

## Blood Systems Research Institute Annual Report 2008

### Murphy Laboratory

Edward L. Murphy, October 2008

#### I. Introduction

Edward L. Murphy, MD MPH, Professor of Laboratory Medicine and Epidemiology/Biostatistics at the University of California San Francisco, maintains his epidemiology Laboratory at Blood Systems Research Institute (BSRI). In 2001 Dr. Murphy moved his laboratory from UCSF to BSRI to continue longstanding collaborations with Dr. Michael Busch, and to initiate new epidemiology research on transfusion safety and blood supply. Reflecting the close working relationship between UCSF and BSRI, the laboratory includes staff from both institutions, and accomplishes collaborative research projects using funding from NIH and the BSRI.

A site visit accomplished Professors Arthur Reingold of UC Berkeley, George Rutherford of UC San Francisco, and Stephen Vamvakas of University of Ottawa in September 2006 recommended expansion of the epidemiology program with recruitment of one to two additional investigators, and the formation of a “center of excellence” in International Transfusion Safety.

The Epidemiology laboratory occupies approximately 1,250 square feet of office space on the second floor of BSRI. Our office suite also includes a small examination room for performing interviews and physical examinations and phlebotomy on research subjects. In addition to networked Windows-based personal computers for each staff member, our equipment includes a dedicated Windows server, a high-capacity Fujitsu scanner, and Teleform questionnaire design and scanning software. Laboratory support is provided by Dr. Leslie Tobler of BSRI, who manages a large specimen repository for the epidemiology laboratory under subcontract funding.

#### Major Research Areas

- HTLV-I and –II
- Epidemiology of other transfusion transmitted infections
- Blood donor epidemiology
- International transfusion safety research and training

#### BSRI Collaborations

- Mike Busch
- Philip Norris
- Tzong-Hae Lee
- Leslie Tobler

#### Non-BSRI Collaborations

- 4 other HOST blood centers
- 5 other REDS blood centers
- Institut Pasteur (Gessain, Mahieux and Fontanet)
- Akihito Okayama (Japan)

Neil Risch, Joe Gray & Bob Hiatt (UCSF – genetic epidemiology)  
 Marc Hellerstein (UC Berkeley – lymphocyte turnover by deuterated H<sub>2</sub>O labeling)  
 Investigators in Sao Paulo, Buenos Aires, Honduras & Vietnam

## **II. Program Summary.**

### HTLV Outcomes Study (HOST)

We have just submitted a competitive renewal application for an additional 5 years of follow-up of this multi-center prospective cohort study of the health outcomes of chronic infection with HTLV-1 and HTLV-2. A total of 151 HTLV-1 and 387 HTLV-2 infected humans were recruited from seropositive blood donors in 1988 through 1992. A group of 799 seronegative controls, matched on age, sex, race/ethnicity, blood center and donation type was recruited at the same time to allow comparison of health outcomes with an appropriate control group. Every two years, subjects are seen by nurse/counselors who perform a health interview, a screening physical examination, and phlebotomy for complete blood count and repository specimens for research testing.

### REDS-2

The Retrovirus Epidemiology Donor Study (REDS) is a multi-center epidemiological study of blood safety funded by research contracts from the National Heart, Lung and Blood Institute. Dr. Murphy and Dr. Busch have been involved in the first period of this study (REDS-1) since its inception in 1989 through the final funding period, which ended September 2003. In 2004, NHLBI announced a request for proposals for a second study, referred to as REDS-2, and UCSF/BSRI was awarded one of six clinical center contracts effective September 2004 (the only blood center to continue from REDS-1). BSRI was also awarded the central laboratory contract (PI Dr. Busch) for REDS-2.

To date, REDS-2 research projects included:

- Donation Database - > 1 million donations per year (Ongoing; group project)
- LAPS-1 – a studies of HLA and WBC antibodies in donors (Finished; Triulzi).
- RISE - iron and hemoglobin metabolism in donors (Ongoing; Cable),
- Molecular surveillance of TTI's (Ongoing; Busch), and
- LAPS-2 – A retrospective cohort study of TRALI incidence in patients transfused with HLA antibody positive vs. negative blood products from donors enrolled in LAPS-1 (About to Start, Kakaia & Triulzi).

### HCV Mortality Study

This retrospective cohort study was funded by a R01 Grant to Drs. Busch, Murphy and Tobler that is pending competitive renewal. Approximately 10,000 HCV seropositive blood donors identified within the Blood Systems network from 1991 through 2002 were matched with an equal number of HCV seronegative blood donors according to age, gender, blood center and zip code. The entire database of about 20,000 blood donors, including names and Social Security

numbers, but without HCV status, was forwarded to the U.S. Public Health Service National Death Index (NDI). NDI matched these data against their national death certificate database to determine vital status of all participants through 2003, and cause of death for subjects who are deceased. Data analysis compared overall mortality, as well as cause specific mortality, between the HCV and control groups.

#### HCV Case Control Study

This project was funded by the same NIH R01 grant to Drs. Busch, Murphy, and Tobler, and directed by Leslie Tobler Ph.D., our close collaborator. It represents a case control study to analyze the epidemiologic and immunologic associations with clearance of HCV viremia. Cases are 150 HCV seropositives who are negative in nucleic acid testing, recruited from the 15% to 20% of BSI systemwide blood donors with these screening lab results at the time of blood donation. Controls (N=300) are both seropositive and nucleic acid positive for HCV, and are matched on age and sex to the cases. After written informed consent, a questionnaire is completed by the donor and a blood specimen is obtained by the local blood center and ship by overnight courier to Dr. Tobler's laboratory at BSRI for processing into the study repository. HCV serology and nucleic acid testing is repeated by Dr. Tobler, and specimens are then shipped to outside collaborators to compare the HCV immunologic response and host genetics between cases and controls.

#### Mid-Career Award in Patient-Oriented Research and Training (K24)

In recognition of both his funded research and teaching skills, Dr. Murphy was awarded this K24 grant from the NHLBI for 5 years effective January 2004. We are now in a one year no-cost extension through 2009 and submitted a competitive renewal at the November 12, 2008 deadline. The grant includes mainly salary support for the PI, to allow him to reduce his effort on other funded projects, groom junior investigators to fill these roles, and have time for additional training and mentoring. He has pursuing research training in the following areas: 1) HTLV-I and -II natural history and pathogenesis using the HOST cohort; 2) studies of blood donor epidemiology, using the Donor Epidemiology Core; and 3) a significant new effort devoted to research training in International Transfusion Safety funded by our separate BSRI grant and potentially REDS-2 international activities. The latter activity has expanded significantly during 2008 with activities in Brazil, Argentina, Mexico Honduras, Vietnam and Paris (for francophone Africa).

#### International Transfusion Safety Research and Training and Donor Epidemiology Core

(see separate Annual Reports by Dr. Murphy)

### **III. Progress Report**

HOST: This mature cohort now allows analysis of mortality related to HTLV infection. There have been 19 additional deaths during Visit 7, for a total of 90 deaths in the cohort. There have been 18 deaths in the HTLV-I group and 34 deaths in HTLV-II group compared to 38 deaths in

the HTLV seronegative group. **Figure 2** shows a Kaplan-Meier curve of survival by HTLV

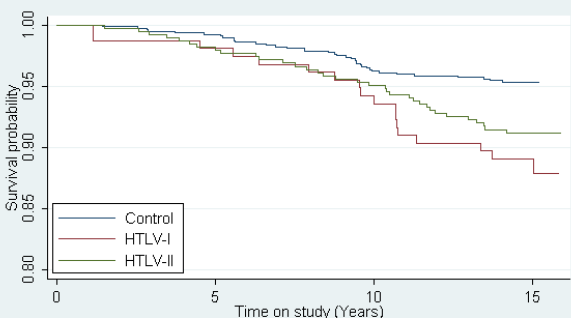


Figure 2. Kaplan-Meier curves showing unadjusted probability of survival for HTLV-I- and HTLV-II-infected subjects relative to seronegative controls. Log-rank  $p=0.0016$  for difference in survival among HTLV-I and control subjects, and  $p=0.006$  for difference among HTLV-II and control subjects.

status, demonstrating significantly higher mortality in the HTLV-I ( $p=0.0016$ ) and HTLV-II ( $p=0.0006$ ) groups, compared to seronegatives. Preliminary Cox proportional hazards models yielded unadjusted hazard ratios for HTLV-I of 2.4 (95% CI 1.4-4.3) and for HTLV-II of 1.9 (95% CI 1.2-3.0). After controlling for age, gender, race, donation type, blood center, injection drug use, alcohol and tobacco use and HCV status, these hazard ratios changed to 1.8 (95% CI 0.9-3.5) for HTLV-I and 2.5 (95% CI 1.4-4.6) for HTLV-II. Thus

HTLV-II is clearly associated with increased risk of death, and HTLV-I probably associated with increased mortality.

Cause-specific mortality is presented in **Table 2**. The greatest number of deaths were due to cancer, including 6 HTLV-I (crude RR= 2.37, 95% CI 0.91-6.13) and 13 HTLV-II (crude RR= 2.07, 95% CI 0.97-4.43) compared to 13 cancer deaths in HTLV seronegative group.

Cardiovascular deaths also showed a trend towards higher mortality in HTLV-I (4 deaths, RR= 4.05, 95% CI 1.10-14.92) and HTLV-II (6 deaths, RR=2.49, 95% CI 0.76-8.10) infected subjects. Preliminary data from Visit 8 shows 16 deaths thus far with about three quarters of work completed. These data support the need for additional follow-up of the cohort.

We published our analysis of complete blood counts in **Blood**. Multivariable repeated measures analyses were conducted to evaluate the independent effect of HTLV infection and potential confounders on nine hematologic measurements. HTLV-II subjects had significant ( $P<0.05$ ) increases in their adjusted lymphocyte counts (+126 cells/mm<sup>3</sup>; approx +7%), hemoglobin (+0.2 gm/dL) and mean corpuscular volume (1.0 fL) compared to seronegative subjects. Both HTLV-I and -II subjects had higher adjusted platelet counts (+16,544 and +21,657 cells/mm<sup>3</sup>;  $p<0.05$ ) than seronegatives. Among all subjects, time led to decreases in platelet count and lymphocyte counts, and to increases in MCV and monocytes. Sex, race, smoking and alcohol consumption all had significant effects on blood counts. The HTLV-II effect on lymphocytes is novel and may be related to viral transactivation or immune response. HTLV-I and -II associations with higher platelet counts suggest viral effects on hematopoietic growth factors or cytokines.

Table 2. Number of deaths by cause of death and HTLV status.\*

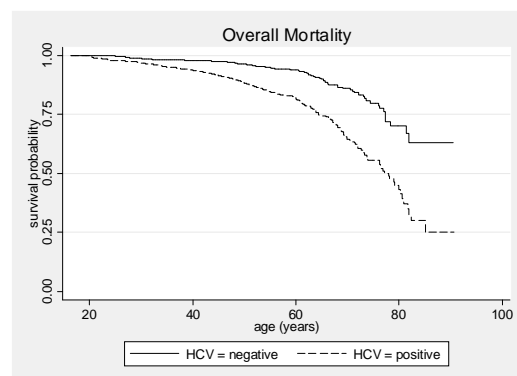
Cause of Death	HTLV-I (N=160)	HTLV-II (N=391)	HTLV Negative (N=810)	All Subjects (N=1361)
Accident/trauma	2	0	5	7
Cancer	6	13	13	32
Cardiovascular	4	6	5	15
Cerebrovascular	2	4	1	7
Diabetes	0	1	0	1
Drug	1	1	0	2
Hepatic	0	2	1	3
Infection	0	2	5	7
Other	3	1	3	7
Pulmonary	0	1	2	3
Unknown	0	3	2	5
<b>Total deaths</b>	<b>18</b>	<b>34</b>	<b>37</b>	<b>89</b>
<b>Deaths per group</b>	<b>11.3%</b>	<b>8.7%</b>	<b>4.6%</b>	<b>6.5%</b>
<b>Proportion of all deaths</b>	<b>20.2%</b>	<b>38.2%</b>	<b>41.6%</b>	<b>100%</b>

\*Subjects who were not enrolled in the original cohort (N=11) and subjects who de-enrolled before completing any visits (N=1) are not included.

**REDS:** The REDS donation database was launched on January 1, 2006. LAPS-1 has been completed and the primary manuscript is under review at JAMA. The primary finding was a strong association of HLA antibody prevalence with parity among female blood donors. Antibody prevalence was quite low in males and in previously transfused donors. Planning is completed and field work about to begin on a retrospective cohort study of the recipients of blood from donors with and without HLA antibodies (LAPS-2). The RISE iron and hemoglobin study completed enrollment earlier in 2008 and is now in follow-up phase. Preliminary data show a higher than expected prevalence of iron deficiency as indicated by low ferritin levels. We continue to be active in other minor REDS projects including Dr. Custer's involvement in studies of the malaria deferral and Dr. Murphy's involvement in an analysis of minority blood donors, for which a manuscript is about to be submitted.

Historically, minority populations represented only a small proportion of USA blood donors, but recent trends in immigration and potential blood shortages emphasize the need for recruitment strategies to increase minority donations. We analyzed of donation data from a network of six USA blood centers for calendar year 2006. Race/ethnicity, country of birth and educational attainment data were collected specifically for the study and assessed for their influence on donation behavior. Logistic regression was used to determine independent associations with repeat donors status and annual donation frequency. We studied 1,288,998 donations from 729,068 donors; most donors had data on race/ethnicity (97.1%) and country of birth (93.1%). The proportion of minority donors differed by blood center, with African Americans (16%) most common at a Georgia blood center, and Asians (12%), Hispanics (13%) and foreign-born donors (13%) most common at a California blood center. Minority donors and those born in Mexico or Latin America were younger than Whites. Minority and non-USA born donors were less likely than Whites and USA-born donors to be repeat donors (odds ratios 0.60 to 0.78), and most were less likely to give  $\geq 2$  annual donations (odds ratios ranging from 0.82 to 1.11). Minority and Mexico/Latin America born donors represent a younger and predominantly first-time donor population compared to White and USA-born donors, but their annual donation frequency was only slightly lower than White and USA-born donors. Increasing the retention and donation frequency of minorities will be important for maintaining the blood supply.

**HCV Mortality:** Hospital-based studies suggest that hepatitis C virus (HCV) infection causes frequent cirrhosis, hepatocellular carcinoma and mortality, but epidemiological studies have shown less morbidity and mortality. We performed a retrospective cohort study of 10,259 RIBA-confirmed HCV antibody positive, allogeneic blood donors from 1991-2002, and 10,259 HCV-antibody negative donors matched for year of donation, age, gender and zip code (Guiltinan A. *Am J Epidemiol* 2008). Vital status through 2003 was obtained from the U.S. National Death Index, and hazard ratios (HR's) with 95 percent confidence intervals (CI's) were calculated using survival analysis. After mean follow-up of 7.7 years, there were 601 (2.92



percent) deaths: 453 HCV+ and 148 HCV- (HR=3.13, 95% CI 2.60-3.76). Excess mortality in the HCV+ group was greatest in liver-related (HR=45.99, CI 11.32-186.74), drug or alcohol related (HR=10.81, 95% CI 4.68-24.96) and trauma/suicide (HR=2.99, 95% CI 2.05-4.36) causes. There was also an unexpected increase in cardiovascular mortality among the HCV+ donors (HR = 2.21, 95% CI 1.41–3.46). HCV infection is associated with a significant, three-fold increase in overall mortality among former blood donors, including significantly increased mortality from liver and cardiovascular causes. High rates of mortality from drug/alcohol and trauma/suicide causes are likely due to lifestyle factors, and may be at least partially preventable. We are currently pursuing a questionnaire directed at living members of the cohort to measure morbidity, treatment and potentially confounding lifestyle variables.

HCV Case Control Study: Since early 1999, nucleic acid testing (NAT) has been performed on blood collected in the United States, allowing for the classification of HCV antibody positive donors into presumptive resolved (20%) and chronic (80%) hepatitis C infections. We report a case-control study of factors associated with presumptive HCV resolution (cases = minipool-NAT negative) compared to chronically infected donors (controls = minipool-NAT positive). Participants completed a risk factor, symptoms and treatment questionnaire followed by phlebotomy for HCV antibody, RNA and liver biochemical testing. We enrolled 100 cases and 202 controls. In a multivariable logistic regression model, significant and independent positive associations with clearance were seen for being an autologous donor (OR=4.70, 95% CI 2.02-10.94) and heavier drinking (OR=2.62, 95% CI 1.22-5.61 for 2-7 drinks per week vs. none). Significant negative associations with clearance were seen for Black race (OR=0.11, 95% CI 0.01-0.87) and being a non-IDU who received a blood transfusion prior to May 1990 (OR=0.36, 95% CI 0.14-0.91). Nine out of the 100 cases (RNA-/Ab+) reported a liver biopsy while one also reported treatment. Using the Metavir scoring system, 4, 2, and 0 had mild, moderate and advanced fibrosis. Ninety-two controls (RNA+/Ab+) reported having a liver biopsy with 44 also reporting treatment. Forty-six, 14, and 11 had mild, moderate and advanced fibrosis based on liver biopsies. Cases were less likely to report hospitalization for nonhepatic gastrointestinal diagnoses, while cases were more likely to report orthopedic surgery. We were able to confirm previously recognized factors in HCV clearance (race and age) and suggest new factors (clearance less likely with transfusion-acquired HCV). We provide additional support for the concept that clearance occurs early in the course of infection. Finally, we provide useful biopsy and treatment data among blood donors versus patients infected with HCV.

Finally, international research and training activities expanded in 2007 under joint funding by Dr. Murphy's NIH K24 award and the BSRI international transfusion safety grant (see separate annual report).

#### **IV. Grants, Contracts and Awards**

##### **Current Extramural**

National Heart, Lung and Blood Institute  
Research Grant 2R01-HL-62235

**February 2005-January 2009 (No-cost extension thru Jan 2010),**

Pathophysiology of HTLV-I and HTLV-II Infection (HTLV Outcomes Study)  
 PI: E.L. Murphy

National Heart, Lung and Blood Institute  
 Research Grant K24-HL075036 (Mid Career Research and Training Award)  
**January 2004-December 2008 (No-cost extension thru Dec 2009),**  
 Clinical Epidemiology of HTLV-I and HTLV-II Infection  
 PI: E.L. Murphy

National Heart, Lung and Blood Institute  
 Research Contract N01-HB-47174  
**September 2004-August 2009**  
 Blood Center for Retrovirus Epidemiology in Donors Study-II (REDS-II)  
 PI: E.L. Murphy

National Heart, Lung and Blood Institute  
 Research Contract HHSN268200417175C  
**February 2006-December 2009**  
 Retrovirus Epidemiology Donor Study-II (REDS-II) International Component – Blood Center  
 PI: M.P. Busch

National Heart, Lung and Blood Institute  
 Research Grant P50-HL-81027  
**September 2005-August 2010**  
 Specialized Centers of Clinical-Oriented Research in Transfusion Biology and Medicine  
 PI: P. Toy

Univ. of Calif. Office of President  
 PIMSA Research Grant (Immigration and Health)  
**November 2007-April 2009**  
 Sangre Segura: an epidemiological study of blood transfusion safety in the Mexico-US border region  
 PI: E.L. Murphy

### **Past Extramural**

National Heart, Lung and Blood Institute  
 Research Grant R01-HL-076902  
**September 2003-August 2008**  
 Hepatitis C: Natural History, Pathogenesis, Therapy and Prevention  
 PI: M.P. Busch

### **Other Significant Activities**

Associate Medical Director, Blood Centers of the Pacific

Blood center physician with on-site daytime and night call (one week per month).

University Service

UCSF Committee on Human Research, 1994-1995 and 2002-2007  
 UCSF Committee on Research, Chair 2008-present  
 UCSF Committee on Research, Vice Chair 2007-2008  
 UCSF Research Advisory Board, 2007 - present

Government Service - NIH

Ad Hoc Study Member of various study sections, 1997-present.

Membership in Professional Organizations:

International Retrovirology Association  
 Board of Directors 1997-present  
 President 2003-2005  
 Society for Epidemiologic Research  
 American Association for the Advancement of Science  
 American Public Health Association  
 AABB  
 International Society for Blood Transfusion

Reviewer for Professional Publications (last 5 years)

AIDS Research  
 Epidemiology Infection  
 Blood  
 BMC Infectious Diseases  
 International Journal of Psychiatry in Medicine  
 Transfusion  
 Journal of Infectious Diseases  
 Transfusion Medicine  
 JAIDS  
 Acta Neuropsychiatrica  
 American Journal of Tropical Medicine Hygiene  
 Journal of Clinical Virology  
 Journal of Virology

Staff Directed – Epidemiology Laboratory

Edward L. Murphy M.D., M.P.H. <sup>2</sup>	Senior Investigator
Brian Custer, Ph.D. <sup>1</sup>	Assistant Investigator*
Thelma Goncalvez, M.D, Ph.D. <sup>1</sup>	Staff Scientist
Hope Biswas, MS <sup>1</sup>	Staff Scientist
Anne Guiltinan, M.S.W. <sup>1</sup>	Senior Research Associate (Manager)
Debby DeVita, R.N., M.S.N. <sup>2</sup>	Research nurse
Susan Yuen <sup>2</sup>	Grants Analyst
Zhanna Kaidarova <sup>1</sup>	Statistician and Database Manager
Daniel Hindes <sup>1</sup>	Research Associate
Shrein Bahrami <sup>1</sup>	Research Associate
Molly Klett <sup>1</sup>	Research Associate

<sup>1</sup> BSRI personnel <sup>2</sup> UCSF personnel

\* As an Assistant Investigator, Dr. Custer leads his own lab, but is part of the Epidemiology Division and is mentored by Dr. Murphy

## Publications (last two years)

### Peer-reviewed articles

1. Gabet AS, Moules V, Sibon D, Nass CC, Mortreux F, Mauciere P, Gessain A, **Murphy EL**, Wattel E. Endemic versus epidemic viral spreads display distinct patterns of HTLV-2b replication. Virology 2006;345:13-21.
2. Barcellos NT, Fuchs SC, Mondini LG, **Murphy EL**. Human T Lymphotropic virus type I/II infection: prevalence and risk factors in individuals testing for HIV in counselling centers from Southern Brazil. Sex Trans Dis 2006;33:302-6.
3. Goncalvez TT, Sabino EC, **Murphy EL**, Chen S, Chamone DA, McFarland W. Human immunodeficiency virus test-seeking motivation in blood donors, Sao Paulo, Brazil. Vox Sang 2006;90:170-6.
4. Busch MP, Glynn SA, Stramer SL, Orland J, **Murphy EL**, Wright DJ, Kleinman S. Correlates of hepatitis C virus (HCV) RNA negativity among HCV-seropositive blood donors. Transfusion 2006;46:469-75.
5. Carneiro-Proietti AB, Catalan-Soares BC, Castro-Costa CM, **Murphy EL**, Sabino EC, Hisada M, Galvao-Castro B, Alcantara LC, Remondegui C, Verdonck K, Proietti FA. HTLV in the Americas: challenges and perspectives. Rev Panam Salud Publica 2006;19:44-53.
6. Glynn SA, Schreiber GB, **Murphy EL**, Kessler D, Higgins M, Wright DJ, Mathew S, Tu Y, King M, Smith JW. Factors influencing the decision to donate: racial and ethnic comparisons. Transfusion 2006;46:980-90.

7. Reich P, Roberts P, Laabs N, McEvoy P, Hirschler N, **Murphy EL**. A randomized trial of blood donor recruitment strategies. Transfusion 2006;46:1090-6.
8. Kwaan N, Lee TH, Chafets DM, Nass C, Newman B, Smith J, Garratty G, **Murphy EL**. Long-term variation in HTLV-I and HTLV-II proviral load and association with clinical data. J Infect Dis 2006;194:1557-64.
9. De Castro-Costa CM, Araujo AQC, Barreto MM, Takayanagui OM, Sohler MP, Da Silva ELM, Carton H, Gotuzzo E, Hall WW, Montano S, **Murphy EL**, Oger J, Remondegui C, Taylor GP. Proposal for diagnostic criteria of tropical spastic paraparesis/HTLV-I-associated myelopathy (TSP/HAM). AIDS Res Hum Retroviruses 2006;22:931-5.
10. Beilke MA, Traina-Dorge VL, Sirois M, Bhuiyan A, **Murphy EL**, Walls JM, Fagan R, Winsor EL, Kissinger PJ. Relationship between human T-lymphotropic virus (HTLV) type 1/2 viral burden and clinical and treatment parameters among patients with HIV type 1 and HTLV-1/2 coinfection. Clin Infect Dis 2007;44:1229-34. Epub 2007 Mar 19.
11. de Almeida Neto C, McFarland W, **Murphy EL**, Chen S, Nogueira FA, Mendrone A Jr, Salles NA, Chamone DA, Sabino EC. Risk factors for human immunodeficiency virus infection among blood donors in Sao Paulo, Brazil, and their relevance to current donor deferral criteria. Transfusion 2007;47:608-14.
12. Custer B, Chinn A, Hirschler NV, Busch MP, **Murphy EL**. The consequences of temporary deferral on future whole blood donation. Transfusion 2007;47(8):1514-23.
13. Schlumpf KS, Glynn SA, Schreiber GB, Wright DJ, Randolph Steele W, Tu Y, Hermansen S, Higgins MJ, Garratty G, Murphy EL; National Heart, Lung, and Blood Institute Retrovirus Epidemiology Donor Study. Factors influencing donor return. Transfusion 2008;48:264-72. Epub 2007 Nov 13.
14. Nguyen DD, DeVita DA, Hirschler NV, **Murphy EL**. Blood donor satisfaction and intention of future donation. Transfusion 2008;48:742-8. Epub 2008 Jan.
15. Guiltinan AM, Kaidarova Z, Custer B, Orland J, Stollo A, Cyrus S, Busch MP, **Murphy EL**. Increased all-cause, liver and cardiac mortality among Hepatitis C Virus seropositive blood donors. Amer J Epidemiol 2008;167:743-50. Epub 2008 Jan 17.
16. Goncalvez TT, Sabino EC, Chen S, Salles NA, Chamone DA, McFarland W, **Murphy EL**. Knowledge, Attitudes and Motivations Among Blood Donors in São Paulo, Brazil. AIDS Behav 2008;12(4 suppl):S39-47. Epub 2008 Apr 4.
17. Hillyer CD, Blumberg N, Glynn SA, Ness PM, for the members of the NHLBI Working Group in Transfusion Recipient Epidemiology and Outcomes Research. Transfusion recipient epidemiology and outcomes research: possibilities for the future. Transfusion 2008; 48:1530-37.

18. Bartman MT, Kaidarova Z, Hirschorn D, Sacher RA, Fridey J, Garratty G, Gibble J, Smith JW, Newman, Yeo AE, **Murphy EL**. Long-term increases in lymphocytes and platelets in human T-lymphotropic virus type II infection. Blood; Aug 28 [Epub ahead of print].
19. Almeida Neto C, **Murphy EL**, McFarland W, Mendrone Junior A, Chen S, Chamone DAF, Sabino EC. Changes in the profile of blood donors with reactive serologic tests for syphilis in Sao Paulo, Brazil and its relevance to blood bank practice. Blood (in press).
20. DeVita DA, White MC, Zhao X, Kaidarova Z, **Murphy EL**. Determinants of subject retention in a prospective cohort study of HTLV infection. BMC Public Health 2008 (in press).

#### Book Chapters and Reviews

1. Beilke MA, **Murphy EL**. The human T-cell leukemia virus types 1 and 2 (HTLV-1 and 2). In Volberding P, Palefsky J (eds.) Viral and Immunological Malignancies Hamilton, Ontario:BC Decker Inc., 2006:326-358.
2. Fiebig EW, **Murphy EL**, Busch MP. HIV, HTLV, and Other Retroviruses. Chapter 45. In Hillyer CD, Silberstein LE, Ness PM, Anderson KC, Roback JD (eds). Blood Banking and Transfusion Medicine. Basic Principles and Practice. 2<sup>nd</sup> ed. Philadelphia:Churchill Livingstone / Elsevier, 2006:600-17.
3. **Murphy EL**. Transfusion Therapy Module 7 Unit 17 Retroviruses: HIV and HTLV-I/II. BSI Web training module.
4. **Murphy EL**. Transfusion-Transmitted Viral Infections. Teaching Module #87 in the Web-based International Health educational resource for medical students and foreign trainees sponsored by the Global Health Education Consortium (GHEC)  
<http://admin.globalhealthedu.org/Documents/87/player.html>

#### Abstracts (Oral and Poster Presentations)

1. Guiltinan AM et al. Mortality in Hepatitis C Virus (HCV) infected blood donors: a large, retrospective cohort study. (Oral 2PS-11-04) Vox Sang 2006; 91 (suppl): 14.
2. Custer B et al. The impact of temporary deferrals on future whole blood donation. (Oral A5-020A) Transfusion 2006; 46 (suppl):167A.
3. Madden E et al. Modeling the implications of whole blood versus double red cell collection and European travel deferral for variant Creutzfeldt-Jakob disease. (Poster AP49) Transfusion 2006; 46 (suppl):188A.

4. Guiltinan A et al. Cardiac mortality and Hepatitis C Virus (HCV) infection: a retrospective cohort study. (Oral S39-030H) Transfusion 2006; 46 (suppl):16A.
5. Kwaan N et al. HTLV-I and HTLV-II disease outcomes and proviral load over 10 years: a prospective study. (Oral S100-040H) Transfusion 2006; 46 (suppl):37A.
6. Neto CD et al. Sexual behavior in 2,457 blood donors with recent and past syphilis in Sao Paulo, Brazil. (Poster SP216) Transfusion 2006; 46 (suppl):107A-108A.
7. Kaidarova Z et al. Prospective analysis of neurological abnormalities in a cohort of HTLV-I and HTLV-II infection. (Oral O-59) AIDS Research and Human Retroviruses 2007; 23 (4):585.
8. Yeo A et al. Long-term abnormalities of complete blood counts in human T lymphotropic virus type I and II (HTLV-I and -II) infection. (Poster P-220) AIDS Research and Human Retroviruses 2007; 23 (4):641.
9. DeVita D et al. Determinants of follow-up rates in a prospective cohort study of HTLV infection. (Poster P-223) AIDS Research and Human Retroviruses 2007; 23 (4):642.
10. Tobler L et al. HCV EIA and RIBA 3.0 seroreversion among subjects in a follow-up study of HCV seropositive blood donors who tested positive or negative for HCV RNA by minipool-NAT screening. (Oral S76-040B) Transfusion 2007; 47 (suppl):30A.
11. Kaidarova Z et al. HIV seroprevalence among US blood donors 2001-2006: evidence for a "Hidden Epidemic"? (Poster SP164) Transfusion 2007; 47 (suppl):98A-99A.
12. Murphy EL et al. Minority and foreign-born blood donors in the USA: demographics and donation frequency for 2006. (Poster SP219) Transfusion 2007; 47 (suppl):116A.
13. Hindes DA et al. Online subject tracking system for Visit 7 of the HTLV Outcomes Study (HOST). (Poster AP65) Transfusion 2007; 47 (suppl):243A.
14. Bahrami SH et al. Comparison of two methods of subject recruitment for a blood donor based research study. Transfusion 2007; 47 (suppl):267A-268A.
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