CLINICAL FELLOWS RESEARCH SYMPOSIUM

WEDNESDAY FEBRUARY 25TH

KEYNOTE SPEAKER
8:00-9:30
Marlo Thomas Center Lecture Hall IA1010

ORAL PRESENTATIONS
9:30-12:00
Marlo Thomas Center Lecture Hall IA1010

POSTER PRESENTATIONS
2:00-4:00
Marlo Thomas Center Grand Hallway

AWARDS CEREMONY
4:00-4:30
Marlo Thomas Center Lecture Hall IA1010

RECEPTION
4:30-5:00
Marlo Thomas Center Grand Hallway
Mentorship, Networking and Career Paths
in Pediatric Academic Departments

Keynote Speaker: Linda Stork, MD
Oregon Health & Science University
Professor of Pediatrics
Division Head, Pediatric Hematology/Oncology

Biography
My primary research focus has been design of clinical trials to optimize outcomes in childhood acute lymphoblastic leukemia (ALL). A secondary focus has been quality of life during and after leukemia treatment. As study chair and vice chair, I have designed, conducted, and published results of a number of clinical trials sponsored by the Children’s Oncology Group (COG). In my roles as institutional PI for COG and elected member of the COG Voting Body Steering Committee, I facilitate a vital multi-institutional research effort. As director of my institution’s Pediatric Leukemia/Lymphoma Program, I foster expert clinical care, continuing education, and trans-disciplinary research collaboration. Throughout my career and as a former Fellowship Director, I have mentored many trainees, espousing the importance and rewards of scholarship embedded into clinical practice. My goal as Division Head of Pediatric Hematology/Oncology is to facilitate the professional development of each faculty member. As Chair of the Professional Development Committee within the American Society of Pediatric Hematology/Oncology, I participate in the design of programs that support trainees and faculty at all stages of their career.
CLINICAL FELLOWS RESEARCH SYMPOSIUM

WEDNESDAY FEBRUARY 25TH

ORAL PRESENTATIONS 9:30-12:00
GECC LECTURE HALL IA1010

Cristyn Branstetter MD
The Genomic Landscape of Pediatric Acute Megakaryoblastic Leukemia

Yuko Okado PhD
Individual Differences in the Longitudinal Trajectories of Anxiety and Depression Symptoms in Children and Adolescents with Cancer

Matthew Ehrhardt MD
Late Outcomes Among Adult Survivors of Childhood Non-Hodgkin Lymphoma (NHL): A Report from the St. Jude Lifetime Cohort Study

Seth Karol MD
Genetic Predisposition for Osteonecrosis in Young Patients Treated for Acute Lymphoblastic Leukemia
4th Annual Clinical Fellow Research Symposium
Lessons Learned: Luncheon Panelist

Pavilion
February 25th, 2015
12:00 – 1:45p

Gabriela Maron, MD
Pediatric Infectious Disease

Monica Metzger, MD
Leukemia/Lymphoma

Sean Phipps, PhD
Psychology

Clinton Stewart, Pharm D
Pharmacology/Pharmacy

Dave Shook, MD
BMT/Cellular Therapy

Linda Stork, MD
Leukemia/Lymphoma

Mitch Weiss, MD/PhD
Hematology

Karen Wright, MD
Neuro-Oncology
Abstract Index
Clinical Fellows Research Symposium
2015

1. Alexander, T – Hematology/Oncology Fellow Clinical and genomic analysis (WES/RNA) of an international cohort of pediatric mixed phenotype acute leukemia

2. Bhakta, N – Hematology/Oncology Fellow Counting multiple events while considering competing risks to better describe disease burden among adult survivors of childhood cancer

3. Branstetter, C – Hematology/Oncology Fellow The genomic landscape of pediatric acute megakaryoblastic leukemia

4. Caballero, M. (Hijano, D – Infectious Diseases Fellow) TLR4 genotype and environmental LPS mediate RSV bronchiolitis through Th2 polarization

5. Chamdine, O – Neuro Oncology Fellow Metastatic low grade gliomas in children: 20 year experience at St Jude Children’s Research Hospital

6. Dejos, M – Pharmacy, Medication Safety Resident Investigating clinician responses to drug-drug interaction and drug-allergy/adverse drug reaction alerts

7. Diaz, A – MD/PhD Developmental Neuro Biology Student The genomic landscape of diffuse intrinsic pontine glioma and pediatric non-brainstem high-grade glioma

8. Ehrhardt, M – Survivorship Fellow Late outcomes among adult survivors of childhood non-Hodgkin lymphoma (NHL): a report from the St. Jude Lifetime Cohort study

9. Eissa, H – Hematology/Oncology Fellow Transplant outcome of pediatric and young adult patients with aplastic anemia: St Jude Children’s Research Hospital experience

10. Ferguson-Paul, K – Infectious Diseases Fellow Impact of the antibiotic stewardship program at Le Bonheur Children’s Hospital – An analysis of antibiotic usage and acquisition costs
11. **Gammal, R – Pharmacy, Pharmacogenetics Resident** Integration of patient education into St. Jude Children’s Research Hospital’s preemptive pharmacogenetics model

12. **Hamilton, J – Neuropsychology Fellow** Isolated memory impairment following bilateral hippocampal damage secondary to human herpes virus 6 encephalitis (hhv6) in the context of bone marrow transplant for pediatric leukemia

13. **Hurley, C – Hematology/Oncology Fellow** Comparison of 18F-FDG-PET-CT and bone scintigraphy for evaluation of osseous metastases in newly diagnosed and recurrent osteosarcoma

14. **Hysmith, N – Infectious Diseases Fellow** A longitudinal study of immune responses to group a streptococcal antigens following pharyngeal infections in pediatric subjects

15. **Interiano, R – General Surgery Research Resident** Long-term renal function in patients with non-syndromic Wilms tumor treated with unilateral radical nephrectomy

16. **Karol, S. – Hematology/Oncology Fellow** Genetic predisposition for osteonecrosis in young patients treated for acute lymphoblastic leukemia

17. **Khuon, D – Infectious Diseases Fellow** *Stenotrophomonas maltophilia* infections in a pediatric immunocompromised population

18. **Malkan, A – Surgery Fellow** Malignant melanoma arising from a giant congenital melanocytic nevus in a child

19. **Mhaissen, N – Infectious Diseases Fellow** Epidemiology of diarrheal illnesses in pediatric oncology patients

20. **Mukkada, S – Infectious Diseases Fellow** Evaluation of adherence to a site-specific algorithm for the management of febrile pediatric oncology patients in Davao City, Philippines

21. **Okado, Y – Psychology Fellow** Individual differences in the longitudinal trajectories of anxiety and depression symptoms in children and adolescents with cancer

22. **Panda, N (Hinkle, N – General Surgery Resident)** PI3K the right target: effects of chemotherapy on the vascular profile in neuroblastoma
23. Sciasci, J – Pharmacy Resident Aerosolized and intravenous pentamidine as prophylaxis for pneumocystis pneumonia in pediatric oncology patients: a retrospective review

24. Sitthi-Amorn, J – BMTCT Fellow Outcome of total lymphoid irradiation based conditioning for allogeneic hematopoietic stem cell transplantation in pediatric patients with non-malignant disease

25. Snaman, J – Hematology/Oncology Fellow Patient-controlled analgesia at the end of life at a pediatric oncology institution

26. Thapa, R – Hematology/Oncology Fellow Comparative functional reactivity of group 1 and 2 HLA-C proteins with KIR2DL2/3 receptors

27. Watts, C – Pharmacy Resident Utilization of body weight vs. body surface area for chemotherapy dosing in infants

28. Weaver, M – Hematology/Oncology Fellow The prioritization of pediatrics and palliative care in cancer control plans in Africa

29. Wesley, K – Psychology Fellow Healthcare transition readiness through the lens of transitioned young adults with sickle cell disease

30. Westfall, M – Infectious Diseases Fellow Incentives and technology survey: evaluation of HIV-infected adolescents and young adults’ interest in innovative adherence strategies

31. Whipple, N – Hematology/Oncology Fellow Altered ventricular global longitudinal strain in children with sickle cell disease
1. **Title:** Clinical and genomic analysis (WES/RNA) of an international cohort of pediatric mixed phenotype acute leukemia

**Authors:** Thomas Alexander MD MPH¹, Charles Mullighan MD², John Choi² MD PhD, Hiroto Inaba MD¹ and collaborating sites³.

Departments of Oncology and Pathology, St. Jude Children's Research Hospital. The Children's Oncology Group [USA], the Dutch Children's Oncology Group, The Children's Hospital at Westmead, Sydney, Australia, The Royal Children's Hospital, Brisbane, Australia, the Japanese Association of Childhood Leukemia Study, the European Organization for Research and Treatment of Cancer [Belgium], and the National University Health System, Singapore.

**Background:** Mixed phenotype acute leukemia (MPAL) represents 3% of childhood cases of acute leukemia. Most studies have shown a poor outcome of MPAL, and the genetic basis of this disorder is poorly understood. The goal of this study is to perform detailed genomic analysis of a large cohort of MPAL cases, and to gain insights into the genetic basis of this disease, identify associations between clinical and genetic features, and identify potential new therapeutic approaches. Genomic analysis of this unique leukemia will provide insights into lineage commitment in acute leukemia.

**Methods:** For each case, diagnostic immunophenotype data is used to design an antibody panel for fluorescence-activated cell sorting to purify tumor subpopulations. Whole exome sequencing and SNP array analysis is being performed on sorted subpopulations as well as matched non-tumor DNA to identify somatic DNA copy number alterations. We are also performing RNA sequencing and expression analysis on the bulk tumor population. There is ongoing clinical data collection, including presenting features, treatment regimen, response rate, event free survival, and overall survival.

**Results:** We have collected samples from 92 pediatric MPAL cases from 8 collaborating sites. We have confirmed 78 samples as meeting the World Health Organization diagnostic criteria for MPAL; 33 are classified as T-cell/myeloid lineage, 28 as B-lineage/myeloid, 8 MLL-rearranged, 2 as Philadelphia chromosome positive and 4 as not otherwise specified. Treatment has included ALL based, AML based, and hybrid regimens. The staining and sorting protocol has been optimized for these samples. RNA from bulk tumor populations of 14 cases has been submitted for analysis. DNA from 41 phenotypically distinct samples from 17 different cases is in the process of whole exome sequencing, each with matched germline DNA.

**Conclusions:** We have collected a large group of MPAL cases by international collaboration and demonstrated the ability to sort and isolate DNA from phenotypically distinct populations. With our data, we hope to clarify the relationship between mutational variation and multiple lineages, search for genomic predictors of outcomes, and identify potential therapeutic targets.
2. Title: Counting Multiple Events While Considering Competing Risks to Better Describe Disease Burden among Adult Survivors of Childhood Cancer

Authors: Bhakta NB, Zhu L, Li Z, Srivatava DK, Yutaka YY, Hudson MM, Robison LL

Background: Previous investigations have described the occurrence of therapy-related chronic health conditions among long-term survivors of childhood cancer. However, the total burden of disease experienced by survivors’ remains inadequately characterized.

Methods: The St. Jude Lifetime Cohort Study (SJLIFE) is a cohort of cancer survivors, over the age of 18 and 10 years post-diagnosis, with therapy exposure data and prospective medical assessments. For a sub-group of 1713 participants, treatment-related adverse health outcomes were graded using the NCI’s Common Terminology Criteria – Adverse Events (CTCAE). Cumulative morbidity, consisting of serious/disabling or life-threatening conditions (CTCAE grades 3 and 4) at 25 years from initial cancer diagnosis was assessed using the “mean cumulative count” (MCC25) method. Unlike standard methods, the MCC estimates the average number of adverse events to occur in a population over time in the presence of competing risks. 78 different health outcomes were evaluated.

Results: At 25 years from initial diagnosis, SJLIFE participants are estimated to experience, on average, 4.6 grade 3 and 4 chronic health conditions. Survivors of primary CNS tumors (MCC25=14.3) and Hodgkin lymphoma (MCC25=6.3) had the most events (211.8% and 37.9% more than entire cohort, respectively). Survivors of retinoblastoma (MCC25=1.83), neuroblastoma (MCC25=2.03) and Wilms tumors (MCC25=2.09) had the least number of events (60.0%, 55.6% and 54.3% less than the entire cohort, respectively). When stratified by treatment exposures, bone marrow transplant recipients had the greatest number of events (MCC25=10.1), a 120.8% increase over the entire cohort mean. Radiation therapy was associated with an average increase of 1.2 grade 3-4 conditions, compared to no radiation (MCC25 4.9 vs. 3.8) and non- White race with an average increase of 2 conditions compared to White race (MCC25 6.3 vs. 4.3).

Conclusions: The MCC method complements cumulative incidence and prevalence measures to elucidate the total disease burden survivors’ experience. Future analysis will incorporate recurrent adverse events and compare these outcomes to matched controls.
3. Title: The Genomic Landscape of Pediatric Acute Megakaryoblastic Leukemia

Authors: Cristyn Branstetter*, Jasmijn de Rooij*, Jing Ma, Yongjin Li, John Easton, Heather L. Mulder, Michael Rusch, Joshua Lim, Katarina Reinhardt, Shirley Kham, Allen Yeoh, Lee-Yung Shih, Der-Cherng Liang, Jeffrey E. Rubnitz, Ching-Hon Pui, Jinghui Zhang, James R. Downing, Franco Locatelli, Dirk Reinhardt, Mary Van den Heuvel-Eibrink, Marten Zwaan, Marten W. J. Fornerod, Tanja A. Gruber

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Background: Non-Down syndrome acute megakaryoblastic leukemia (non-DS-AMKL) carries a dismal prognosis with overall survival of 14-34%. Aside from the t(1;22)(p13;q13) seen in infants, the genomic landscape of non-DS-AMKL has remained elusive. Recently, Gruber et al. identified a cryptic inversion on chromosome 16 fusing CBFA2T3 to GLIS2 in up to 27% of cases by RNAseq in a discovery cohort of 14 patients. To more fully understand the leukemic drivers in this rare subtype of myeloid leukemia, we have extended our analysis of non-DS-AMKL through next generation sequencing of an additional 130 cases in addition to the initial discovery cohort (105 pediatric and 25 adult).

Design/Method: A total of 144 non-DS-AMKL cases (25 adult, 119 pediatric) will undergo RNA sequencing to evaluate for the presence of gene fusion events and/or whole exome sequencing for the detection of single nucleotide variants, insertions, and deletions. Gene fusions will be validated using PCR followed by Sanger sequencing and mutations will be validated by targeted capture.

Results: To date 92 patient samples have been RNA sequenced and analyzed. Whereas the majority of pediatric cases (77%) contained an identifiable gene fusion event, 12 of 25 adult cases (48%) lacked any detectable fusion. Recurrent fusions identified in pediatric cases include CBFA2T3-GLIS2 (17.2%), MLL rearrangements (MLLr; 13.8%), HOX rearrangements (HOXr; 13.8%), NUP98-KDM5A (10.3%), and RBM15-MKL1 (9.2%).

Single nucleotide variations (SNVs) and insertions/deletions (indels) have been catalogued for 109 patients that are undergoing validation. Recurrently mutated genes include GATA1, MPL, JAK kinases, TP53, and NOTCH and RAS pathway genes, which have all been previously reported in AMKL.

Conclusions: Pediatric non-DS-AMKL is a heterogeneous disease characterized largely by the presence of recurrent gene fusion events. Despite this heterogeneity, patients can be grouped into those that carry fusion events leading to HOX mediated leukemogenesis (MLLr, NUP98-KDM5A, HOXr) and those that do not (CBFA2T3-GLIS2, RBM15-MKL1). Patients not carrying a fusion gene harbored either a GATA1 truncating mutation, or multiple pathologic SNVs in genes previously demonstrated to play a role in acute myeloid leukemia.

References: Gruber et al., Cancer Cell, 2012
4. **Title:** TLR4 genotype and environmental LPS mediate RSV bronchiolitis through Th2 polarization

**Authors:** Mauricio T. Caballero\(^{1,2}\), M. Elina Serra\(^{1,2}\), Patricio L. Acosta\(^{1,2,3}\), Diego R. Hijano\(^{1,2,4}\), Renato T. Stein\(^{1,5}\), R. Stokes Peebles\(^4\), Mark Boothby\(^6\), Steven R. Kleeberger\(^7\) and Fernando P. Polack\(^{1,2,4}\)

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**Background:** While 30%–70% of RSV-infected infants develop bronchiolitis, 2% require hospitalization. It is not clear why disease severity differs among healthy, full-term infants; however, virus titers, inflammation, and Th2 bias are proposed explanations. While TLR4 is associated with these disease phenotypes, the role of this receptor in respiratory syncytial virus (RSV) pathogenesis is controversial.

**Methods:** We evaluated the interaction between TLR4 and environmental factors in RSV disease and defined the immune mediators associated with severe illness.

We prospectively studied 2 independent populations of infants with bronchiolitis from 3 geographical regions of Buenos Aires involving districts where lived in families of low socioeconomic status (High LPS exposure) and high social economic status (Low LPS exposure) to test the hypothesis that the interaction of TLR4 SNPs with the environment modulates RSV disease severity.

**Results:** Severity of RSV infection is determined by the TLR4 genotype of the individual and by environmental exposure to LPS. RSV-infected infants with severe disease exhibited a high GATA3/T-bet ratio, which manifested as a high IL-4/IFN-γ ratio in respiratory secretions. The IL-4/IFN-γ ratio present in infants with severe RSV is indicative of Th2 polarization. Murine models of RSV infection confirmed that LPS exposure, Tlr4 genotype, and Th2 polarization influence disease phenotypes.

**Conclusion:** Together, the results of this study identify environmental and genetic factors that influence RSV pathogenesis and reveal that a high IL-4/IFN-γ ratio is associated with severe disease.
5. Title: Metastatic low grade gliomas in children: 20 year experience at St Jude Children's Research Hospital

Authors: Omar Chamdine¹, Alberto Broniscer¹, Shengjie Wu², Amar Gajjar¹, Ibrahim Qaddoumi¹

¹Neuro-Oncology, St. Jude Children’s Research Hospital
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Background: Low-grade gliomas (LGG) are the most common brain tumors during childhood. Long-term survival rates are excellent with the current treatment approaches. Dissemination of LGG along the neuroaxis is rare (2-5% at diagnosis and 5-12% at time of progression). Robust data regarding true incidence, presentation, patterns of dissemination, disease behavior, outcome and best management approaches does not exist. In this study, we describe the longest follow period up of a large group of patients with metastatic low grade gliomas (MLGG), at diagnosis and/or at follow up, treated at St Jude Children’s Research Hospital.

Methods: Data was retrospectively collected between January 1990, and December 2010. Inclusion criteria were: diagnosis of MLGG, age less than 21 years at diagnosis, MRI of the brain and/or spine at diagnosis and follow up. Collection of data included age at diagnosis, sex, race, diagnosis, extent of surgical intervention, time from first symptoms to diagnosis, treatment modalities, and outcome.

Results: A total of 599 patients with LGG were identified. Thirty-eight patients (6%) had metastatic disease either at diagnosis or at follow up. Most of the tumors were located in the brain (87%), and one half had metastatic disease at presentation. Only 3 patients did not have tissue confirmation at diagnosis. The most common diagnosis was pilocytic astrocytoma (55%). Chemotherapy was the most common initial treatment modality, followed by surgery. Median number of treatments per patient was 3 (range 1-5). Fifteen patients (40%), died at a median of 6 years from diagnosis (range 0.8 to 15 years). Death occurred due disease progression in all but 1 case. Median survival for the whole group was 6.2 years (range 0.1-16.9). Overall survivals were 80.7 ± 6.6%, 63.0 ± 10.2%, and 50.9 ±16.0% at 5, 10 and 15 years respectively.

Conclusions: This study describes the longest follow up of MLGG in children to date. We showed that MLGG are underestimated and entail major morbidity and mortality. Large-scale studies are required to unveil the true incidence, study the biology of these tumors, and determine the best treatment and follow up modalities.
6. **Title:** Investigating Clinician Responses to Drug-Drug Interaction and Drug-Allergy/Adverse Drug Reaction Alerts

**Authors:** Michael C. Dejos, PharmD, BCPS, Jonathan Burlison, PhD, Donald Baker, PharmD, MBA, Murad Hasan, MBBS, MS, DrPH, Jennifer Robertson, PharmD, BCPS, Cyrine Haidar, PharmD, BCPS, BCOP, Seth Karol, MD, Christine Hartford, MD, Andras Sablauer, MD, PhD, James Hoffman, PharmD, MS, BCPS

**Background:** To advance patient safety, clinical decision support (CDS), such as drug-drug interaction (DDI) and adverse drug reaction (ADR) alerts, improves prescribing practices and is a growing feature of healthcare technology. Excessive or repetitive alerts are common, which results in alert fatigue where alerts are ignored and safety benefits are eliminated. Fortunately, institutions are able to customize alerts and settings to improve CDS and prevent alert fatigue.

As institutions work to improve their alerts, they are evaluating the status quo. Existing metrics and evaluative methods have many limitations. Override rate, the ratio of alerts dismissed by the prescriber to those presented, is the most common metric. It is hypothesized that alerts with high override rates are considered candidates for deactivation; however, this metric is inconsistently calculated and does not always reflect prescriber responses. Therefore, a more effective method of evaluating the quality of prescriber alerts is needed. The purpose of this research is to assess clinician responses of selected DDI and ADR alerts using a developed method that reflects the true level of alert adherence.

**Methods:** Clinical experts, using consensus techniques, will produce a list of DDI and ADR alerts that always require adherence. Alerts and details needed to determine if prescribers adhered to the alerts’ recommendations will be retrieved from the electronic health record (EHR) from October 2009 to June 2014. Adherence will be calculated by analyzing the queried data and additional details in the EHR, and adherence rates will be compared to EHR vendor-generated override rates. It is hypothesized that the developed adherence rate will differ from the vendor-generated override rate.

**Results:** To date, a list of selected ADRs has been compiled including vancomycin. During the study period, there were 1,174 patients with 12,588 vancomycin orders, and an ADR alert fired 4,929 times in 479 patients with a vancomycin order.

**Conclusions:** Measuring alert adherence may identify how alerts are used and assist in improving the quality of alerts at St. Jude. In addition, the methods used to calculate this measure may be generalized to other healthcare institutions.
8. Title: Late outcomes among adult survivors of childhood non-Hodgkin lymphoma (NHL): a report from the St. Jude Lifetime Cohort Study.

Authors: Matthew J. Ehrhardt, MD, MS; John T. Sandlund, MD; Nan Zhang, MMS; Kirsten K. Ness PhD; Wassim Chemaitilly, MD; Kevin R. Krull, PhD; Tara M. Brinkman, PhD; Deborah B. Crom, RN, PhD; Larry Kun, MD; Sue C. Kaste, DO; Gregory T. Armstrong, MD, MSCE; Daniel M. Green, MD; Kumar Srivastava, PhD; Leslie L. Robison, PhD; Melissa M. Hudson, MD; Daniel A. Mulrooney, MD, MS; St. Jude Children’s Research Hospital

Background: Adult survivors of childhood NHL are at risk for chronic conditions likely underestimated by patient reported outcomes. Prevalence and severity based on direct clinical assessment are lacking.

Methods: Clinical, laboratory, and performance-based evaluations were obtained on 200 adult survivors of pediatric NHL at St. Jude Children’s Research Hospital. Chronic conditions were graded per CTCAE criteria. Impaired physical function was defined as performance below the 10th percentile of normative data. Multivariable Poisson regression models were used to investigate associations [relative risk (RR), 95% confidence intervals (CI)] between patient characteristics, therapies, and clinical outcomes.

Results: Survivors (66% male, 87% white) were a median age of 10 years (range 1-19) at diagnosis and 34 years (20-58) at evaluation. Forty-six (23%) received radiation to the brain, 69(35%) high dose methotrexate, and 161(81%) steroids. Most (93%) had ≥1 chronic condition, 77% ≥2 chronic conditions, and 50% a severe/life-threatening (grade 3-4) condition. Most prevalent were overweight/obesity (65%), cognitive impairment (46%), dyslipidemia (41%), and impaired fasting glucose (37%). Most prevalent grade 3-4 conditions were obesity (35%), hypertension (15%), and cognitive impairment (13%). Risk-based screening detected cardiomyopathy in 14(8.5%); 50% grades 3-4.

There were 27 second cancers (61% grades 3-4) in 23(12%) survivors. Prevalence of abnormal body composition, measured by waist to height ratio and percent fat on dual-energy x-ray absorptiometry was 72%. Many had impaired aerobic (22%), strength (48%), muscular endurance (36%), flexibility (39%), and mobility (36%) assessments. Adjusting for ages at diagnosis and evaluation, race, and methotrexate, male sex (RR 1.2, CI 1.1-1.5), anthracycline ≥250mg/m² (RR 1.3, CI 1.1-1.6), and radiation (RR 1.3, CI 1.1-1.6) were associated with having ≥2 chronic conditions. Non-white race (RR 1.6, CI 1.2-2.1) was associated with a grade 3-4 condition.

Conclusions: Prospective systematic evaluation identified significant chronic conditions and performance limitations in adult survivors of childhood NHL.
9. Title: Transplant Outcome of Pediatric and Young Adult Patients with Aplastic Anemia: St. Jude Children’s Research Hospital Experience

Authors: Hesham Eissa, MD1, Brandon M. Triplett, MD2*, Mari H Dallas, MD2, Ashok Srinivasan, MD2, Christine Hartford, MD2, Ulrike M. Reiss, MD3, Winfred C. Wang, M.D.3 and Wing Leung, MD, PhD2*

1 St Jude Children’s Research Hospital, Memphis, TN; 2 Bone Marrow Transplantation and Cellular Therapy, St Jude Children’s Research Hospital, Memphis, TN; 3 Department of Hematology, St Jude Children’s Research Hospital, Memphis, TN

Background: Bone marrow transplant (BMT) remains the preferred frontline curative modality for patients with aplastic anemia in the presence of a matched sibling donor (MSD). In the absence of MSD the general consensus is frontline immunosuppressive therapy (IST) followed by BMT from a matched unrelated donor (MUD) in case of failure or relapse. No randomized controlled studies have been performed to compare earlier MUD transplant to 2nd cycle IST in case of failure of response to 1st IST cycle. In the pediatric population a higher percentage of congenital marrow failure syndromes is encountered than in adult world; the diagnosis of many of those is challenging clinically and from the molecular and genetic standpoints.

Objectives: Review the outcome of 25 patients younger than 20 years diagnosed with aplastic anemia and recently transplanted at our institution. Compare outcomes of MSD versus MUD versus umbilical cord (UC) BMT in this patient population.

Methods: A retrospective analysis was performed on 25 patients diagnosed with aplastic anemia who underwent BMT at St Jude Children’s Research Hospital between 9/1/2009 through 8/31/2013. Initial diagnosis and treatment, patients’ characteristics, transplant data, overall survival, and complications were analyzed.

Results: Of the 25 patients reviewed, 15 patients were diagnosed with acquired aplastic anemia and 10 with congenital marrow failure, including 7 with dyskeratosis congenita (DKC), 1 with Shwachman Diamond syndrome (SDS), and 2 with congenital marrow failure not otherwise specified (negative genetic testing, but age, family history, and presentation consistent with congenital marrow failure). All 7 DKC patients had telomere lengths less than first percentile, and 2 had documented genetic mutations; of the 7 patients 2 received MSD, 3 received MUD and 2 received UC transplants.

Most donors were MUD (13/25), 2 were UC donors as there were no other available donors, and 10 were MSD. All MSD recipients are alive, engrafted and disease free. There were 3 deaths. One MUD recipient with acquired aplastic anemia died of uncontrolled sepsis. Both UC recipients died; one had failure of engraftment and later died of acute myeloid leukemia that had developed on day +224 of transplant while on Danazol and G-CSF, and the other died of pulmonary and hepatic failure. The latter was the only patient who received TBI (2 Gy) as part of his conditioning regimen, engrafted on day +27 and died on day +33. There was no statistical difference in overall survival (OS) between MSD and MUD transplant (100% vs 92.3% at 3 years, respectively, p value = 0.38).

Acute graft versus host disease (aGVHD) developed in 5 patients; 3 had received MUD transplant and 2 had received MSD. Two of these 5 patients also developed chronic graft versus host disease (cGVHD), which was limited in both cases. There was no statistically significant difference in engraftment or GVHD occurrence between the MSD and MUD patients.
Conclusions: In our recent experience aplastic anemia in children, outcomes from MUD BMT were comparable to MSD BMT, especially with improved supportive care and GVHD prevention and treatment. Cord blood as an alternative donor source remains very challenging in this patient population from the engraftment and toxicity standpoints especially in certain congenital marrow failure syndromes. These data suggest that BMT should be considered earlier when there is MUD availability for patients with aplastic anemia.

\[ P_{\text{unrelated vs cord}} = 0.0007 \]
\[ P_{\text{Sibling vs cord}} = 0.0002 \]
\[ P_{\text{unrelated vs sibling}} = 0.38 \]
Title: Impact of the Antibiotic Stewardship Program at Le Bonheur Children’s Hospital – An analysis of antibiotic usage and acquisition costs

Authors: Kenice Ferguson-Paul, MD\textsuperscript{1,3}; Bindiya Bagga, MD\textsuperscript{2,3}; Sandra Arnold, MD \textsuperscript{2,3}; Kelley Lee, PharmD \textsuperscript{2,3}

\textsuperscript{1} St Jude Children’s Research Hospital; \textsuperscript{2} Le Bonheur Children’s Hospital; \textsuperscript{3} University of Tennessee Health Science Center

Background: Antibiotic Stewardship Programs (ASPs) are recommended in acute care hospitals to address excessive antibiotic use. The ASP at Le Bonheur Children’s Hospital has initiated programs including development of antimicrobial guidelines with retrospective audit and periodic feedback, education on appropriate antibiotic use, and prospective audit and prescriber feedback on targeted antibiotics (meropenem, cefepime and piperacillin-tazobactam).

Purpose: The primary purpose of this study was to determine the impact of the ASP on acquisition costs and antibiotic days and to compare these to reported outcomes from other institutions.

Methods: Antibiotic purchasing data was obtained from our wholesaler’s database for August 2011- July 2014. Antibiotic usage data was extracted from the Pediatric Health Information Systems (PHIS) database for August 2011- March 2014 Antibiotic usage data was normalized to 1000 patient days to allow comparison over time. Changes in antibiotic use and purchasing associated with implementation of ASPs at children’s hospital was determined by literature review.

Results: Average monthly antibiotic days/1000 patient days during the first and third years of our ASP were 890 and 707 respectively (21.8\% decrease). Total antibiotic acquisition costs decreased from $902,996 during the first year to $730,015 for the third year (savings of $173,000; 20\% decrease). Average monthly targeted antibiotic days/1000 patient days decreased from 95 during the first year, to 53 during the first 8 months of the third year (30\% decrease). Targeted antibiotic acquisition costs were $285,689 during the first year, and $108,336 for the third year (55\% decrease). Comparatively, the few literature reports available for pediatric ASPs have shown an approximate 22\% reduction in restricted antibiotic costs and 14\% decrease in restricted antibiotic use after ASP implementation. Decreases of 3 - 6\% in overall antibiotic use and $50,000 - $100,000 overall cost reductions have been reported by pediatric ASPs at other institutions.

Conclusions: Our study demonstrates that both usage and acquisition costs of our targeted antibiotics have decreased since the inception of ASP at our institution. As a parallel benefit, overall antibiotic use and costs have also decreased demonstrating the success of the ASP beyond the targeted antibiotics. Our decreases in antibiotic use and costs compare favorably with reports from other ASPs. Continued efforts are ongoing to ensure that the antibiotic usage and acquisition continues to decline without compromising on patient outcomes.
11. Title: Integration of Patient Education into St. Jude Children's Research Hospital's Preemptive Pharmacogenetics Model

Authors: Roseann S. Gammal, PharmD; Cyrine E. Haidar, PharmD; Kristine R. Crews, PharmD; Sheri Ring, RN; Nancy M. Kornegay, MBA; James M. Hoffman, PharmD; Sima Jeha, MD; Mary V. Relling, PharmD

Background: Pharmacogenetic test results have life-long implications for drug therapy. Informing patients about their gene test results may facilitate the use of this information over time. Here we describe the patient education that has been implemented as part of St. Jude's preemptive pharmacogenetic testing program (PG4KDS).

Methods: During the PG4KDS informed consent discussion, research nurses educate patients and families about pharmacogenetic testing. Patients may view a video on the PG4KDS webpage that discusses the study. Participants are asked whether they wish to be informed of their pharmacogenetic test results. If they request notification, a letter is mailed to them and posted to their EHR. The letter explains, in lay language, the patient’s phenotype and its implications for pharmacotherapy. The letters are accompanied by gene-specific, and sometimes medication-specific, information sheets. Written materials are approved by the Patient Education Committee and are also available on www.stjude.org.

Results: To date, 5 genes (TPMT, CYP2D6, SLCO1B1, CYP2C19, and DPYD) linked to 14 drugs have been integrated into the EHR through PG4KDS. For each of the genes, a patient information sheet has been created. For each drug, the medication information sheet has been updated. From May 2011 to July 2014, 2,159 patients (97%) elected to receive their pharmacogenetic test results by mail; of those who reached 18 years of age after study enrollment, none has elected to discontinue receiving results as an adult. Overall, 8,575 patient letters have been distributed to 1,854 patients in 23 countries. Of these patients, 75% have received at least one letter with an actionable gene test result that will impact prescribing for certain drugs. Patients are encouraged to share the letters with outside providers so their future therapy may be guided using a gene-based approach.

Conclusions: Patient education is an integral element in applying preemptive pharmacogenetic testing to clinical practice. A variety of patient education modalities may be used to explain pharmacogenetic testing, to inform patients about their test results, and to facilitate gene-based prescribing by outside providers.
Title: Isolated Memory Impairment following Bilateral Hippocampal Damage Secondary to Human Herpes Virus 6 Encephalitis (HHV6) in the Context of Bone Marrow Transplant for Pediatric Leukemia

Authors: John R. Hamilton, Heather M. Conklin, Zsila S. Sadighi, Noah D. Sabin, Christine M. Hartford

Background: The case study of HM, an adult patient who suffered severe anterograde amnesia following bilateral medial temporal lobectomy, indicated the importance of the hippocampus in memory functioning. A pediatric oncology patient developed bilateral hippocampal lesions secondary to an acute herpes simplex encephalitis. Focal lesions are rare in pediatric populations; thus, this patient provides a unique opportunity to examine the role of the hippocampus in pediatric neurocognitive functioning.

Methods: A Caucasian male who was diagnosed with acute myeloid leukemia at age 7 was evaluated at age 11. He received chemotherapy, total body irradiation, and four bone marrow transplants (BMT). He experienced HHV6 following the third BMT. MRI scans indicated stable encephalomalacia involving the hippocampal complexes, compatible with chronic sequelae of prior HHV6.

Results: Results indicated average verbal and nonverbal reasoning skills (WASI-II VCI=91, PRI=107). Receptive and expressive language was intact. Visual perception, visual motor integration and fine motor dexterity were age typical. Immediate verbal recall was low average (CVLT-C Total T=36, WRAML-2 Story Memory ScS=7); delayed verbal recall was impaired (CVLT-C Long Delay Free Recall Z=-2.0, WRAML-2 Story Memory Recall ScS=5). Visual memory was impaired for immediate and delayed recall (NEPSY-2 Memory for Designs Total ScS=1, Delayed Total ScS=1).

Conclusions: The neurocognitive pattern of anterograde amnesia within the context of otherwise intact cognitive functioning is consistent with bilateral hippocampal lesions. Amnestic memory processes are well documented for humans and animals following medial temporal lobe damage, with deficits evident following time delay, secondary to interruption in memory encoding and consolidation. Findings were instrumental in correcting attributions of academic problems solely to significant school absences and in informing memory based interventions.
13. Title: Comparison of $^{18}$F-FDG-PET-CT and bone scintigraphy for evaluation of osseous metastases in newly diagnosed and recurrent osteosarcoma

Authors: Caitlin Hurley, Beth McCarville, Barry L. Shulkin, Shenghua Mao, Jianrong Wu, Fariba Navid, Najat C. Daw, Alberto S. Pappo, Michael W. Bishop

Background: Bone scintigraphy (BS) is routinely used to detect osseous metastases in osteosarcoma. The use of $^{18}$F-fluorodeoxyglucose positron emission tomography-computed tomography ($^{18}$F-FDG-PET-CT) to assess tumor extent in pediatric sarcomas has increased recently. We compared the sensitivity, specificity, and diagnostic accuracy of PET-CT and BS for detection of osseous metastases in osteosarcoma.

Methods: We retrospectively reviewed 39 patients with osteosarcoma who underwent paired PET-CT and BS at diagnosis and/or first recurrence between 2003 and 2012. PET-CT and BS studies were independently reviewed by 2 pediatric imaging specialists who were blinded to results of the opposing modality and reference standard. Reviewers categorized lesions as benign, malignant or indeterminate. Reference standard for lesion histology was biopsy or clinical follow-up. Diagnostic performance of PET-CT, BS, and combined modalities were determined.

Results: Forty-two examinations from 39 patients were reviewed and 123 bone lesions were evaluated. Median age was 11 years (range 5-19 years). Four patients had 13 osseous metastases at diagnosis (3 biopsied, 10 clinically), and 3 had 9 osseous metastases at recurrence (2 biopsied, 7 clinically). For all sites combined, sensitivity, specificity and diagnostic accuracy were 92%, 76%, and 84% respectively for PET-CT, 77%, 94%, and 85% for BS, and 98%, 69%, and 84% for PET-CT and BS combined. For metastatic sites alone, sensitivity, specificity and diagnostic accuracy were 77%, 76% and 76% for PET-CT, 41%, 94% and 80% for BS, and 96%, 69% and 76% for combined modalities. Improved sensitivity of PET-CT for metastatic sites compared to BS approached significance ($p = 0.077$); PET-CT and BS combined did not improve sensitivity over PET-CT alone ($p = 0.125$), but was significantly higher than BS alone ($p < 0.001$). BS specificity was superior to both PET-CT ($p = 0.02$) and combined imaging ($p < 0.001$).

Conclusion: $^{18}$F-FDG-PET-CT is at least as sensitive as BS in detecting osseous metastases in osteosarcoma; combined use with BS further increases sensitivity. Our findings support the use of both $^{18}$F-FDG-PET-CT and BS for staging of osteosarcoma.
14. **Title:** A Longitudinal Study of Immune Responses to Group A Streptococcal Antigens Following Pharyngeal Infections In Pediatric Subjects

**Authors:** N Hysmith¹, E Kaplan², P Cleary³, D Johnson³, T Penfound¹, J Dale¹

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**Purpose of Study:** Multiple antigens of group A streptococci (GAS) are being considered as vaccine components, yet little is known about the human immune responses to these antigens following natural infection. We evaluated immune responses following pharyngeal infections in pediatric subjects using a panel of 28 GAS antigens.

**Methods:** Fifty-six pediatric subjects (ages 6-15) were evaluated during a 24-month longitudinal study. A total of 235 serum samples and 58 positive throat cultures (13 different emm types) representing new acquisitions of GAS were obtained. ELISA was performed with: streptolysin O (SLO), DNaseB, C5a peptidase (SCPA), GAS40, streptococcal serine esterase (SSE), serum opacity factor (SOF), fibronectin binding protein (FBP54), three M-related protein peptides (MrpI-III), and 18 M peptides.

**Results:** Increases in SLO and/or DNaseB antibodies were observed following 32/58 (55%) new GAS acquisitions. In 34/58 (58%) new acquisitions there were increases in type-specific M antibodies corresponding to the infecting emm type. No new GAS acquisitions of the same emm type were observed when type-specific antibodies were present. Of the remaining 8 common antigens, there was a response to an average of 1.6 antigens (range 0-4). Antibody responses to GAS40 and SCPA after GAS acquisition were seen in 45% and 33% of subjects, respectively. Twelve cases of immunologically significant GAS acquisition were only detected by antibody increases to GAS40 or SCPA.

**Conclusions:** Immunologically significant GAS infections in children were associated with humoral immune responses to common and type-specific antigens. Persistence of newly acquired GAS in the posterior oropharynx was not influenced by significant and sustained immune responses to type-specific or shared antigens. Sensitivity of commonly used clinical markers of GAS infection (SLO and DNaseB) can be improved from 55% to 75% by the addition of common antigens. The human immune responses to GAS antigens provide important information regarding potential vaccine formulations designed to prevent GAS infections.
15. Title: Long-term renal function in patients with non-syndromic Wilms tumor treated with unilateral radical nephrectomy

Authors: Rodrigo B. Interiano, MD\textsuperscript{1,2}, Noel Delos Santos, MD\textsuperscript{3}, Sujuan Huang, PhD\textsuperscript{4}, Deo Kumar Srivastava, PhD\textsuperscript{4}, Leslie L. Robison, PhD\textsuperscript{5}, Melissa M. Hudson, MD\textsuperscript{6}, Daniel M. Green, MD\textsuperscript{5}, Andrew M. Davidoff, MD\textsuperscript{1,2}.

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Purpose: Partial nephrectomy is being considered by some for children with unilateral Wilms tumor (UWT) to avoid the theoretical complication of renal insufficiency. We evaluated the prevalence of hypertension and impaired renal function in long-term survivors of non-syndromic UWT treated without nephrotoxic chemotherapy or ionizing radiation.

Patients and Methods: Eligibility included: age ≤15 years at diagnosis of non-syndromic UWT, treatment prior to 2002 and maintenance of remission following unilateral nephrectomy without abdominal irradiation or nephrotoxic chemotherapy. Renal function was assessed by urinalysis and estimated glomerular filtration rate (eGFR). Patients on anti-hypertensive medication or with blood pressure >140/90 mmHg were defined as hypertensive.

Results: Seventy-five patients with median age at diagnosis of 3.2 (range: 0.2-12.1) years met eligibility criteria. The median length of follow-up was 19.6 (range: 10.0-32.8) years. All but one patient had stage 1/2 disease. Sixty-eight (90.7%) patients had favorable histology WT; seven had anaplastic histology. Sixteen (21.3%) patients had an eGFR <90 ml/min/1.73m\textsuperscript{2}, two of whom also had proteinuria (12.5%). No patient had an eGFR <60 ml/min/1.73m\textsuperscript{2}. Five (6.7%) patients had hypertension, three of whom were taking anti-hypertensive 20 medications. No patient has developed end-stage renal disease.

Conclusions: Patients with UWT treated with unilateral radical nephrectomy without nephrotoxic chemotherapy or ionizing radiation are at low risk for significant long-term renal dysfunction. For this patient population, routine use of partial nephrectomy does not appear justified. However, monitoring and counseling are important for identifying the rare patient who develops subtle renal insufficiency and so might be at increased risk for adverse cardiovascular sequelae.
**Title:** Genetic predisposition for osteonecrosis in young patients treated for acute lymphoblastic leukemia


**Department:** Department of Oncology, St. Jude Children’s Research Hospital, Memphis, TN; Department of Pharmaceutical Sciences, St. Jude Children’s Research Hospital; PHARP Pharma Consulting, Mystic, CT; University of Colorado School of Medicine and Children's Hospital Colorado, Aurora, CO; Department of Pediatrics, Maine Medical Center; Department of Pediatrics, University of California School of Medicine, San Francisco, CA; Department of Pediatrics, Children’s Hospital of Philadelphia, Philadelphia, PA; Department of Pediatrics, University of Utah; Department of Pediatrics, New York University Langone Medical Center, New York, NY; Department of Biostatistics, College of Medicine, Public Health & Health Professions, University of Florida, Gainesville, FL; Department of Radiological Sciences, St. Jude Children’s Research Hospital; Department of Radiological Sciences, University of Tennessee, Memphis, TN; Department of Biostatistics, St. Jude Children’s Research Hospital

**Background:** Osteonecrosis (ON) has emerged as a major therapy limiting toxicity for patients being treated for acute lymphoblastic leukemia (ALL). Patients aged 10-20 years are at high risk of developing ON during therapy, while the risk is lower among younger children. Because of this, the majority of cases in all prior genome wide association studies (GWAS) for ON have been older than 10 years. Here, we describe the first GWAS of ON risk in patients younger than 10.

**Methods:** We performed a GWAS on a case-control cohort of patients from Children’s Oncology Group (COG) AALL0331, and tested for replication of those results in patients younger than 10 treated on COG AALL0232 or St. Jude Children’s Research Hospital (SJCRH) TOTAL XV. Germline DNA was obtained from peripheral blood samples at the time of remission. Genotyping was performed using the Illumina Human Exome BeadChip (all) and the Affymetrix GeneChip Human Mapping Array 6.0 (COG) or GeneChip Human Mapping 500k (SJCRH). Analyses were controlled for therapy, age, gender, and genetically defined ancestry.

**Results:** Within the discovery cohort, the top SNP was located on chromosome 2 in the DOCK10 gene, with a risk allele frequency of 72.2% and an odds ratio of 7.9 (rs13427433, \( P=1.11\times10^{-3} \)); however, this variant was not associated with ON in the replication cohorts. The top variant associated with ON in AALL0331 (\( P=8.36\times10^{-7} \)), that did replicate in another cohort was rs7658097 located in an intergenic region of chromosome 4, with a significant association also noted in the young patients treated on AALL0232 (\( P=0.03 \) in AALL0232). Of the top 100 SNPs associated with ON in AALL0331, 6 were validated in the replication cohorts (5 in AALL0232, 1 in TOTAL XV). None of the top 100 SNPs associated with ON in AALL0331 were validated in older patients treated on AALL0232.

**Conclusions:** This analysis identifies unique genetic variations associated with the development of ON in young patients receiving ALL therapy. The genetic variations associated with ON in young patients appear discrete from those seen in older patients. Interventions to decrease the incidence of ON may be variably effective based on patient age.
Stenotrophomonas maltophilia Infections in a Pediatric Immunocompromised Population

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Background: Stenotrophomonas maltophilia is a Gram negative rod (GNR) ubiquitously found in the environment and is intrinsically resistant to many broad spectrum antibiotics. Rarely serious in the immunocompetent host, infections in patients with malignancies undergoing chemotherapy are more frequent and serious due to use of central venous catheters, intense immunosuppression, and use of very broad spectrum antibiotics. Infections vary from asymptomatic colonization to hemorrhagic pneumonia and death. Several studies have evaluated risk factors for developing S. maltophilia infections and death, but these studies are derived from mostly adult patients. Our population at St. Jude provides a unique opportunity examine the spectrum of S. maltophilia infections in children and compare outcomes among S. maltophilia, GNR, and multi-drug resistant (MDR) GNR infections

Methods: All patients with GNR infections from August 1, 2008 to August 31 2013 at St. Jude were identified through database search. Charts of patients who had S. maltophilia infections were reviewed and summarized. For association with serious S. maltophilia, bivariate analysis was performed with either chi-square or Fisher exact tests for categorical variables and student t-test or Wilcoxon rank-sum tests for continuous variables. All covariates with alpha < 0.2 were included in multivariate analysis. Mortality associated with S. maltophilia, GNR, and MDR GNR blood stream infections (BSI) will be similarly compared.

Results: 32 patients with S. maltophilia infection were identified during this time period. All 8 patients without BSI did well. 9 patients with BSI required ICU admission, of whom 6 died. Neutropenia during infection, recent ICU admission and intubation, and concomitant pneumonia were all significantly associated with severe disease in univariate analysis. One biopsy specimen had resistance to TMP-SMX; isolates were otherwise susceptible. 210 patients had GNR BSIs. Of these, 25 had S. maltophilia and 58 had MDR GNR.

Conclusions: S. maltophilia causes a significant number of GNR BSI in pediatric immunocompromised patients and are at risk for having severe infection and death. TMP-SMX remains the antibiotic of choice due to low resistance.
Title: Malignant Melanoma Arising from a Giant Congenital Melanocytic Nevus in a Child

Authors: Alpin D. Malkan, Aaron D. Seims, Fariba Navid, John A. Sandoval

Abstract: Giant congenital melanocytic nevi (GMN) occur in approximately 1 in 20,000 newborns, and typically affect the trunk and proximal limbs. Criterion that defines a GMN in childhood includes a diameter greater than 9 cm or 2 percent of body surface area. The risk for malignant melanoma (MM) arising in GMN is 5-15% and leads to significant multidisciplinary challenges. We herein report a rare case of MM arising from GMN in a child. An 8-year-old male with a GMN in the capec distribution underwent several planned, staged partial resections. A new blackish-blue lesion was noted by the caregiver to arise and rapidly grow within the GMN which was subsequently surgically excised. Histopathological examination was consistent with MM (Breslow thickness 5.7 mm, no ulceration, mitotic rate 8 per mm², NRAS positive) and Peg-interferon was initiated. A new lesion was noted after 42 weeks of therapy and excisional biopsy confirmed recurrent MM. Chemotherapy was changed to Ipilimumab, Trametinib (MEK inhibitor), Temozolomide and finally Nivolumab (anti-PD1 inhibitor) secondary to aggressive recurrences after a trial of each individual agent, respectively. The patient ultimately developed a malignant pleural effusion requiring a tunneled chest catheter and subsequently expired. Although malignant melanoma in children and adolescents is uncommon, MM arising from within GMN can exhibit highly aggressive behavior, with poor response to current available therapies.
19. **Title:** Epidemiology of Diarrheal Illnesses in Pediatric Oncology Patients

**Authors:** Nael Mhaissen, MD, Z. Gu, H. Zhu, A. Rodriguez, L. Tang, Y. Sun, S. Schultz-Cherry, R. T. Hayden, E. Adderson

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**Introduction:** Diarrhea is common in children treated for cancer but our understanding of the epidemiology of diarrheal diseases in this population is incomplete.

**Methods:** We used conventional diagnostic tests and 2 broadly multiplexed PCR assays to identify gastrointestinal pathogens in stool samples collected between January 2010 and June 2011 from pediatric oncology patients. Demographic and clinical data were abstracted from patients’ medical records. Patients with recent HSCT were excluded.

**Results:** 185 episodes of diarrhea occurred in 146 patients. Patients’ median age was 3.8 yrs, range 0.2-18.79; 42% had hematological malignancies, 58% solid tumors and 61% were outpatients. One or more gastrointestinal pathogens was identified in 135 episodes (73%), including *Clostridium difficile* (n=74, 40%), norovirus (n=40, 22%), adenovirus (n=26, 14%), astrovirus (n=12, 6%) and *Entamoeba histolytica* (n=9, 5%). Children with pathogens were younger (median 3.2 vs. 6.8 yrs, p=0.002) but otherwise similar to children without potential infectious etiologies for their diarrhea; the proportion of patients with specific systemic and gastrointestinal symptoms did not differ. Some viral infections had distinct characteristics; most were associated with significant morbidity, including high rates of hospitalization and systemic symptoms. Multiple pathogens were identified in 44 episodes (33%). Patients with multiple pathogens were similar to those with single pathogens; the duration of diarrhea and rates of symptoms did not differ between these groups.

**Conclusion:** Most pediatric oncology patients in this study had one or more potential infectious causes of their diarrhea. A relatively large proportion had viral infections and these were associated with considerable morbidity. Additional studies are warranted to characterize the gastrointestinal infections in pediatric cancer patients and mitigate the impact of these on cancer therapy.
Background: Clinical algorithms to standardize care of febrile pediatric oncology patients are underutilized in low and middle-income countries (LMIC). With our collaborators at the Southern Philippines Medical Center (SPMC), we designed and implemented a site-specific algorithm using resource-appropriate testing and antimicrobials.

Methods: We are now prospectively evaluating the frequency of practitioner adherence and identifying factors associated with algorithm deviations for pediatric oncology patients admitted with fever. Data used to assess adherence include laboratory studies, medications, and imaging ordered, whether orders were completed, and barriers to completion for incomplete orders. Outcome measures include length of hospitalization, intensive care unit stay, mortality, and types and frequency of pathogens recovered.

Results: We have enrolled 48 patients to date. Analysis of the first 28 patients revealed 18 patients (64.2%) with at least one deviation from the algorithm with a total of 40 deviations occurring overall. 26 (65%) deviations were related to medication access and cost, 11 (27.5%) to missed laboratory orders and cost, and 2 (5%) to imaging cost. 18 deviations (45%) occurred on days 0-1 of hospitalization. 7/26 (26.9%) medication deviations continued for several days (range 2-6 days) and 6/7 (85.7%) were not corrected prior to discharge. 2/28 (7.14%) patients never had blood cultures obtained. 3/26 (11.5%) remaining patients had separate positive blood cultures for Chryseobacterium indologenes, Pseudomonas aeruginosa, and Escherichia coli.

Conclusions: Despite local collaboration in design and implementation, numerous algorithm deviations occurred. Statistical analysis of the complete cohort will attempt to identify associated risk factors and predictors of deviation. We will use this analysis to direct prioritization of future interventions to improve care.
Title: Individual differences in the longitudinal trajectories of anxiety and depression symptoms in children and adolescents with cancer

Authors: Okado, Y., Howard Sharp, K., Tillery, R., Long, A., & Phipps, S.

Background: Children with cancer, as a group, do not exhibit clinically elevated symptoms of anxiety or depression (Phipps et al., 2005). However, individual differences in the longitudinal trajectories of these symptoms have not yet been studied. As a result, it is unclear whether there are subsets of children that experience clinically significant anxiety or depression over time. The present study sought to fill this gap and to also identify protective factors that are associated with trajectories reflecting resilience, which are characterized by consistently low levels of symptoms.

Methods: 255 children and adolescents with cancer [mean age = 12.52 years (SD = 2.87), range = 8-17 years] were followed prospectively for 3 years. They reported on their anxiety and depression symptoms using validated self-report measures [SCARED, CDI, and BASC-2]. Individual differences in the trajectories of these symptoms across 3 years were modeled using latent class growth analysis. To identify potential protective factors, the resultant latent classes, or subgroups of children that differed in their symptom trajectories, were then compared on demographic, medical, and psychosocial characteristics.

Results: Two classes of children were identified based on the trajectories of their anxiety symptoms. One group (88.1%) had consistently low symptoms, whereas another group (11.9%) showed slightly elevated baseline scores that declined over time. Children in the more resilient group had higher socio-economic status and lower negative affectivity. Examining trajectories of depression symptoms revealed one group (58.8%) with consistently low symptoms, a second group (39.1%) with average-level symptoms that increased slightly over time, and a third group (2.0%) with clinically elevated baseline symptoms that decreased substantially over time. Membership in the most resilient class was predicted by low dispositional pessimism and low prior exposure to stressful life events. These classes of children differed in teacher and parent-reported psychosocial variables, in expected directions.

Conclusions: Children with cancer are heterogeneous in their anxiety and depressive symptoms over time; however, there is no identifiable subgroup that is persistently distressed. Having low levels of negative affectivity and pessimism is especially protective.
Title: PI3K the Right Target: Effects of Chemotherapy on the Vascular Profile in Neuroblastoma

Authors: Nikhil Panda¹, Nathan Hinkle MD², Ramon Klein-Geltink PhD³, Walter Lang PhD³, Christopher Morton³ and John A. Sandoval MD³

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Background: Outcomes for children with high-risk neuroblastoma (NB) are dismal and better treatment strategies are needed. The phosphatidylinositol 3-kinase (PI3K) pathway has emerged as a potential therapeutic target for advanced stage NB. Targeting this pathway may affect many intracellular signal transduction pathways and physiological processes within the tumor like angiogenesis. We sought to compare antiangiogenesis profiles in response to directed PI3K inhibition between NB subtypes.

Methods: Baseline PI3K pathway activation levels in NB subtypes were determined by Western blot. Cytotoxicity assays were performed on NB cell lines using specific small molecule PI3K antagonists. Immunohistochemistry (IHC) analysis with angiogenic specific markers (SMA+ and CD34+) of mouse NB xenografts were performed upon exposure to standard of care (SOC) chemotherapy or 2x cycles of SOC combined with specific PI3K-inhibitors (OSI-BEZ235 and OSI-BKM120).

Results: Western blot analysis demonstrated a differential PI3K pathway expression profile between NB types. Cytotoxicity assays of NB subtypes showed a spectrum of sensitivities in response to treatment with selected PI3K inhibitors. IHC analysis of NB subtype (MAST3) showed statistically significant decreases in vascularity only in tissues treated with OSI-BEZ (45% decrease) in SMA+-stained tissue. Similarly, CD34+-stained MAST3 tissue showed an 83% decrease in vascular density in OSI-BEZ treated tissue; however, SOC and OSI-BKM treatments also produced significant decreases in vascularity. In NB subtype (NB5), exposure to SOC and OSI-BEZ yielded 35% and 24% decreases in SMA+-stained tissue, respectively, in comparison to untreated samples. The effects of OSI-BKM in SMA+-NB5 tissues were found to be insignificant. Similarly, SOC treatment in CD34+-NB5 tumors decreased vascularity by 31%; however, the PI3K-inhibitors did not significantly change vascular density relative to the control.

Conclusion: Antiangiogenic effects of chemotherapy and targeted PI3K inhibitors among NB subtypes respond differently to treatment. While basal PI3K levels may not accurately predict the effects of PI3K-inhibitors on angiogenesis, it is plausible that activation of compensatory feedback pathways may contribute to angiogenesis regulation.
23. Title: Aerosolized and Intravenous Pentamidine as Prophylaxis for Pneumocystis Pneumonia in Pediatric Oncology Patients: A Retrospective Review

Authors: Joseph Sciasci, PharmD; Hope Swanson, PharmD; Jennifer Pauley, PharmD; Delia Carias, PharmD; Joshua Wolf, MBBS; Gabriela Maron, MD; Patrick Campbell, MD; Sima Jeha, MD; William Greene, PharmD

Background: Pneumocystis jiroveci pneumonia (PCP) is a potentially life-threatening opportunistic infection in pediatric oncology patients. In the absence of prophylaxis, up to 25% of pediatric oncology patients receiving chemotherapy will develop PCP. Various agents with activity against PCP have been identified, including trimethoprim-sulfamethoxazole, dapsone, atovaquone, and aerosolized or intravenous pentamidine. Low-dose trimethoprim-sulfamethoxazole is widely recognized as the drug of choice for PCP prophylaxis in pediatric oncology patients. Patients that cannot tolerate trimethoprim-sulfamethoxazole require prophylaxis with an alternative agent, the optimal choice of agent is unclear, as limited data exists regarding the efficacy and safety of the alternative agents in pediatric patients.

Methods: A retrospective chart review of children between the age of 1 year and 18 years of age who received at least one dose of aerosolized or intravenous pentamidine for PCP prophylaxis between January 1, 2007 and August 31, 2014 was performed. Research methods were approved by the hospital’s institutional review board. The primary outcome of this review was to determine the overall rate of pentamidine failure in all patients receiving pentamidine for PCP prophylaxis. Failure of pentamidine for PCP prophylaxis is defined as breakthrough PCP infection, or development of an intolerable adverse drug reaction necessitating use of an alternative agent. Additional outcomes of this review included reason for use of pentamidine over alternative agents, as well as a review of concomitant medications that may have been associated with the development of an adverse drug reaction.

Results: Data analysis still in progress.

Conclusions: Data analysis still in progress.

References:

24. Title: Outcome of total lymphoid irradiation based conditioning for allogeneic hematopoietic stem cell transplantation in pediatric patients with non-malignant disease

Author: Jitsuda Sitthi-amorn, MD

Clinical Fellow, Division of Bone Marrow Transplantation and Cellular Therapy, Department of Oncology, St Jude Children's Research Hospital

Background: Barriers to non-malignant transplants include achievement of durable engraftment in immunocompetent hosts, concerns of treatment related complications, graft versus host disease (GVHD) and long term complications. Total lymphoid irradiation (TLI) has been shown to be immunosuppressive, allowing successful engraftment with low incidence of GVHD. Using TLI-based conditioning lessens exposure to chemotherapy, making it a promising modality for non-malignant transplants. To better clarify the outcome of TLI-based conditioning for non-malignant transplants at our institution, we performed a retrospective review.

Methods: Retrospective review was performed on 24 patients who received TLI-based conditioning for severe aplastic anemia (n=19), Hurler’s syndrome (n=3), HLH (n=1) and PNH (n=1). The donors were matched unrelated (n=14), haploidentical (n=5), matched sibling (n=4) or double cord blood (n=1). TLI (625 – 900 cGy) was given with 1-2 alkylating and/or antimetabolite agents and 1-2 anti T cells agents based on protocol available and patient’s comorbidity. Immunosuppressive therapies were administered based on institutional standard practice during the time period. The study was approved by St Jude IRB. Results: The patients’ age ranged from 8 months – 19 years (median 11.7). The incidence of successful primary engraftment was 100%. There were 3 (12.5%) secondary graft failure. Information on GVHD was available on 21 patients transplanted after year 2000. The incidence of acute GVHD was 28.5% (5 with grade I-II, 23%; 1 with grade III-IV, 4.8%). One patient had limited chronic GVHD and none had extensive chronic GVHD. There were 3 transplant related mortality. Other treatment related complications included venoocclusive disease (n=2), microangiopathy (n=1) and pericardial effusion (n=1). Survival analysis showed a 1 year OS of 87.5% and a 1 year EFS of 76.2%. Late effects included mild restrictive lung disease (n=1), decreased glomerular filtration rate (n=3), growth hormone deficiency (n=2), hypothyroidism (n=2) and primary gonadal insufficiency (n=5). There was no cardiac dysfunction, cataracts or secondary malignancy.

Conclusions: TLI-based conditioning is effective in allowing high rate of successful engraftment, with low incidence of GVHD and treatment related complications. A prospective clinical trial is warranted to confirm the role of TLI in patients with non-malignant diseases.
25. **Title:** Patient-Controlled Analgesia at the End of Life at a Pediatric Oncology Institution

**Authors:** Jennifer Snaman, MD, Doralina Anghelescu, MD Luis Trujillo, MD, April Sykes, Y Yuan, PhD, Justin Baker, MD

**Background:** Patient controlled anesthesia (PCA) is increasingly used to manage pain in pediatric cancer patients and is important in the treatment of escalating pain at the end of life. The description of the use of opioid PCA in this population has been limited.

**Methods:** This retrospective chart review of the last 2 weeks of life addressed the following objectives: 1) to describe the patient population treated with opioid PCA; 2) to describe the morphine-equivalent doses (MED) (mg/kg/day); and 3) to describe the pain scores.

**Results:** Twenty-seven percent of inpatients used opioid PCA for pain control during the last 2 weeks of life. The mean MED (mg/kg/day) (SD) at 2 weeks prior and the day of death were 10.7 (17.9) and 19 (25.8). The mean MED increased over the last 2 weeks of life for all patients and across age groups and cancer diagnoses (all \( p < 0.05 \)). The mean MED was significantly higher in the younger age group (age <13 vs. age ≥13) on the day of death \( (p < 0.04) \). There was a significant change in mean pain score over the last 2 weeks of life \( (p < 0.001) \), with the highest pain score on the day before death. The most frequently used concurrent medications were benzodiazepines (91%).

**Conclusions:** Children and young adults with cancer experience high opioid requirements and significant dose increases during the last 2 weeks of life. Additionally, pain scores increase toward the end of life. Opioid rotation and addition of adjuvant medications merit early consideration in the context of escalating opioid requirements.
26. Title: Comparative Functional reactivity of group 1 and 2 HLA-C proteins with KIR2DL2/3 receptors

Authors: Rajoo Thapa MD, Rafijul Bari, PhD Wing Leung, MD, PhD

Background: Killer cell immunoglobulin-like receptors (KIR) are the most important regulators of NK cells activity which interact with HLA class I molecules on target cells. KIR2DL1, KIR2DL2, KIR2DL3, and KIR3DL1 are the most important inhibitory receptors in transplantation. The lack of cognate ligand in recipient for one of these receptors is associated with lower risk of relapse and GVHD. Thus, inhibitory KIRs affect HSCT outcomes but there is a need to stratify the degree of interaction of respective receptors with their cognate ligands, thereby having some idea on the nature of transplant outcomes based on this phenomenon. In other words, greater the degree of interaction between the two, more is the anticipated inhibition of killing activity of NK cells which may translate into relatively poorer outcomes.

Methods: 721.221 cells were transduced individually with ligands of HLA-C group 1 (HLA-Cw1, 3, 7, 8, 12, 14, 16) and HLA-C group 2 (HLA-Cw2, 4, 5, 6, 15, 17, 18) and served as target (T) cells. YT-Indy cells were transduced with individual inhibitory KIRs (KIR2DL2*001, KIR2DL2*002, KIR2DL3*001 and KIR2DL3*003) and served as effector (E) cells. BATDA cytotoxicity was done at E:T ratio of 20:1. NOD-SCID mice were injected at E:T ratio of 10:1. For in-vivo experiments, ligands with minimum (min) and maximum (max) activity (HLA-C group 1: Cw7 and Cw14; HLA-C group 2: Cw18 and Cw4) were selected, based on in-vitro results. Also, KIRs that showed min (KIR2DL2*001) and max (KIR2DL3*002) killing were selected.

Results: Statistically significant difference in killing was observed between Cw-7 and Cw14 (HLA-C group 1) and between Cw18 and Cw4 (HLA-C group 2). Also, statistically significant difference was seen between the activity of KIR2DL3*002 (max killing) and KIR2DL2*001 (min killing) when analyzed against different ligands. In vivo, largest tumors were seen in the groups with KIR showing min killing (KIR2DL2*001) when injected with ligands showing min interaction (Cw7 from group 1 and Cw18 from group 2). Smallest sized tumors were seen with KIR showing max killing (KIR2DL3*002) when injected with ligands showing max interaction (Cw14 from group 1 and Cw4 from group 2).

Conclusions: Differential killing was noted on interaction of KIR2DL2/3 receptors with the ligands of HLA-C groups 1 and 2 ligands with statistical significance between the two ligands (with max and min activity) in each group and between the KIRs with max and min activity. These may have implications in donor selection for best HSCT outcomes.
Title: Utilization of body weight vs. body surface area for chemotherapy dosing in infants

Authors: Courtney S. Watts, PharmD., BCPS; Shane Cross, PharmD., BCPS; John McCormick, PharmD., BCNSP; Deborah Ward, PharmD., BCPS, BCOP; Jennifer L. Pauley, PharmD., BCPS, BCOP; Tanja Gruber, M.D., Ph.D.; Mary V. Relling, PharmD.; St. Jude Children’s Research Hospital.

Background: Approximately 10 percent of all pediatric malignancies occur in patients less than 12 months of age. The most common malignancy diagnosed in infancy is neuroblastoma, followed by central nervous system cancers, acute lymphoblastic leukemia, retinoblastoma, and wilms tumor. Controversy exists regarding whether to utilize body weight or surface area for chemotherapy dosing in this patient population. Inconsistent dosing strategies are utilized in protocols within individual disease states, as well as between them. Additionally, variables such as age or weight have been used to determine whether dosing by body weight or surface area is preferred. This can result in significant differences in applied doses at various time intervals. The primary objective of this study is to evaluate dosing strategies utilized for chemotherapy in infants in order to standardize dosing practices for this age group at St. Jude Children’s Research Hospital.

Methods: Protocols will be reviewed for the five most common malignancies occurring in infancy (age ≤ 12 months) and will include neuroblastoma, central nervous system malignancies, acute lymphoblastic leukemia, retinoblastoma, and wilms tumor. Protocol dosing strategies will be collected for patients less than 12 months of age and compared within individual oncologic disease states as well as between the five identified oncologic disease states. A literature review will then be conducted to evaluate evidence supporting current dosing strategies.

Results: Research in progress.

Conclusions: Research in progress.
28. Title: The prioritization of pediatrics and palliative care in cancer control plans in Africa

Authors: Meaghann S. Weaver MD,1 JJ Atteby Yao MD,2 Lorna A. Renner MD,3 Mhamed Harif MD,4 and Catherine G. Lam MD MPH*,1,5

1. Department of Oncology, St Jude Children's Research Hospital, Memphis, TN, United States
2. Pediatric Oncology Service, Hôpital de Treichville, Abidjan, Côte d'Ivoire
3. Department of Child Health, University of Ghana School of Medicine and Dentistry, Accra, Ghana
4. Centre Hospitalier Mohammed VI, Marrakech, Morocco
5. International Outreach Program, St Jude Children's Research Hospital, Memphis, TN, United States

Background: Given the burden of childhood cancer and palliative care need in Africa, this paper investigated the pediatric and palliative care elements in cancer control plans.

Methods: We conducted a comparative content analysis of accessible national cancer control plans in Africa, using a health systems perspective attentive to context, development, scope, and monitoring/evaluation. Burden estimates were derived from World Bank, World Health Organization, and Worldwide Palliative Care Alliance.

Results: Eighteen national plans and one continental plan (10 English, 9 French) were accessible, representing 9 low-income, 4 lower-middle, and 5 upper-middle-income settings. Ten plans discussed cancer control in the context of noncommunicable diseases. Pediatric cancer was prioritized in 7 national plans, representing 5127 children, or 13% of the estimated continental burden for children aged 0-14 years. Palliative care needs were recognized in 11 national plans, representing 157,490 children, or 24% of the estimated continental burden for children aged 0-14 years; four plans specified pediatric palliative needs. Palliative care was itemized in four budgets. Sample indicators and equity measures were identified, including those highlighting contextual needs for treatment access and completion.

Conclusion: Recognizing explicit strategies and funding for pediatric and palliative services may guide prioritized cancer control efforts in resource-limited settings.
29. **Title:** Healthcare Transition Readiness Through the Lens of Transitioned Young Adults with Sickle Cell Disease

**Authors:** Kimberly Wesley, Mimi Zhao, Rebecca Rupff, Jane Hankins, & Jerlym Porter St. Jude Children’s Research Hospital

**Background:** Medical advances have resulted in more adolescents and young adults (AYAs) with sickle cell disease (SCD) surviving into adulthood and requiring transfer of care from pediatric to adult care settings. The Social-ecological Model of Adolescent and Young Adult Readiness for Transition (SMART) incorporates numerous complexities surrounding the transition period, and includes pre-existing (e.g., medical status, socio-demographics) and modifiable (e.g., knowledge, skills) variables. This model has been used with pre-transition patients, though it has not been utilized with post-transition AYAs or patients diagnosed with SCD.

**Methods:** Qualitative data were collected from three focus groups. Eligible participants were AYAs with SCD aged 18-30 years. Data were transcribed, then coded independently by four staff. Conjoint coding was completed until consensus was reached. Codes were divided into categories and themes in accordance with the SMART Model.

**Results:** Nineteen AYAs participated in the focus groups (M age = 24.4 years; 67% female). Codes fell into each of the modifiable domains listed in the SMART Model. Participants identified key aspects of knowledge (e.g., disease complications), skills (e.g., pain management), beliefs/expectations (e.g., inevitability), goals (e.g., health maintenance, having insurance), relationships (e.g., gaining autonomy), psychosocial functioning (e.g., feeling scared) that are relevant to the transition process.

**Conclusions:** These results identify information that AYAs found to be useful or wish they had known prior to transitioning to adult care, and will guide the formation and modification of transition programs. These domains were consistent with those listed in the SMART Model. Additionally, incorporating the unique perspectives of AYAs with SCD is important for tailoring transition programs to their specific needs.
30. **Title:** Incentives And Technology Survey: Evaluation of HIV-Infected Adolescents and Young Adults’ Interest in Innovative Adherence Strategies

**Authors:** Mary R. Westfall, MD¹,²; Ronald H. Dallas¹; Timothy D. Minniear, MD¹,²; Aditya H. Gaur, MD¹,²; Lisa M. Ingerski, PhD³; Patricia M. Flynn, MD¹,²

¹ Department of Infectious Diseases, St. Jude Children’s Research Hospital, Memphis, TN
² Department of Pediatrics, University of Tennessee Health Sciences Center, Memphis TN
³ Department of Psychology, St. Jude Children’s Research Hospital, Memphis, TN

**Background:** HIV-infected adolescents and young adults (AYA) are at increased risk of poor antiretroviral adherence. Innovative adherence strategies like financial incentive programs (FI), real-time medication monitoring (RTMM), and text message reminders (TMRs) are available, but information about acceptability and feasibility among AYA is lacking.

**Design/Methods:** AYA (ages 16–24) attending routine HIV care visits completed an anonymous, audio computer-assisted self-interview survey.

**Results:** 99 AYA completed the survey. The median age of respondents was 21 years; 74% were male; 18% were perinatally infected. 77% of respondents were prescribed ARVs; 78% of that group reported virologic suppression.

Most respondents expressed interest in both FIs and RTMM. There were no significant differences between demographic groups. A minority of respondents were using the clinic’s available TMR system.

<table>
<thead>
<tr>
<th>Topic and Question Summary</th>
<th>n</th>
<th>Yes (%)</th>
<th>Maybe (%)</th>
<th>No (%)</th>
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</thead>
<tbody>
<tr>
<td><strong>Financial Incentives (FIs)</strong></td>
<td></td>
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<tr>
<td>Is providing incentives for medication adherence a good idea?</td>
<td>77</td>
<td>93.5%</td>
<td>NA</td>
<td>6% (5)</td>
</tr>
<tr>
<td>Would FIs improve your medication adherence?</td>
<td>77</td>
<td>83.1%</td>
<td>11.7% (9)</td>
<td>7.8% (6)</td>
</tr>
<tr>
<td>Would FIs improve your clinic attendance?</td>
<td>99</td>
<td>84.8%</td>
<td>5% (5)</td>
<td>10.1%</td>
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<tr>
<td><strong>Real-time Medication Monitoring (RTMM)</strong></td>
<td></td>
<td></td>
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<td></td>
</tr>
<tr>
<td>Would you use an RTMM?</td>
<td>99</td>
<td>93.9%</td>
<td>NA</td>
<td>6% (6)</td>
</tr>
<tr>
<td>Would you use an RTMM as part of a rewards program?</td>
<td>99</td>
<td>85.9%</td>
<td>12.1%</td>
<td>2% (2)</td>
</tr>
<tr>
<td><strong>Text Message Reminders (TMRs)</strong></td>
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<tr>
<td>Do you currently get automated TMRs from the clinic?</td>
<td>92</td>
<td>28.3%</td>
<td>NA</td>
<td>71.7%</td>
</tr>
<tr>
<td>Group receiving TMRs:</td>
<td>26</td>
<td>96.2% (25)</td>
<td>NA</td>
<td>3.8% (1)</td>
</tr>
<tr>
<td>Group not receiving TMRs:</td>
<td>66</td>
<td>42.4% (28)</td>
<td>NA</td>
<td>57.6% (38)</td>
</tr>
</tbody>
</table>

93% of respondents had a personal cell phone; 99% of those had internet access capability. Of those with phones, 92% reported daily use for phone calls and 97% reported daily text messaging and mobile internet use.

**Conclusions:** FIs and RTMM are innovative strategies that are acceptable to the majority of HIV-infected AYA surveyed. TMRs are less widely used, but were well regarded by the subset of individuals using them. Communication technology use is widespread among the surveyed population, and programs utilizing these technologies should be considered as a part of adherence-promotion strategies.
**Title:** Altered Ventricular Global Longitudinal Strain in Children with Sickle Cell Disease

**Authors:** Nicholas Whipple, MD, Vijay Joshi, MD, Ronak Naik, MD, Matthew Smeltzer, MS, PhD, Guolian Kang, PhD, Sarala Devi Govindaswamy BS, RDCS, Jola Dowdy, MS, Russell E. Ware, MD, PhD, Amber Yates, MD, Jane Hankins, MD, MS

1 Department of Hematology, St Jude Children’s Research Hospital, Memphis, TN, 2 Division of Pediatric Cardiology, Le Bonheur Children’s Hospital, Memphis, TN, 3 Department of Biostatistics, St Jude Children’s Research Hospital, Memphis, TN, 4 Cardiopulmonary Services, St Jude Children’s Research Hospital, Memphis, TN, 5 Cincinnati Children’s Hospital Medical Center, Cincinnati, OH, 6 Baylor College of Medicine and Texas Children’s Hematology Center, Houston, TX

**Background:** Patients with sickle cell disease (SCD) have increased risk of cardiopulmonary disease with subsequent higher morbidity and premature mortality. Decreased myocardial deformability (smaller absolute global longitudinal strain), is an early sign of myocardial dysfunction and may result from elevated pulmonary pressure or diastolic dysfunction. Few studies have investigated right and left ventricular global longitudinal strain (RVGLS and LVGLS) among children with SCD; none has investigated the role of disease-modifying therapies (hydroxyurea, chronic transfusions) on strain.

**Methods:** Prospective measurement of RVGLS and LVGLS by speckle-tracking echocardiography in children with Hb-SS and HbSβthalassemia ages 5-19 performed with central reading by one single cardiologist. Biomarkers of hemolysis were obtained concurrently. Objectives included: 1) compare RVGLS and LVGLS in pediatric SCD with published normal reference values 2) investigate the association of disease-modifying therapies and global longitudinal strain, 3) investigate the relationship between hemoglobin, lactate dehydrogenase, tricuspid regurgitation velocity (TRV), and global longitudinal strain.

**Results:** RVGLS was significantly reduced in children with SCD, but LVGLS was not. Among children with SCD, 88% and 37% had absolute RVGLS and LVGLS values below the mean for normal children, respectively. RVGLS significantly decreased with age. No association was observed between RVGLS, disease-modifying therapies, hemoglobin, lactate dehydrogenase, or TRV.

**Conclusions:** Right ventricular deformability is decreased in children with SCD, is independent from TRV elevation, and may represent an early marker of pathologic cardiac change. Although no difference was observed in patients receiving disease-modifying therapies, longitudinal data are needed to determine their role in preventing deterioration of RVGLS.
4th Annual Clinical Fellow Research Symposium
February 25th, 2015

Award Recipients

Speakers
- Cristyn Branstetter, Pediatric Hematology-Oncology
- Matt Ehrhardt, Survivorship
- Seth Karol, Pediatric Hematology-Oncology
- Yuko Okado, Psychology

1st Place Posters
- Nickhill Bhakta, Pediatric Hematology-Oncology
- Daliya Khuon, Pediatric Infectious Diseases

2nd Place Posters
- Mohammad Mhaissen, Pediatric Infectious Diseases
- Anna Sitthi-amorn, Bone Marrow Transplant & Cellular Therapy
- Nicholas Whipple, Pediatric Hematology-Oncology

Peer Choice
- Thomas Alexander, Pediatric Hematology-Oncology
THANK YOU TO THE POSTER SESSION JUDGES!!!!

Greg Armstrong MD MPH       Epidemiology and Cancer Control
Sandra Arnold MD MPH         UT Infectious Diseases
Wassim Chemaitilly MD       Pediatric Medicine, Endocrinology
Andrew Davidoff MD          Surgery
Sara Federico MD            Oncology
Wayne Furman MD             Oncology
Bill Green PharmD           Pharmaceutical Sciences
Chris Hartford MD           BMTCT
Mark Hatley MD, PhD         Oncology
Randy Hayden MD             Pathology
Jeff Klco MD, PhD           Pathology
Kevin Krull PhD             Epidemiology and Cancer Control
Belinda Mandrell BScN, PhD  Nursing Research
Ray Morrison MD             Pediatric Medicine, Critical Care-Pulmonary
Kim Nichols MD              Oncology
Jerlym Porter PhD           Psychology
Ulrike Reiss MD             Hematology
Raul Ribeiro MD             Oncology
Dave Shook MD               BMTCT
Jane Schreiber PhD          Psychology
Beth Stewart MD             Oncology
Linda Stork MD              Hematology/Oncology
Win Wang MD                 Hematology
Josh Wolf MBBS              Infectious Diseases
Resources

Making the Right Moves: Howard Hughes Medical Institute
A Practical Guide to Scientific Management for Postdocs and New Faculty
http://www.hhmi.org/programs/resources-early-career-scientist-development/making-right-moves

Characteristics of Successful and Failed Mentoring Relationships
Melanie Wass
https://www.youtube.com/watch?v=7NG-YGGFWow
Sharon Straus

Mentoring in pediatric oncology: a report from the Children's Oncology Group Young Investigator Committee

ASPHO Career Guide
http://aspho.org/career-development/overview

<table>
<thead>
<tr>
<th>Fellow</th>
<th>Early Career</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mentee</td>
<td>Find local faculty to guide career choices</td>
</tr>
<tr>
<td></td>
<td>Find local/national mentors - work-life, academic issues</td>
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<td>Learn to be a pro-active mentee</td>
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<td>Meet to identify research, leadership opportunities</td>
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<tr>
<td>Mentor</td>
<td>Advise med students, peers</td>
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<td>Mentor med students, residents, fellows, peers</td>
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<td></td>
<td>Learn to give and take advice</td>
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<tr>
<td></td>
<td>Take training classes in mentorship</td>
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<tr>
<td>Networking</td>
<td>Connect at meetings</td>
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<td>Network to find new collaborators and mentors</td>
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</tbody>
</table>