that identical twins would be more alike than fraternal twins in willingness to donate organs, blood, and bone marrow as well as in other altruistic behaviors.

## Methods

### Design

We performed a survey study that the institutional review board of MetroHealth Medical Center granted exempt status.

### Setting/Population

The study was conducted on August 5 to 6, 2017 at an annual twin's day festival in Twinsburg, Ohio. The festival is the

<sup>1</sup> Center for Reducing Health Disparities, Case Western Reserve University, Cleveland, OH, USA

<sup>2</sup> Division of Nephrology, Department of Medicine, MetroHealth Medical Center, Cleveland, OH, USA

<sup>3</sup> Division of Nephrology, Department of Medicine, University Hospitals, Cleveland, OH, USA

<sup>4</sup> Division of Pulmonary and Critical Care Medicine, Department of Medicine, MetroHealth Medical Center, Cleveland, OH, USA

<sup>5</sup> Department of Population and Health Sciences, Case Western Reserve University, Cleveland, OH, USA

<sup>6</sup> Department of Bioethics, Case Western Reserve University, Cleveland, OH, USA

### Corresponding Author:

Anne M. Huml, Division of Nephrology, Department of Medicine, MetroHealth Medical Center, 2500 MetroHealth Drive Rammelkamp 208A, Cleveland, OH 44109, USA.

Email: [ahuml@metrohealth.org](mailto:ahuml@metrohealth.org)

largest gathering of twins in the world and includes both identical and fraternal twins. Twins were recruited via signage in the research plaza area of the festival. Participants were each given an US \$2 bill for answering the survey. Each twin gave verbal consent for participation.

### Data Collection

Each participating twin was asked to complete a survey. Survey questions asked about demographic characteristics; stage of change with respect to organ, bone marrow, and blood donation; and altruistic behaviors. Stage of change questions, based on the transtheoretical model, have been used extensively to study smoking cessation and other health behaviors.<sup>8-10</sup> The transtheoretical model posits that individuals move through a series of stages in decision-making, that is precontemplation, contemplation, preparation, action, and maintenance. Each stage reflects a particular level of readiness to act so interventions can be tailored to patient responses.<sup>11</sup> The stage of change items were from a reliable questionnaire used previously that asked patients (1) if they had already decided not to be an organ donor, (2) if they were contemplating being an organ donor or needed more information about organ donation, (3) if they were thinking about being an organ donor, (4) if they were interested in being an organ donor, and (5) if they were already registered to be an organ donor.<sup>12</sup> Similar questions were asked about bone marrow and blood donation.

The other altruistic behaviors were from a validated scale.<sup>13,14</sup> We used 14 relevant items from the scale that did not overlap with questions asked in other parts of our survey and were considered time- and age-appropriate altruistic behaviors for the year that the survey took place and age range of participants. This self-reported survey asked about how often twins engaged in altruistic acts. Participants responded to these questions with one of the following choices: "Never," "Once," "More than Once," "Often," and "Very Often." Responses for each of the questions were scored on a 0 to 100 scale. A score of 0 meant that the participant "Never" engaged in the altruistic behavior. A score of 100 meant that the participant responded "Very Often" to the altruistic behavior. The score for each question increased by 25 points for each increase in frequency on the scale. All responses were summed together and higher scores meant more altruism. The highest possible score would be 100. We also examined each participant's driver's license to determine whether he/she was registered as an organ donor. A total of 68 (23%) participants did not have a license to review. In these cases, self-report of donor status was used as a proxy.

### Analysis

Demographic information is reported as frequencies for categorical variables and means for continuous variables. We used the  $\chi^2$  test or the  $t$  test to compare the demographic characteristics of identical and fraternal twins. Overall concordance was defined as each twin in a pair providing the same response to a specific question. We used the  $\chi^2$  test to compare overall

concordance among identical twins versus fraternal twins. In addition, we examined concordance separately for altruistic and nonaltruistic responses. Positive concordance was defined as each twin in a pair selecting one of the top 2 stages of change for organ, blood, or bone marrow donation (interested in being a donor or already donated) and frequency of altruistic behaviors (often and very often). Negative concordance was defined as each twin in a pair selecting responses in any of the other stages of change or frequency of altruistic behaviors. Data were analyzed using JMP Pro version 13.0.0 (SAS Institute, Cary, North Carolina). For 2 twin pairs, only 1 twin completed the survey. As a result, we excluded these 2 twin pairs (total of 4 individuals) from all analyses.

## Results

### Participant Characteristics

Of 296 twins who participated in the survey, 246 (83%) were identical twins and 50 (17%) were fraternal twins. The mean age was 36 years (Table 1). Most participants were female non-Hispanic whites. Most had a religious affiliation, and three-fourths completed additional education beyond high school. There were no statistically significant differences between identical and fraternal twins in demographic characteristics.

### Organ Donation

Among all twins, 23 (8%) did not want to be an organ donor, 27 (9%) had not contemplated being an organ donor or needed more information, 34 (11%) were thinking about being an organ donor, 34 (11%) were interested in being an organ donor, and 176 (59%) were already registered to be an organ donor. The overall concordance for stage of change for organ donation was 65% among identical twin pairs versus 33% among fraternal twin pairs ( $P = .004$ ; Table 2). Overall concordance for stage of change for bone marrow donation and blood donation did not differ significantly among identical versus fraternal twin pairs. There was no difference in overall concordance for being a registered organ donor among identical versus fraternal twin pairs. The results for positive and negative concordance are presented in Table 3.

### Other Altruistic Behaviors

The mean total altruism score was 50 among identical twins and 52 among fraternal twins ( $P = .47$ ) on a scale from 0 to 100, where 100 is highest level of altruism. Rates of concordance were higher among identical versus fraternal twin pairs for several altruistic behaviors, including giving directions to a stranger (63% vs 24%,  $P < .001$ ), giving money to a stranger (51% vs 29%,  $P = .048$ ), donating goods to charity (46% vs 16%,  $P = .005$ ), and offering a seat on the bus (46% vs 24%,  $P = .04$ ; Table 2).

**Table 1.** Characteristics of Participants.

Characteristic	Overall (N = 296)	Identical Twins (n = 246)	Fraternal Twins (n = 50)	P Value
Mean age, years (SD)	36 (18)	36 (18)	35 (18)	.52
Female	N (%)	n (%)	n (%)	
	235 (80%)	200 (81%)	35 (71%)	.12
Race				.55
White	259 (87%)	214 (87%)	45 (90%)	
Black	22 (7%)	18 (7%)	4 (8%)	
Other	17 (6%)	14 (6%)	1 (2%)	
Hispanic	3 (1%)	3 (1%)	0 (0%)	.45
Religion				.24
Catholic	73 (26%)	66 (28%)	7 (15%)	
Protestant	118 (42%)	96 (41%)	22 (46%)	
Jewish	6 (2%)	5 (2%)	1 (2%)	
Other	24 (8%)	21 (9%)	3 (6%)	
None	63 (22%)	48 (20%)	15 (31%)	
Highest education				.07
High school graduate	70 (24%)	54 (22%)	16 (32%)	
Some college or vocational training	56 (19%)	42 (17%)	14 (28%)	
College degree	110 (38%)	97 (40%)	13 (26%)	
Graduate degree	46 (19%)	49 (20%)	7 (14%)	

**Table 2.** Concordance of Twin Pairs for Stage of Change, Organ Donor Registration, and Other Altruistic Behaviors.<sup>a</sup>

	Concordance Among Identical Twins (%)	Concordance Among Fraternal Twins (%)	P Value
Stage of change			
Organ donor	79/122 (65%)	8/24 (33%)	.004
Bone marrow donor	53/122 (43%)	13/24 (54%)	.33
Blood donor	74/123 (60%)	15/24 (63%)	.83
Registered organ donor	98/119 (82%)	18/25 (72%)	.23
Altruism behaviors			
Given directions to a stranger	77/123 (63%)	6/25 (24%)	<.001
Given money to charity	80/123 (65%)	12/25 (48%)	.11
Given money to a stranger	63/123 (51%)	7/24 (29%)	.048
Donated goods to charity	56/121 (46%)	4/25 (16%)	.005
Done volunteer work for charity	61/120 (51%)	8/24 (33%)	.12
Delayed an elevator and held door for stranger	57/123 (46%)	10/25 (40%)	.56
Allowed someone to go ahead in line	64/121 (53%)	12/25 (48%)	.66
Given a stranger a lift in car	86/122 (70%)	14/24 (58%)	.24
Pointed out a clerk's error in undercharging for item	55/122 (45%)	6/24 (25%)	.07
Let a neighbor borrow an item of value	50/120 (42%)	7/25 (28%)	.20
Voluntarily looked after a neighbor's pets or children without being paid	47/123 (38%)	7/25 (28%)	.33
Offered to help a handicapped or elderly stranger across street	49/122 (40%)	7/25 (28%)	.25
Offered my seat on a bus or train to stranger	55/120 (46%)	6/25 (24%)	.04
Helped an acquaintance to move households	50/123 (41%)	6/25 (24%)	.12

<sup>a</sup>Missing data. One or both twins in pair did not answer question and were omitted from analysis.

## Discussion

We found that the rate of concordance in stage of change for organ donation was significantly higher among identical twins versus fraternal twins. Rates of concordance were also higher for several other altruistic behaviors among identical twins as compared to fraternal twins, including giving directions or money to a stranger, donating goods to charity, and offering a seat on the bus. By contrast, there was no statistically

significant difference in rates of concordance among identical as compared to fraternal twins for stage of change for bone marrow donation and blood donation, organ donor registration, and several other altruistic behaviors. The strengths of our study include a large sample size of twins, use of driver's licenses to confirm organ donor registration, and assessment of a variety of altruistic behaviors.

**Table 3.** Positive and Negative Concordance of Twin Pairs for Stage of Change and Other Altruistic Behaviors.

	Positive Concordance Among Identical Twins (%)	Negative Concordance Among Identical Twins (%)	Positive Concordance Among Fraternal Twins (%)	Negative Concordance Among Fraternal Twins (%)
Stage of change				
Organ donor	76/122 (62%)	21/122 (17%)	11/24 (46%)	2/24 (8%)
Bone marrow donor	15/122 (12%)	73/122 (60%)	2/24 (8%)	14/24 (58%)
Blood donor	67/123 (54%)	27/123 (22%)	15/24 (63%)	2/24 (8%)
Registered organ donor	66/119 (55%)	32/119 (27%)	10/25 (40%)	8/25 (32%)
Altruism behaviors				
Given directions to a stranger	37/123 (30%)	54/123 (44%)	5/25 (20%)	8/25 (32%)
Given money to charity	47/123 (38%)	52/123 (42%)	7/25 (28%)	11/25 (44%)
Given money to a stranger	9/123 (7%)	91/123 (74%)	2/24 (8%)	19/24 (79%)
Donated goods to charity	66/121 (55%)	17/121 (14%)	13/25 (52%)	1/25 (4%)
Done volunteer work for charity	46/120 (38%)	42/120 (35%)	6/24 (25%)	9/24 (38%)
Delayed an elevator and held door for stranger	73/123 (59%)	14/123 (11%)	14/25 (56%)	3/25 (12%)
Allowed someone to go ahead in line	49/121 (40%)	38/121 (31%)	15/25 (60%)	5/25 (20%)
Given a stranger a lift in car	1/122 (1%)	112/122 (92%)	0/24 (0%)	23/24 (96%)
Pointed out a clerk's error in undercharging for item	8/122 (7%)	96/122 (79%)	2/24 (8%)	17/24 (71%)
Let a neighbor borrow an item of value	5/120 (4%)	104/120 (87%)	3/25 (12%)	20/25 (80%)
Voluntarily looked after a neighbor's pets or children without being paid	13/123 (11%)	85/123 (69%)	2/25 (8%)	12/25 (48%)
Offered to help a handicapped or elderly stranger across street	14/122 (11%)	88/122 (72%)	6/25 (24%)	16/25 (64%)
Offered my seat on a bus or train to stranger	10/120 (8%)	75/120 (63%)	3/25 (12%)	9/25 (36%)
Helped an acquaintance to move households	15/123 (12%)	74/123 (60%)	4/25 (16%)	11/25 (44%)

Previous research suggested that genetic factors may also play a role in altruism. A Spanish study on genetics and altruism found that identical twin pairs were more willing to self-sacrifice for each other than fraternal twin pairs. However, there was no difference between identical and fraternal twin pairs in willingness to fight for each other.<sup>7</sup> A study of Danish twins showed that rates of concordance for blood donation were higher among identical twin pairs (42%) than among fraternal twin pairs (23%).<sup>6</sup> An English study on self-reported altruistic behaviors concluded that about half of the variance in patient responses was associated with genetic factors.<sup>5</sup>

Since there is a genetic component to altruism and organ donation, our findings suggested that efforts to improve organ donation registration may focus on members of the same family and even through family discussions. Future research to address attitudinal, socioeconomic, or religious differences among genetically similar or identical individuals in willingness to register as organ donors may be important.

Several limitations must be considered in interpreting our findings. We enrolled a convenience sample of participants. The modest number of fraternal twin pairs may have limited our ability to draw statistically significant conclusions. The proportion of participants who were registered donors is very high and may not be representative of the general population.<sup>1</sup> This high level of registration may also have limited the power

of study to find a difference in concordance between identical and fraternal twin pairs.

## Conclusion

Genetic factors appear to play a role in decisions about organ donation and other altruistic behaviors. Future work is needed to better quantify the relative importance of genetic versus nongenetic factors and to use this information to help develop interventions to increase organ donation.

## Declaration of Conflicting Interests

The author(s) declared no potential conflicts of interest with respect to the research, authorship, and/or publication of this article.

## Funding

The author(s) disclosed receipt of the following financial support for the research, authorship, and/or publication of this article: Grants U54MD002265, P60MD002265, and K23DK101492 from the National Institutes of Health and grant R390T26989 from the Health Resources and Services Administration.

## References

1. U. S. Department of Health and Human Services. *Organ Donation Statistics*. <https://www.organdonor.gov/statistics-stories/statistics.html>. Accessed January 19, 2019.

2. Sanner MA. Registered bone marrow donors' views on bodily donations. *Bone Marrow Transplant*. 1997;19(1):67-76.
3. Sehgal NK, Scallan C, Sullivan C, et al. The relationship between verified organ donor designation and patient demographic and medical characteristics. *Am J Transplant*. 2016;16(4):1294-1297. doi:10.1111/ajt.13608.
4. Ladin K, Wang R, Fleishman A, Boger M, Rodrigue JR. Does social capital explain community-level differences in organ donor designation? *Milbank Q*. 2015; 93(3):609-641. doi:10.1111/1468-009.12139.
5. Rushton JP, Fulker DW, Neale MC, Blizard RA, Eysenck HJ. Altruism and genetics. *Acta Genet Med Gemellol*. 1984;33(2):265-271.
6. Pedersen OB, Axel S, Rostgaard K, et al. The heritability of blood donation: a population-based nationwide twin study. *Transfusion*. 2015;55(9):2169-2174. doi:10.1111/trf.13086.
7. Tornero E, Sanchez-Romera JF, Morosoli JJ, Vazquez A, Gomez A, Ordonana JR. Altruistic behavior among twins: willingness to fight and self-sacrifice for their closest relatives. *Hum Nat*. 2018;29(1):1-12. doi:10.1007/s12110-017-9304-0.
8. Cahill K, Lancaster T, Green N. Stage-based interventions for smoking cessation. *Cochrane Database Syst Rev*. 2010;10(11):CD004492. doi:10.1002/14651858.CD04492.pub4.
9. Prochaska JO. Decision making in the transtheoretical model of behavior change. *Med Decis Making*. 2008;28(6):845-849. doi:10.1177/0272898X08327068.
10. Robbins ML, Levesque DA, Redding CA, et al. Assessing family members' motivational readiness and decision making for consenting to cadaveric organ donation. *J Health Psychol*. 2001;6(5):523-535. doi:10.1177/135910530100600506.
11. Prochaska JO, Velicer WF. The transtheoretical model of health behavior change. *Am J Health Promot*. 1997;12(1):38-48.
12. Thornton JD, Wong KA, Cardenas V, Curtis JR, Spigner C, Allen MD. Ethnic and gender differences in willingness among high school students to donate organs. *J Adolesc Health*. 2006;39(2):266-274.
13. Rushton JP, Chrisjohn RD, Fekken GC. The altruistic personality and the self-report altruism scale. *Pers Individ Dif*. 1981;2(4):293-302.
14. Duerden MD, Witt PA, Fernandez M, Bryant MJ, Theriault D. Measuring life skills: standardizing the assessment of youth development indicators. *J Youth Dev*. 2012;7(1):99-117.