

Ethnic Differences in Donation-Related Characteristics among Potential Hematopoietic Stem Cell Donors

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Background. Although the National Marrow Donor Program has been highly successful at recruiting ethnic minorities as potential hematopoietic stem cell donors, there have been no systematic investigations of whether donor characteristics that might be linked to the donation experience vary by ethnicity.

Methods. Questionnaires assessing four domains—demographic, volunteer-related, general psychosocial, and donation-related—were mailed to potential donors after they were contacted as a preliminary match for a patient and had agreed to donate. In all, 1,679 potential donors completed and returned a predonation questionnaire. Data from potential donors belonging to five major ethnic groups were analyzed; white, black, Asian/Pacific Islander, Hispanic, and Native American.

Results. Bivariate analyses indicated that virtually all factors in the four domains were associated with ethnicity. Direct discriminant function analysis identified three significant functions. The most striking of the three functions indicated that Asian Americans were more highly educated, more ambivalent (reluctant about donation), more concerned (medical, work/family), and more anxious and depressed than all other ethnic groups. Key differences among other ethnic group members were also identified.

Conclusions. This study provides the first evidence of ethnic group differences in key predonation variables. Findings suggest that Asian/Pacific Islanders possess a number of characteristics that are known psychosocial risk factors for less positive postdonation outcomes and that more intensive pre and postdonation contact with this group may be necessary. Strategies for improving future research in this area are discussed.

Keywords: Hematopoietic stem cell donation, Ethnicity.

(*Transplantation* 2005;80: 890–896)

The increasing use of hematopoietic stem cell (HSC) transplantation as treatment for life-threatening diseases of the blood has led to increasing numbers of patients seeking compatible stem cells from unrelated donors (1, 2, 3). The National Marrow Donor Program (NMDP), which manages the largest volunteer donor registry in the world, facilitated 2,103 bone marrow and stem cell transplants in 2002, an increase of 17% from 2001 (4). Since it was founded in 1986, the

This work was supported in part by grant R29-HL56901 from the National Heart Lung and Blood Institute, and by the National Marrow Donor Program.

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Received 5 May 2004. Revision requested 7 June 2004.

Accepted 11 May 2005.

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ISSN 0041-1337/05/8007-890

DOI: 10.1097/01.TP.0000173648.60978.30

NMDP registry of unrelated volunteer donors has grown from 31,600 to more than 5 million, with approximately 30,000 new unrelated volunteers currently being registered monthly (4). As the NMDP registry has grown, recruitment strategies have been refined to concentrate on securing potential donors from groups that are underrepresented on the registry and/or those that have less common human leukocyte antigen (HLA) types (5, 6). In the United States, ethnic minority groups—blacks, Asian/Pacific Islanders, Hispanics, and Native Americans—have been the focus of many of these recruitment efforts. Although the NMDP has been highly successful at recruiting members of U.S. ethnic minority groups and performing increasing numbers of transplants involving minority donors, there have been no systematic investigations of whether donor characteristics that might be linked to the donation experience (e.g., psychosocial characteristics, attitudes about donation) vary across ethnic groups.

An examination of such characteristics is warranted for at least three reasons. First, the increasing number of ethnic minorities recruited to the registry and serving as donors now makes an examination of potential donor characteristics by ethnic group membership feasible. Second, demonstrated ethnic group differences in religious/spiritual beliefs (7), trust of the medical system in general (8, 9), and attitudes about solid organ donation specifically (10, 11), suggest that impor-

tant differences in potential donor characteristics and attitudes might exist in this context as well. Finally, our work with 343 of the first bone marrow donors to undergo NMDP-facilitated donations indicated that predonation attitudes are linked to postdonation physical and psychological outcomes (12). Findings from this previous investigation indicated that (a) donors who were less happy in general before donation were more likely to experience negative feelings about the donation shortly after donation, and (b) donors who were ambivalent before donation experienced more physical difficulty with donation, and less positive feelings about donation shortly, and 1-year postdonation. We concluded that donors' predonation psychosocial status contributed significantly to postdonation outcomes. This previous investigation was somewhat limited in that it evaluated a restricted set of predonation psychosocial/psychological predictors and did not have adequate numbers to examine ethnic groups separately.

Given the increasing participation of ethnic minorities as potential and actual HSC donors, the documented evidence that cultural beliefs are linked to medical and donation-related behavior, and evidence that predonation factors are linked to postdonation outcomes, we believed it was critical to examine ethnic variation in the characteristics of individuals agreeing to serve as HSC donors. Specifically, we set out to examine ethnic differences on key variables among a group of potential donors who had completed DR-stage testing. When a physician who is searching the registry for a match for a patient identifies one or more potentially matched registrants, he/she may request that they undergo further blood typing (DR-stage testing; see (13) for a complete description of the donor work-up process). In a stem cell transplant, six HLA antigens are considered most important for matching: two A antigens, two B antigens and two DR antigens. DR-stage testing confirms the match on the third of these antigen pairs. After complete HLA typing has been conducted, potential donors are contacted, informed that they are a potential match, and asked whether they are still interested in donating. Our current investigation included only individuals who had completed DR-stage testing and had agreed to continue toward potential donation; our previous work has examined differences between potential donors who continue toward donation at DR-stage and those who discontinue registry participation at this point (14, 15, 16). We examined variation in demographic, volunteer-related, general psychosocial, and donation-related factors across five ethnic groups—white, black, Asian/Pacific Islander, Hispanic, and Native American (including American Indians and Alaska Natives).

METHODS

Study Participants and Procedure

All 93 NMDP domestic U.S. donor centers were invited to participate in the study. Sixty-five centers representing 32 different states agreed to participate and provided data for the current investigation. Centers that declined participation cited the extra burden posed by data collection or concerns about the protection of potential donor confidentiality. The distribution of nonparticipating centers was similar to that of participating centers in terms of registry size and geographic region. Potential study participants included all potential bone marrow donors (the NMPD had not yet begun to collect

peripheral blood stem cells from first-time donors) at participating centers that matched an ill patient between 1998 and 2001 and agreed to undergo further blood testing to confirm the match. Participants were randomly sampled, stratified by ethnic group. We sought to include a minimum of 5% of each of the three major nonwhite ethnic groups and as many Native Americans as possible. The final sample ($n=1,679$) included 7% blacks, 5% Asian/Pacific Islanders, 6% Hispanics and 1.5% Native Americans. Both the NMDP and University of Pittsburgh IRBs approved the study, and informed consent was obtained from all participants.

Packets including the questionnaire, consent forms, and a cover letter were mailed to donor centers where the sampled registry members (identified to us only by center number and donor ID numbers) were registered. Donor coordinators at each center mailed the packet to the potential donor. Potential study participants who did not respond to the initial mailing within two weeks were sent a reminder postcard, and after two more weeks, a second full packet. The response rate was 65%. Response rates varied across donor centers, but did not vary by ethnic group or gender.

Measures

In addition to demographic characteristics we assessed variables in three domains: volunteer-related, general psychosocial, and donation-related.

Volunteer-Related

Two scales were derived from a questionnaire originally used with blood donors (17). The extent to which participants defined themselves as marrow volunteers was assessed by a five-item scale that included items asking respondents if they would feel a loss if they could not donate, and whether being a marrow volunteer was an important part of who they were. Responses ranged from 1=strongly disagree to 10=strongly agree and were averaged so that a higher score indicated a higher level of self-definition as a marrow volunteer (Cronbach's $\alpha=0.74$). The extent to which respondents had incorporated being a potential marrow donor into their social-roles was measured by an eight-item scale. Items asked about the responses of others to the volunteer's decision to join the registry (e.g., whether others were aware that the subject was a marrow volunteer and whether others would be disappointed/surprised if the volunteer dropped out of the registry). Items were scored from 1=strongly disagree to 10=strongly agree and were averaged to form a composite scale with a higher score indicating a stronger social-role as a marrow volunteer (Cronbach's $\alpha=0.79$).

General Psychosocial

Emotional well-being was assessed with the anxiety and depression subscales of the Hopkins Symptom Check List (18). Respondents were asked to respond to anxiety-related and depression-related symptoms on a scale ranging from 0=not at all bothered by the symptom to 4=extremely bothered during the past two weeks. Responses were averaged within subscale (Cronbach's α ; anxiety=.74, depression=.81). Self-esteem was assessed with the eight-item Rosenberg self-esteem scale (19). Responses ranged from 1=strongly agree to 4=strongly disagree and were dichotomized (most extreme high self-esteem category vs. all others)

to correct for skewed distributions and averaged to create a final scale ranging from 0=lower self-esteem to 1=higher self-esteem (Cronbach’s alpha=0.87). The seven-item Mastery scale (20) was used to assess whether individuals felt that they have influence over things that happened to them. Responses ranged from 1=strongly agree to 4=strongly disagree and were dichotomized to correct for skewed distributions and averaged to create a final scale ranging from 0=lower mastery to 1=higher mastery (Cronbach’s alpha=0.88).

Donation-Related Characteristics

Ambivalence or reluctance about donation was assessed with a seven-item scale created for kidney donors (21) and used in our previous studies of bone marrow donors (12). The scale included items such as “How hard was it for you to decide whether or not to donate?” (1=not at all, to 4=very). Responses were dichotomized to correct for skewed distributions so that each item reflected whether participants expressed any ambivalence (1) or no ambivalence (0). An ambivalence scale was formed by averaging the dichotomized responses (Cronbach’s alpha=0.82).

Whether respondents felt informed about donation was assessed with two items (“How informed do you feel?” and “Would you need more information if you were asked to donate tomorrow?”). Responses ranged from 1–4 with a higher score indicating that the respondent felt more highly informed about donation (Pearson’s correlation for the two items=0.66). The two items were averaged to form a composite variable. Medical and work/family concerns about the donation process were assessed by asking respondents to endorse any of a list of possible concerns. Medical concerns included pain, general anesthesia, damage to donor’s health, and fear of needles. Work and family concerns included miss-

ing work, ability to care for family, missing family activities, payment for procedure, and travel to and from the donation center. All items were scored as 0=not endorsed or 1=endorsed. A summative scale was computed for each set of concerns.

Analytic Strategy

Analyses were conducted in two phases. First, we examined the patterns of responses to the independent variables by ethnic group category. For demographic variables we calculated and compared (via chi-square statistics) proportions of individuals in each ethnic group who possessed each of the demographic characteristics. For volunteer-related, general psychosocial, and donation-related variables, means and standard deviations were calculated and compared with Analysis of Variance (ANOVA).

Next, we conducted direct discriminant function analysis using SPSS software to determine whether the entire set of independent variables could reliably discriminate between ethnic groups. Before discriminant analyses were performed, variables were examined and found to meet analytic assumptions adequately (22). Mahalanobis distance statistics were evaluated to identify outliers and four cases were eliminated on this basis. The central goal of discriminant function analysis is to determine whether groups of independent variables could reliably explain individual membership in a group—in this case ethnic group membership. In other words, the analysis seeks to determine which groups of independent variables are associated with membership in a particular ethnic group.

RESULTS

Descriptive statistics for each of the ethnic groups are presented in Table 1 along with significance tests and effect

TABLE 1. Ethnic group differences among potential donors (n=1679)

Donor characteristic	White	Black	Asian/ Pacific Islander	Hispanic	Native American	Test Statistic, ^b	Effect size (r)
n	1,359	111	83	101	25		
Demographics (%)							
Women	65	74	62	69	76	5.90	0.06
<40 years	44	50	64	59	56	20.36**	0.11
Married	73	43	57	63	40	61.72**	0.19
College degree	54	49	85	27	16	77.28**	0.22
Volunteer-related (range 1–10)							
Define self as donor ^b	6.4 (1.9)	6.8 (1.9)	5.9 (1.7)	6.9 (1.8)	7.2 (1.7)	4.85**	0.11
Volunteer social role	3.2 (1.6)	3.7 (1.7)	3.5 (1.7)	4.1 (1.9)	3.7 (2.0)	9.18**	0.15
General psychosocial							
Anxiety (range 1–5)	1.2 (0.33)	1.2 (0.37)	1.4 (0.46)	1.2 (0.33)	1.1 (0.30)	5.53**	0.11
Depression (range 1–5)	1.3 (.040)	1.3 (0.46)	1.5 (0.54)	1.3 (0.44)	1.2 (0.22)	4.90**	0.11
Self-esteem (range 0–1)	0.59 (0.35)	0.71 (0.29)	0.50 (0.36)	0.60 (0.36)	0.55 (0.38)	4.88**	0.11
Mastery (range 0–1)	0.47 (0.38)	0.57 (0.36)	0.39 (0.35)	0.52 (0.37)	0.57 (0.36)	3.30*	0.09
Donation-related							
Ambivalence (range 0–1)	0.37 (0.34)	0.36 (0.33)	0.55 (0.35)	0.37 (0.36)	0.29 (0.33)	5.68**	0.12
Feel informed (range 1–3)	2.0 (0.52)	2.1 (0.50)	1.9 (0.48)	2.0 (0.52)	2.3 (0.52)	3.63**	0.09
No. of medical concerns (range 1–5)	1.3 (1.1)	1.6 (1.2)	2.0 (1.3)	1.3 (1.1)	0.8 (0.80)	8.66**	0.15
No. of work/family concerns (range 1–5)	0.99 (1.0)	0.89 (0.98)	1.5 (1.0)	0.97 (1.0)	0.60 (0.71)	5.42**	0.11

^a Chi-square for dichotomous variables (demographics), one-way ANOVA F (df = 4, 1674) for continuous variables (all except demographics).

^b Values in columns are mean (SD) for all subsequent variables (i.e., all nondemographic variables).

* P<0.01.

** P<0.001.

size estimates indicating the degree of association between each of the predictor variables and ethnic group membership. Participants with “missing” (n=42) or “other” ethnic group codes (n=6) were excluded from all analyses; the final sample included 1,679 potential donors. Chi-square tests of independence among ethnic groups for the demographic variables indicated that age, marital status, and level of education were associated with ethnic group membership; sex was not significantly associated with group membership. Whites were older and more likely to be married, and Asian/Pacific Islanders were more highly educated than other ethnic groups. For nondemographic variables, ANOVAs indicated that there were significant associations between ethnic group membership and all variables in these categories—volunteer-related, general psychosocial, and donation-related. Effect sizes for all variables significantly associated with ethnic group membership were in the small range (23).

As we examined the mean values across ethnic groups for each of the independent variables, a relatively consistent pattern emerged. This pattern is illustrated in Figures 1–4 with variables from each of the three nondemographic variable categories. Bars in the Figures represent mean scores on an independent variable, lines represent standard errors. Figure 1 indicates that Asian/Pacific Islanders were less likely than other ethnic groups to have internalized a donor self-concept (i.e., to view themselves as the kind of person who donates), whereas Native Americans were more likely to have done so (see Table 1 for test-statistics and *P* values associated with these differences). Figures 2, 3 and 4 indicate that Asian/Pacific Islanders reported more general anxiety, ambivalence, and medical concerns about donation than did other groups, whereas Native Americans reported less anxiety, ambivalence, and concerns. This basic pattern of elevated levels of “less positive” volunteer-related, general psychosocial, and donation-related scores among Asian/Pacific Islanders and “more positive” scores across these variables among Native Americans was evident for virtually all the nondemographic variables. Although it is clear that ethnic groups differed on the independent variables, these bivariate analyses do not evaluate whether the groups can be reliably distinguished

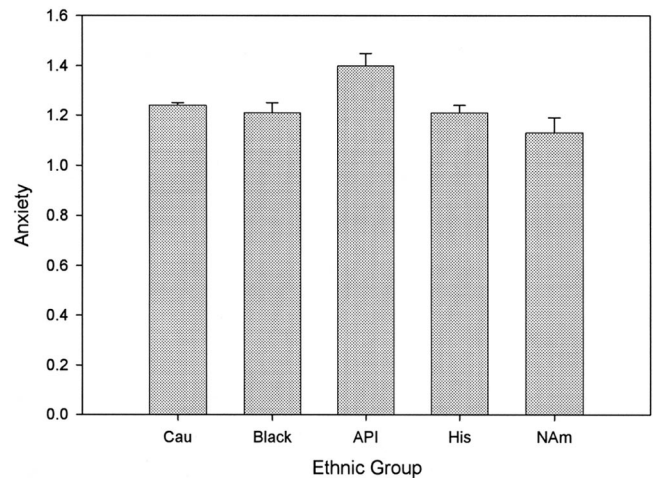


FIGURE 2. Mean level of anxiety by ethnic group.

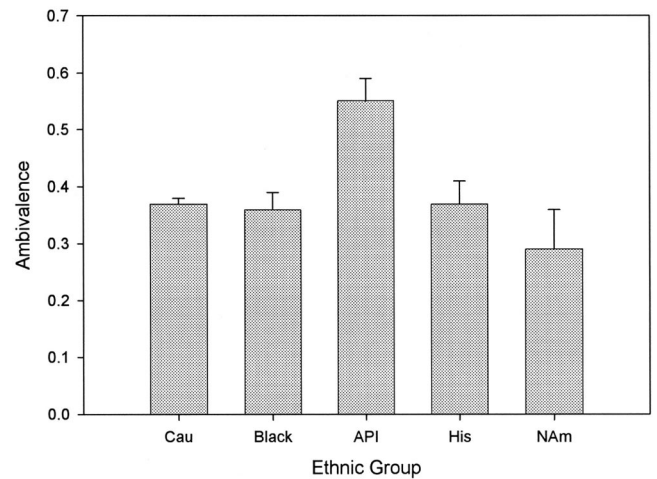


FIGURE 3. Mean level of ambivalence by ethnic group.

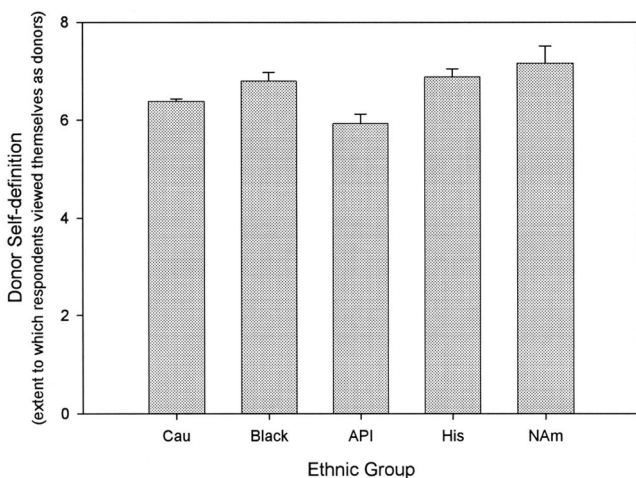


FIGURE 1. Mean level of donor self-definition by ethnic group.

from each other across the complete array of interrelated independent variables. This question was addressed in the second phase of the analysis.

A direct discriminant function analysis adjusted for differences in group size was performed using the 14 variables presented in Table 1 as predictors of membership in four ethnic groups. Native Americans were not included in the analysis because of concern that the small number of individuals might lead to less reliable estimates. Additionally, 121 individuals were eliminated because of missing data on at least one of the 14 variables and 4 were eliminated as outliers—the final sample for the discriminate function analysis was 1,529. Discriminant function analysis is designed to predict group membership—in this case, ethnic group—using combinations of independent variables called functions. The first phase of the analysis revealed three highly significant functions (Function 1, $\chi^2(16)=96.84, P<0.001$; Function 2, $\chi^2(14)=86.63, P<0.001$; Function 3, $\chi^2(12)=39.54, P<0.001$) explaining respectively 44%, 38%, and 18% of the total variance in ethnic group membership. The full discriminate function solution—as is required by the procedure—explains 100% of the variance in ethnic group membership. Table 2

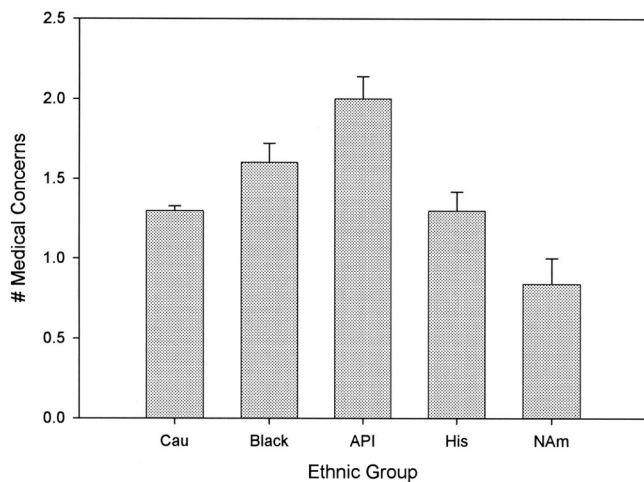


FIGURE 4. Mean number of medical concerns by ethnic group.

presents a matrix listing the loadings of independent variables on the three functions. Each loading in the function columns represents the correlation of a particular variable with that underlying function. For example, the first loading for Function 1 (0.62) indicates that being unmarried is strongly associated with Function 1 and, in fact, is one of the primary attributes that defines this function. Loadings <0.30 are excluded from the matrix given their low explanatory power (i.e., $<10\%$ of the variance; 20). Thus, the first function distinguishes individuals who are more likely to be unmarried, to view being a donor as part of their social role, and to define themselves in terms of their donor status compared to all other individuals in the sample. Group centroids for this function, presented in the lower portion of Table 2, indicate that blacks and Hispanics were most likely to have this constellation of characteristics (i.e., they had high group centroids on this function of 0.74 and 0.59 respectively), whereas

whites and Asian/Pacific Islanders had much lower centroids. The second function describes individuals who are highly educated, more ambivalent, more concerned about medical and work/family aspects of donation, and more anxious and depressed. As Table 2 indicates, this function discriminates Asian/Pacific Islanders (group centroid=1.0) from all other ethnic groups which have low or negative group centroids. Finally, the third function describes individuals who are less likely to view being a donor as part of their social role, are older, and have higher self-esteem. Along this dimension, blacks (group centroid=0.36) were maximally separated from Hispanics (group centroid=-0.53), with whites and Asian/Pacific Islanders lying between these extremes. Taken together, the functions accurately classified 82% of the sample into the correct ethnic group category.

DISCUSSION

This study provides the first evidence of the existence of ethnic group differences in key predonation variables among potential HSC donors. As such, it has implications for the management of large ethnically diverse volunteer registries like the NMDP registry, and for the focus of future research in this area.

The first bivariate phase of our analysis indicated that ethnic groups differed on virtually all the donor characteristics investigated—only gender did not differ by ethnic group. Not only did ethnic groups differ on these characteristics, but the pattern of difference was also strikingly consistent. Asian/Pacific Islanders had elevated levels of “less positive” psychosocial and donation-related characteristics—e.g., less likely to think of themselves as donors, more anxious and depressed, more ambivalent, more concerns about donation—and Native Americans tended to score lower (i.e., more positively) on these variables compared to other groups. Although Native Americans were not included in the discriminant analysis because of small numbers, the findings from this multivariate analysis for Asian/Pacific Islanders

TABLE 2. Three discriminant functions, their associated variable loadings, and group function scores (n = 1529)

	Function 1	Function 2	Function 3
Donor characteristic			
Unmarried	0.62		
Volunteer social role	0.52		-0.42
Define self as donor	0.32		
Education (more)		0.68	
Medical concerns (more)		0.54	
Ambivalence (more)		0.47	
Work/family concerns (more)		0.44	
Anxiety (more)		0.41	
Depression (more)		0.38	
Age (older)			0.51
Self-esteem (higher)			0.34
Function Scores (group centroids)			
White	-0.10	-0.05	0.02
Black	0.74	0.05	0.36
Asian/Pacific Islander	0.04	1.0	-0.17
Hispanic	0.59	-0.27	-0.53

Loadings less than 0.30 are not presented. Sex, mastery, and feeling informed about donation were not reliably associated (> 0.30) with any of the three functions.

both supported and broadened our understanding of the bivariate results. A function including higher education, more concerns, more ambivalence, and higher anxiety and depression distinguished Asian/Pacific Islanders from all other groups.

The higher scores for Asian/Pacific Islanders on these variables are intriguing. It is possible that more highly educated individuals seek out information and/or weigh the costs and benefits of donation differently than those with less education—a process that could produce more ambivalence and concerns. It is also possible that cultural or religious beliefs contributed to Asian/Pacific Islanders' predonation psychosocial status. For example, lower rates of willingness to donate organs among Asians has been attributed to the Confucian concept of "filial piety" which dictates that individuals, out of respect for their ancestors are required to return their bodies in the same condition that they received them from their parents (24, 25). Although bone marrow regenerates, it seems possible that culturally based beliefs that affect willingness to donate solid organs may also be present among those who have agreed to, and are on the pathway toward HSC donation. Although we did not have a large enough sample of Asian Americans to empirically examine variations in perceptions among Asian subgroups, we qualitatively explored potential differences across the four largest subgroups in our sample (Asian Indian, Japanese, Korean, and Southeast Asian/Southern Chinese; 20 per group) and found significant variance in the mean scores for donor self-definition, ambivalence and concerns across groups. Although the explanation for variation across Asian subgroups is not immediately clear, these preliminary observations strongly suggest that future research should closely examine differences within, as well as across, broad ethnic categories and include assessment of cultural and religious factors potentially associated with this variation.

In addition to the discriminant profile for Asian/Pacific Islanders, two other profiles were extracted. One described a group of blacks and Hispanics who were more likely to be unmarried, and to view their donor status as important to their internal self-conception and to their public role than other groups. This function seems to indicate the importance of, and pride in, being a potential donor. A possible contributor to blacks' and Hispanics' high scores on this function may be NMDP recruitment techniques which have, at times, stressed assistance to one's own ethnic group and ethnic group pride as a reason for joining the registry.

A final function described a group of blacks who were older, had higher self-esteem, and were less likely to view being a donor as part of their social role, and a group of Hispanics who represented the inverse of these characteristics (i.e., younger, lower self-esteem, high social role.). This was the weakest of the three functions and is perhaps the most difficult to understand. It is possible that older age is linked to higher self-esteem in this group, which, in turn, is associated with less need to project a donor social-role to one's peers. However, further research will be necessary to determine the reliability and nature of this function.

Although this study represents the first examination of ethnic group differences among potential HSC donors, the cross-sectional nature of the study limits our ability to draw conclusions about the causal direction of associations among

these variables. Future investigations would be enhanced by the inclusion of a longitudinal component. The study would also have benefited from the inclusion of variables that might be associated with both ethnicity and perceptions about donation or the medical system (e.g., socioeconomic status, medical mistrust). A third limitation is our inability to adequately test for group differences and patterns among subgroups within the five broad ethnic categories examined here. We are aware that the interaction among race, ethnicity, and culture is complex and will need to be addressed with larger numbers of minority group participants and a more nuanced approach to variables used as indicators of these concepts (26). Finally, although there were no differences in response rates by gender or ethnic group, we do recognize that the response rate to the survey was not perfect and that this is a limitation of the study.

Overall, our findings suggest that key demographic and psychosocial variables are associated with ethnic group membership among potential HSC donors. Furthermore, given the link between predonation donor characteristics and postdonation outcomes demonstrated in our previous work (12), it appears that Asian/Pacific Islanders in this population may be especially "at-risk" for less positive outcomes following donation. In contrast to Asian/Pacific Islanders, other ethnic minority groups tended to view being a donor as an important part of their self-concept and to score more positively on other psychosocial variables – perhaps putting them at less postdonation risk. These findings have implications for HSC donor registry management, including the potential need for more intensive predonation efforts among Asian/Pacific Islanders to discuss donation-related concerns or ambivalence, and to elicit and address the source of such concerns. Additionally, more intensive postdonation follow-up may be necessary among Asian/Pacific Islanders to ensure that donors who donate despite some feelings of ambivalence or concern receive extra assistance in coping with any negative postdonation physical or psychosocial outcomes. These findings also suggest that future research in this area could productively address questions raised by the current investigation by (a) including a more nuanced set of variables to assess race/ethnicity/culture and other donor attitudes/beliefs, (b) including assessment of religious beliefs and medical mistrust as they relate to tissue donation, and (c) prospectively following potential donors from pre to postdonation.

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