

Murphy Research Program October 2009

I. Introduction

Major Research Areas

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

BSRI Collaborations

Brian Custer
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)
Investigators in Brazil, South Africa, Buenos Aires, Honduras & Vietnam

Staff

Thelma Gonzalez, MD, PhD, Staff Scientist¹ *
Hope Biswas, MSc, Staff Scientist¹ *
Anne Guiltinan, MSW, Senior Research Associate (Manager)¹
Debby DeVita, RN, MSN, PhD, Research Nurse²
Susan Yuen, Grants Analyst²
Zhanna Kaidarova, MA, MBA, Statistician¹
Daniel Hindes, Research Associate¹
Shrein Bahrami, MA, Research Associate¹
Molly Klett, Research Associate¹

¹ BSRI personnel ² UCSF personnel

* also supervised by Dr. Custer

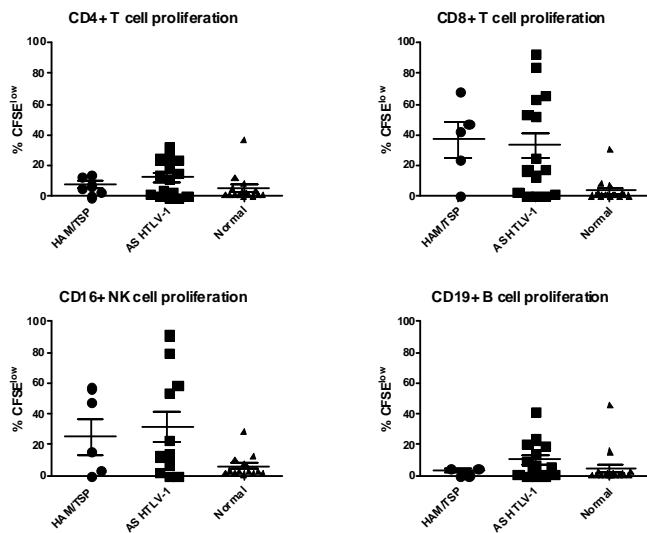
II. Program Summary / Progress Report / Plans

a) HTLV Outcomes Study (HOST)

This is a 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.

In the last year, our staff scientist Hope Biswas has written a manuscript on our analysis of HTLV mortality described in last year's annual report. This is currently under revision at JAIDS. In addition, Hope's analysis of neurologic exam findings in the cohort, which showed an excess of neurologic findings in HTLV-I and HTLV-II subjects without overt HTLV myelopathy, has been published in Neurology. We also published a couple of reports describing results from collaborations with immunology colleagues:

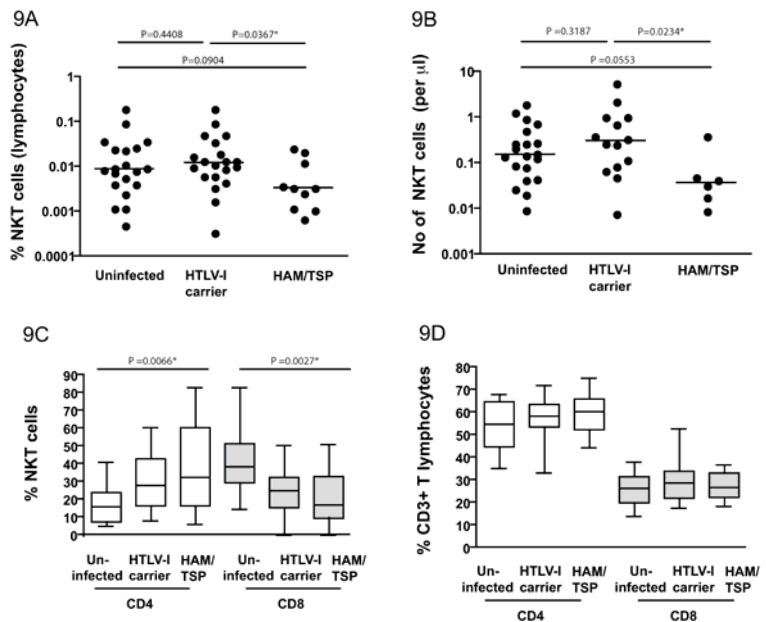
A collaboration with Philip Norris (BSRI) yielded a publication that is now in press in a new online journal, Virulence. Most human T cell leukemia virus type 1 (HTLV-1) infected subjects remain asymptomatic throughout their lives, with a few individuals developing HTLV-1 associated myelopathy/tropical spastic paraparesis (HAM/TSP) or adult T cell leukemia. Lymphocytes from about half of HTLV-1 infected subjects spontaneously proliferate *in vitro*, and how this phenomenon relates to symptomatic disease outcome and viral burden is poorly understood.



Spontaneous proliferation was measured in lymphocyte subsets, and these findings were correlated with HTLV-1 proviral load and Tax expression in PBMCs. We found that in addition to previously described vigorous CD8+ T cell spontaneous proliferation, natural killer (NK) cells spontaneously proliferated to a similar high level, resulting in expansion of CD56-expressing NK cells. Spontaneous NK cell proliferation positively correlated with HTLV-1 proviral load but not with Tax expression or the presence of HAM/TSP. The strongest correlate with clinical outcome in this cohort was the ability of cells to express Tax, while HTLV-1 proviral load was more closely related to spontaneous NK cell proliferation. These results demonstrate that spontaneous proliferation, Tax expression, and proviral load are inter-related but

not equivalent, and that spontaneous lymphocyte proliferation is not restricted to T cells, the targets of HTLV-1 infection.

A collaboration with them Lish Nhdlovu and Doug Nixon (UCSF) resulted in a publication that is now in press at Clin Exp Immunol. Approximately three per cent of HTLV-I carriers develop the debilitating neurological disease HTLV-1-associated myelopathy/tropical spastic paraparesis (HAM/TSP). There is currently no cure, vaccine, or effective therapy for HTLV-1 infection, and the mechanisms for progression to HAM/TSP remain unclear. NKT cells are an immunoregulatory T cell subset whose frequencies and effector functions are critically associated with immunity against infectious diseases. We hypothesized that NKT cells are associated with HAM/TSP progression. We measured NKT cell frequencies and absolute numbers in individuals with HAM/TSP infection from two cohorts on two continents: São Paulo, Brazil and San Francisco, CA, USA, and found significantly



lower levels when compared with healthy subjects and/or asymptomatic carriers. Also, the circulating NKT cell compartment in HAM/TSP subjects is comprised of significantly more CD4+ and less CD8+ cells than healthy controls. These findings suggest that lower numbers of circulating NKT cells and enrichment of the CD4+ NKT subset are associated with HTLV-1 disease progression.

Plans for the coming year. Unfortunately, our amended (A1) competitive renewal application for an additional 5 years of follow-up did not receive a competitive priority score. We are awaiting the comments from the IRG and will determine alternative funding strategies at that point.

b) 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 (PI Dr. Murphy) 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.

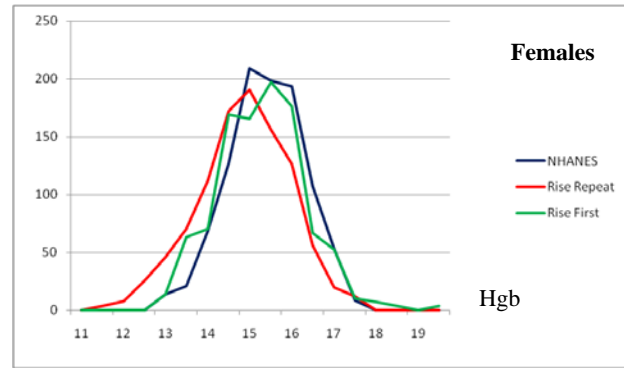
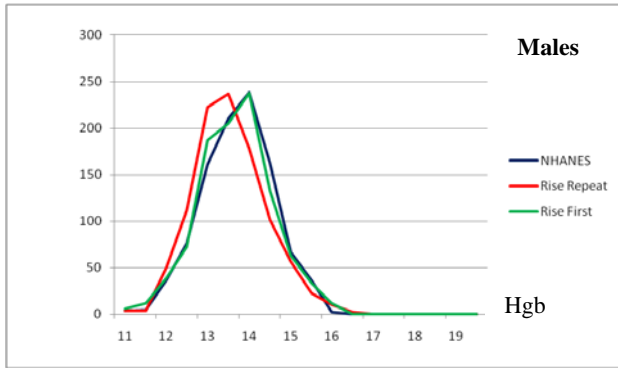
To date, REDS-2 research projects included:

- Donation Database: > 1 million donations per year 2006-2009 (Ongoing; group project)
- Molecular surveillance of TTI's: (Ongoing; Busch), and
- LAPS-1: a studies of HLA and WBC antibodies in donors (Finished; Triulzi).
- RISE: Iron and hemoglobin metabolism in donors (Ongoing; Cable),
- 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 (Ongoing, Kakaia & Triulzi).
- PDI: a study of post-donation information reported to blood centers by donors after donation. Focus group-type interviews will be used to determine reasons for PDI.

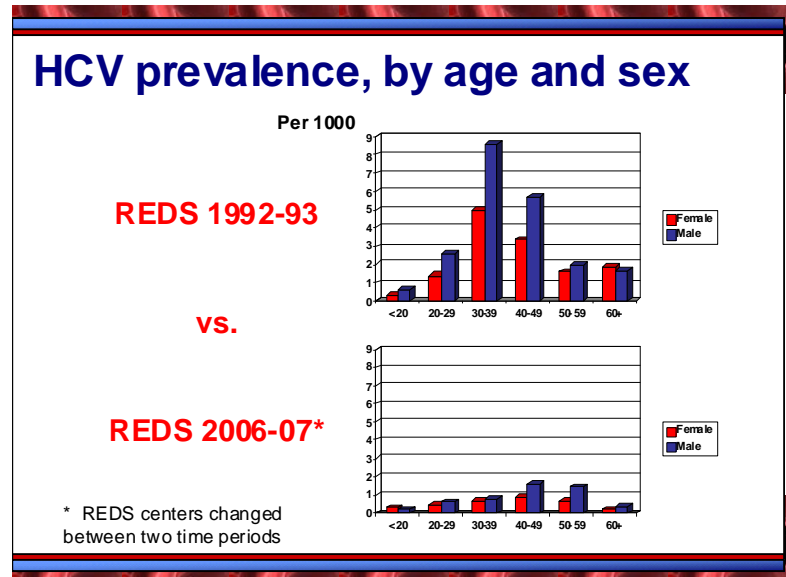
The REDS donation database was launched on January 1, 2006. LAPS-1 has been completed and the primary manuscript has been published in [Transfusion](#). The primary finding was a strong association of HLA antibody prevalence with parity among female blood donors. Antibody prevalence was quite low in males and in previously transfused donors. We are currently doing fieldwork 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 in 2008 and is now in the final visit phase. Baseline data to be reported in four oral presentations at the 2009 AABB meeting show hemoglobin levels in first-time blood donors similar to those in the general population (see below), and a higher than expected prevalence of iron deficiency among repeat blood donors. We continue to be active in REDS database analyses, including an analysis of HCV prevalence and clearance among US blood donors.

Good normal population data for hemoglobin concentration exist in the United States, but similar data are not available for US blood donors, who are selected to have normal hemoglobin and to be free of disease. Data were obtained from a prospective observational cohort study of hemoglobin balance among blood donors (RISE). Donors were stratified by race/ethnicity and first-time (FT; includes some reactivated donors with a donation >2 years previous) versus repeat (RPT) donor status. We compared baseline hemoglobin values for RISE (2008) to publically-available data from the US National Health and Nutrition survey (NHANES) in 2005-2006; all pregnant women were excluded. Hemoglobin concentration (g/dl) was measured by autoanalyzers on venous blood; differences in mean values and associated 95% confidence intervals (CI's) were calculated. Compared to NHANES subjects, FT RISE blood donors had similar hemoglobin concentrations for both males (-0.23 g/dl; left Figure) and females (+0.01 g/dl; right Figure) after adjustment for age, race and smoking intensity. RPT blood donors had lower hemoglobin than their NHANES counterparts for both males (-0.40 g/dl) and females (-0.25 g/dl). Despite being selected for good health and lack of anemia, FT blood donors appear to have similar hemoglobin

concentrations compared to their general population counterparts after adjustment for age race and smoking intensity. Lower hemoglobin concentrations in RPT compared to FT donors are probably attributable to the loss of donated red blood cells and iron.



Hepatitis C virus (HCV) is prevalent among the U.S. population and first-time blood donors. The first large-scale report from REDS published in 1992-93 found a prevalence of 360 per 10⁵. More contemporary data is important to blood donor recruitment and calculation of residual risk after antibody and nucleic acid testing (NAT) strategies. We performed a cross-sectional seroprevalence study among blood donors at six U.S. blood centers from Jan 2006 thru Sept 2007 with combined donation data. HCV infection was defined as the presence of either antibody alone (enzyme immunoassay followed by recombinant immunoblot) or both antibody and viral RNA (NAT). We calculated prevalence rates with 95 percent confidence intervals (95% CI), and independent odds ratios (OR's) using multivariate logistic regression. We studied 959,281 donors of whom 695 (72 per 10⁵) had evidence of HCV infection (74% with both HCV antibody and RNA and 26% with HCV antibody only). Age and sex specific HCV prevalence from the current study compared to data from 1992-93 is given in the **Figure**. We also found significant, independent associations between HCV and: high school or lower education (OR= 8.1, 95% CI 6.2-10.5), previous blood transfusion (OR=2.1, 95% CI 1.6-2.8) and obesity (BMI>30; OR=0.6, 95% CI 0.5-0.8 vs. normal or low BMI). In a model with female donors only and including previous transfusion and race/ethnicity, women with multiple pregnancies were significantly more likely to test HCV positive (OR for 2-4 pregnancies = 1.6, 95% CI 1.1-2.4, and for >=5 pregnancies =3.2, 95% CI 1.9-5.4, both versus nulliparous). We conclude that fourteen years after a previous study, we found a five-fold decrease in overall HCV prevalence, with a shift in the age groups with the highest HCV prevalence from 30-39 to 40-59, consistent with a birth cohort effect. We confirmed recognized gender, race/ethnicity, socioeconomic and parenteral risk factors for HCV infection, and discovered a new association between HCV and multiple pregnancies and an inverse association with obesity.



c) HCV Mortality and Morbidity 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. Our finding of a threefold increase in mortality among HCV seropositive former blood donors was published last year (Guiltinan A. et al [Amer J Epidemiol](#) 2008). This report also found that mortality due to alcohol and drug abuse, trauma and suicide were associated with HCV infection and numerically more important than mortality related to liver disease. We also showed a two fold excess of cardiovascular mortality in HCV seropositives.

In light of these findings, we have initiated follow-up of living members of the cohort. We chose a sample of 2000 HCV positives and 2000 HCV negatives known to be living at the time of the 2003 National Death Index search. A health history questionnaire was mailed to this target sample, with follow-up by telephone. The response rate was disappointing, with questionnaires were returned by 312 (16%) HCV+ and 446 (22%) HCV- subjects. Both groups had similar age, sex and race/ethnicity but HCV+ had lower income and educational attainment. HCV+ subjects reported chronic hepatitis (21%), cirrhosis (8%), other liver disease (4%) and hepatocellular carcinoma (0.6%). Among HCV+, ALT testing was done in 211 (68%). In the 89 (42%) with abnormal ALT, 68 had liver biopsies and 54 (79%) were abnormal; among the 101 (48%) with normal ALT, 53 had liver biopsies and 15 (28%) were abnormal. Interferon treatment was started in 112 HCV+ and was successful in 62 (55%), ineffective in 18 (16%) and stopped for side effects or other reason in 31 (28%). Myocardial infarction (4% vs. 2%) and stroke (3% vs. 2%) were slightly but not significantly increased in HCV+. Cigarette smoking ($p<0.0001$) and family history of CAD ($p<0.01$) were more frequent among HCV+ but high cholesterol ($p=0.03$) and hypertension ($p<0.01$) were more frequent among HCV-. Psychiatric disorders (OR=2.74), substance abuse (OR=5.52) and drug overdose (OR=5.94), as well as motor vehicle (OR=2.98) and workplace accidents (OR=2.65), were all significantly ($p<0.05$) associated with HCV+ status. We concluded that former blood donors living with HCV infection had substantial rates of chronic hepatitis and cirrhosis. Medical management of HCV, and the implementation and success of interferon treatment were similar to reports from previous case series. We had insufficient power to detect possible small increases in cardiovascular disease and stroke; previously reported HCV associations with these conditions may be confounded by lower socioeconomic status, higher cigarette smoking and more frequent family history of CAD. Lifestyle issues associated with past or current drug abuse may account for substantial psychiatric and trauma co-morbidity.

d) Genetic epidemiology studies and blood donors

A graduate student, Megan Rice conducted a survey on attitudes towards genetic research in the blood bank among current BCP donors during summer 2008. Blood banks' altruistic donor bases and existing infrastructure make them attractive sites for genetic epidemiologic research. However, there are concerns that genetic studies may negatively impact blood donation rates. We conducted a survey among blood donors to assess their interest in participating in genetic studies and the potential impact of such studies on future blood donations. A total of 2162 blood donors in Northern California responded to a cross-sectional questionnaire in August and September 2007. Participants were asked to provide demographic information as well as indicate how likely they would be to participate in three different scenarios at the blood bank: genetic research where donor identities would be linked to their samples, genetic research where donor identities would not be linked to their samples, and genetic testing as a service. In addition, participants indicated how likely they would be to donate blood in the future if they were asked to participate in the three scenarios. The majority of blood donors indicated that they would

be very likely/likely to participate in identity-linked genetic research (67%) and in identity-unlinked genetic research (54%). While older donors and more frequent donors were more likely to participate in identity-linked research, younger donors, Caucasian donors, donors with higher education, and more frequent donors were more likely to participate in identity-unlinked research. Less than 10 percent of donors would be less likely to donate blood in the future if genetic research was conducted at blood banks. Over 75 percent of donors would be interested in genetic testing as an optional service, however over 20 percent of donors would be less likely to donate blood in the future if such a service was offered. Overall, we found that the majority of blood donors would be likely to participate in genetic studies and very few donors would be less inclined to donate in the future if genetic studies were conducted in blood banks.

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

In recognition of both his funded research and teaching skills, Dr. Murphy was first awarded this K24 grant from the NHLBI for 5 years effective January 2004. After a one-year no-cost extension, a competitive renewal application has just been awarded from 2009 through 2014. 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. A major focus of the renewal application was research training in international transfusion safety, which has expanded significantly over the past five years (see separate annual report), with courses in or trainees from Brazil, Argentina, Mexico Honduras, Vietnam, Paris (for francophone Africa) and South Africa (for Anglophone Africa). Other areas of research training include: 1) HTLV-I and –II natural history and pathogenesis using the HOST cohort; and 2) studies of blood donor epidemiology, using the Donor Epidemiology Core.

f) International Transfusion Safety Research and Training and Donor Epidemiology Core

(See separate Annual Reports by Dr. Murphy)

III. Grants, Contracts and Awards

Current Extramural

Research Grant 2R01-HL-62235 (Murphy, PI)
 NHLBI 02/0505-01/31/10 15% effort
 Pathophysiology of HTLV-I and HTLV-II Infection (HTLV Outcomes Study)
 A prospective cohort study of HTLV-I and HTLV-II health outcomes in former blood donors.

Research Grant 2K24-HL075036 (Mid Career Research and Training Award) (Murphy, PI)
 NHLBI 08/15/09-05/31/14 50% effort
 Health Outcomes in Blood Donors and Recipients
 Mid-career investigator award for research and training in HTLV infection and international transfusion safety

Research Contract N01-HB-47174 (Murphy, PI)
 NHLBI 9/01/04 - 8/31/10 20% effort
 Blood Center for Retrovirus Epidemiology in Donors Study-II (REDS-II)
 Epidemiologic studies of transfusion safety and blood supply. Six blood centers participate in a network epidemiology and clinical laboratory studies involving issues such as transfusion-related infections, transfusion-related lung injury (TRALI) and iron balance in blood donors.

Research Contract HHSN268200417175C (Busch, PI)
 NHBLI 02/01/06-9/30/11 10% effort
 Retrovirus Epidemiology Donor Study-II (REDS-II) International Component – Blood Center

Conduct epidemiological, laboratory and survey research on blood donors in selected developing countries seriously impacted by the AIDS epidemic such as Africa, Asia, and South America, to ensure the safety and availability of blood for transfusion.

Role: Co-Investigator

Research Grant P50-HL-81027 (Toy, PI)

NHLBI 09/01/05-08/31/10 5% effort

Specialized Centers of Clinical-Oriented Research in Transfusion Biology and Medicine

The objectives of this SCCOR are to provide scientific data that will support methods to diagnose and prevent transfusion-related acute lung injury (TRALI), as well as to provide new knowledge regarding the fundamental pathogenic mechanisms of the disease.

Role: Co-Investigator

PIMSA Research Grant (Immigration and Health) (Murphy, PI)

Univ. of Calif. Office of President 02/25/08-02/28/10 0% effort

Sangre Segura: an epidemiological study of blood transfusion safety in the Mexico-US border region

Construct a research database across 6 Mexican blood centers and measure volunteer donor recruitment

N/A (Murphy, PI)

International Society of Blood Transfusion Foundation 07/01/09-6/30/10 0% effort

Research training in international transfusion safety

Provide research training programs in HIV-related transfusion safety for Latin America and Africa, consisting of a two-week overseas short course

CFAR/Fogarty grant (Murphy, PI)

UCSF 06/15/09-06/30/10 0% effort

Training in clinical research minimizing HIV infection of the blood supply in resource-limited countries

This project aims to provide training in clinical research methodology to promising young professionals in transfusion medicine in developing countries of Latin America and Africa.

Past Extramural

Research Grant K24-HL075036 (Mid Career Research and Training Award) (Murphy, PI)

NHLBI 01/01/04-08/14/09 40% effort

Clinical Epidemiology of HTLV-I and HTLV-II Infection

Mid-career investigator award for research and training in HTLV infection and international transfusion safety

Research Grant R01-HL-076902 (Busch, PI)

NHLBI 09/01/03-8/31/08 10% effort

Hepatitis C: Natural History, Pathogenesis, Therapy and Prevention

Extensive study of blood donors newly identified with asymptomatic, acute, chronic, and/or resolved community-acquired HCV. Goals: Determine cause-specific morbidity, mortality, and medical follow-up and treatment status; characterize determinants of viral clearance in donors with resolving HCV infection, with rates of late clearance and recurrent viremia; investigate HCV genetic evolution and cellular immune responses during acute infection

Role: Co-Investigator

IV. 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).
Member of BCP Medical and Scientific Advisory Committee

University Service

UCSF Committee on Human Research, 1994-1995 and 2002-2007
UCSF Committee on Research, Chair 2008-2009
UCSF Committee on Research, Vice Chair 2007-2008
UCSF Research Advisory Board, 2007 – present
Chair, Search Committee for tenured faculty member in Genetic Epidemiology (UCSF
Lab Medicine, UCSF Genetics Institute and BSRI)

Government Service - NIH

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

Membership in Professional Organizations:

International Retrovirology Association
Board of Directors 1997-2009
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

V. Publications (last two years)

Peer-reviewed articles

1. 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.
2. 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.
3. 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.
4. 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.
5. Nguyen DD, DeVita DA, Hirschler NV, **Murphy EL**. Blood donor satisfaction and intention of future donation. Transfusion 2008;48:742-8. Epub 2008 Jan.
6. 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.
7. 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.
8. 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.
9. Bartman MT, Kaidarova Z, Hirschhorn D, Sacher RA, Friley J, Garratty G, Gible J, Smith JW, Newman, Yeo AE, **Murphy EL**. Long-term increases in lymphocytes and platelets in human T-lymphotropic virus type II infection. Blood 2008;112:3995-4002. Epub 2008 Aug 28. PMCID: PMC2581993
10. 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. Transfusion 2009;49:330-6. Epub 2008 Nov 19.
11. DeVita DA, White MC, Zhao X, Kaidarova Z, **Murphy EL**. Determinants of subject retention in a prospective cohort study of HTLV infection. BMC Med Res Methodol 2009;9:19. PMCID: PMC2660365
12. Tagny CT, Diarra A, Yahaya R, Hakizimana M, Nguessan A, Mbensa G, Nebie Y, Dahourou H, Mbanya D, Shiboski C, **Murphy E**, Lefrere JJ. Characteristics of blood donors and donated blood in sub-Saharan Francophone Africa. Transfusion 2009 Mar 10. [Epub ahead of print].

13. Custer B, Kamel H, Kiely NE, **Murphy EL**, Busch MP. Associations between West Nile virus infection and symptoms reported by blood donors identified through nucleic acid test screening. Transfusion 2009;49:278-88.
14. Truilzi DJ, Kleinman S, Kakaiya RM, Busch MP, Norris PJ, Steele WR, Glynn SA, Hillyer CD, Carey P, Gottschall JL, **Murphy EL**, Rios JA, Ness PM, Wright DJ, Carrick D, Schreiber GB. The effect of previous pregnancy and transfusion on HLA alloimmunization in blood donors: implications for a transfusion-related acute lung injury risk reduction strategy. Transfusion 2009 May 18. [Epub ahead of print].
15. **Murphy EL**, Shaz B, Hillyer CD, Carey P, Custer BS, Hirschler N, Fang J, Schreiber GB for the NHLBI Retrovirus Epidemiology in Blood Donors Study-II (REDS-II). Minority and foreign-born representation among USA blood donors: demographics & donation frequency for 2006. Transfusion 2009;49:2221-8. Epub 2009 Jun 23. NIHMSID # 127859
16. Laperche S, Boukatou G, Kouegnigan L, Nébié Y, Boulahi MO, Tagny CT, Yahaya R, Tapko JB, **Murphy E**, Lefrère JJ. Transfusion safety on the African continent: an international quality control of virus testing in blood banks. Transfusion 2009 Jun 10. [Epub ahead of print]
17. Halin M, Douceron E, Clerc I, Journo C, Ko NL, Landry S, **Murphy EL**, Gessain A, Lemasson I, Mesnard JM, Barbeau B, Mahieux R. Human T-cell leukemia virus type 2 produces a spliced antisense transcript encoding a protein that lacks a classical bZIP domain but still inhibits Tax2-mediated transcription. Blood 2009 Jul 14. [Epub ahead of print]
18. Lefrère JJ, Shiboski C, Fontanet A, **Murphy EL**. [Teaching transfusion medicine research in the francophone world.]. Transfus Clin Biol 2009 Jul 27. [Epub ahead of print] French.
19. **Murphy EL**, McFarland W, Lefrere, JJ. Teaching transfusion medicine research methods in the developing world. Transfusion 2009;49:1532. PMID: PMC2740979
20. Biswas HH, Engstrom JW, Kaidarova Z, Garratty G, Gible JW, Newman BH, Smith JW, Ziman A, Fridley JL, Sacher RA, **Murphy EL**. Neurological abnormalities in HTLV-I and -II infected individuals without overt myelopathy. Neurology 2009;73:781-9.

Book Chapters and Reviews

1. **Murphy EL**. Transfusion Therapy Module 7 Unit 17 Retroviruses: HIV and HTLV-I/II. BSI Web training module.
2. **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>
3. Bouvard V, Baan R, Straif K, Grosse Y, Secretan B, El Ghissassi F, Benbrahim-Tallaa L, Guha N, Freeman C, Galichet L, Coglianò V, WHO International Agency for Research on Cancer Monograph Working Group. A review of human carcinogens – Part B: biological agents. Lancet Oncol 2009;10:321-2. PMID: 19350698
4. **Murphy EL**, Biswas HH. Human T-Cell Lymphotropic Virus Types I and II. Chapter 168. In Mandell G, Bennett J, Dolin R (eds). Principles and Practice of Infectious Diseases. 7th ed. Philadelphia:Churchill Livingstone / Elsevier, 2009.

5. **Murphy EL.** Human T-cell lymphotropic viruses I/II. Chapter 4.3.3. WHO Recommendations on Screening Donated Blood for Transfusion-Transmissible Infections, 2009;40-41.

Abstracts (Oral and Poster Presentations)

1. 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.
2. 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.
3. 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.
4. 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.
5. 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.
6. 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.
7. Hindes DA et al. Online subject tracking system for Visit 7 of the HTLV Outcomes Study (HOST). (Poster AP65) Transfusion 2007; 47 (suppl):243A.
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