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v 89.3%; p = 0.2), and history of one or more mammograms (93.5% *v* 91.7%; p = 0.51); Males–regular testicular cancer screening (17.6% *v* 20.4; p = 0.5) in the past 2 years.

Conclusions: HCT-survivors had similar cancer screening practices when compared to healthy sibling controls. The current study found that despite potential long-term risks, survivors continue to engage in high-risk behaviors such as smoking and excessive alcohol intake, indicating the need for targeted interventions in the high-risk populations.

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PREGNANCY AFTER HEMATOPOIETIC-CELL TRANSPLANTATION: A REPORT FROM THE LATE EFFECTS COMMITTEE OF THE CENTER FOR INTERNATIONAL BLOOD AND MARROW TRANSPLANT RESEARCH

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Preservation of fertility and the ability to bear children after HCT can be an important positive influence on the quality of life of young transplant survivors. We describe 182 pregnancies that were reported to the CIBMTR between 2002 and 2007 among female HCT recipients (N = 84) or partners of male HCT recipients (N = 98). Transplant types included autologous (auto) HCT (20 women, 13 men), myeloablative (MA) allogeneic (allo) HCT (50 women, 80 men) and non-myeloablative (NMA) allo HCT (14 women, 5 men). Age at HCT was <10 years for 6% women and 4% men and 10-19 years for 44% women and 16% men. HCT was performed for a non-malignant disorder in 58% women and 31% men. Conditioning regimen used total body irradiation (TBI) in 16% women and 20% men. Bu-Cy conditioning was used in 6% women and 40% men. Six women and 6 men had received two transplants before pregnancy. Fifteen men reported the use of cryopreserved sperm to facilitate pregnancy. Among 35 women who received HCT for a malignant disorder, 4 had relapsed between HCT and pregnancy; one was in remission and 3 had persistent disease at time of pregnancy (Hodgkin's lymphoma, myeloma and solid cancer). Among 66 men with malignant disorders, 12 had relapsed between HCT and pregnancy; of these 10 achieved a subsequent remission and were disease free at the time of pregnancy. In summary, some HCT recipients can retain their fertility, including patients who have received myeloablative TBI based conditioning and recipients of more than one HCT. Appropriate patients should be counseled about fertility issues both before and after HCT. Outcomes of pregnancy after HCT need prospective evaluation.

Pregnancy after HCT

Variable	Women			Men		
	Auto	MA allo	NMA allo	Auto	MA allo	NMA allo
N	20	54	10	13	81	3
Median age at HCT, range (yrs)	22 (16-33)	18 (5-45)	24 (12-33)	28 (20-40)	24 (1-53)	34 (25-49)
Median age at pregnancy, range (yrs)	28 (18-40)	28 (15-50)	26 (18-37)	32 (23-48)	31 (11-55)	35 (32-51)
Time b/w HCT and pregnancy						
≤5 years	7 (35%)	15 (28%)	8 (80%)	4 (31%)	25 (31%)	3 (100%)
>5 years	13 (65%)	39 (72%)	2 (20%)	9 (69%)	56 (69%)	0
TBI in conditioning	0	10 (19%)	2 (20%)	1 (8%)	18 (22%)	1 (33%)
Median TBI dose (cGy)	-	1200	200	1320	1200	200
Chronic GVHD	-	12 (22%)	3 (30%)	-	39 (48%)	2 (67%)
Received 2nd HCT*	0	4 (8%)	2 (14%)	2 (15%)	3 (4%)	1 (33%)
Median followup of survivors	9 yrs	11 yrs	4 yrs	8 yrs	11 yrs	3 yrs

*Two patients received three HCT's.

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SECOND SOLID CANCERS AFTER ALLOGENEIC HEMATOPOIETIC-CELL TRANSPLANTATION USING BUSULFAN-CYCLOPHOSPHAMIDE CONDITIONING

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Survivors of allogeneic hematopoietic-cell transplantation (allo HCT) who receive total body irradiation based conditioning have 2 to 3 folds increased risks of developing second solid cancers compared to the general population (Rizzo et al, Blood 2009). We evaluated the risks of second solid cancers (excluding skin squamous and basal cell cancers) in a population of allo HCT recipients who had received chemotherapy based conditioning. Our study cohort consisted of 4349 pediatric and adult recipients of allo HCT using busulfan-cyclophosphamide (Bu-Cy) conditioning from 1986-2005 for acute myeloid leukemia in first complete remission (AML CR1) or chronic myeloid leukemia in first chronic phase (CML CP1). Patients with therapy related AML were excluded. The median followup of survivors was 8.2 years; 47% had survived >5 years and 18% had survived >10 years after HCT. Our cohort represented 22,269 person-years at risk. For the whole cohort, 79% received HCT from HLA identical siblings and 84% had bone marrow as graft source. Median age at HCT was 29 years for AML and 36 years for CML. Acute (grade 2-4) and chronic graft-versus-host disease (GVHD) occurred in 34% and 33% of AML patients and 42% and 46% of CML patients, respectively. Sixty-six solid cancers were reported; the cumulative incidence of solid cancers at 3, 5 and 10 years after HCT was 0.7%, 0.9% and 2.0% for AML patients and 0.5%, 1.1% and 3.4% for CML patients. The overall rate of solid cancers among HCT recipients was significantly higher than the expected general population rates (observed to expected ratio [O/E] 1.4; 95% confidence intervals 1.1-1.8). Significantly elevated risks were observed for tumors of the lip (O/E 25.7), tongue (O/E 9.1), mouth (O/E 7.2), esophagus (O/E 10.3), lung (O/E 2.6), soft tissue (O/E 7.1) and brain (O/E 4.7). On Cox-regression analysis, older age at HCT, chronic GVHD and use of peripheral blood as graft source increased the risks of solid cancers while use of methotrexate (MTX) and cyclosporine (CSA) for GVHD prophylaxis (vs. T-cell depletion) decreased the risks of solid cancers (Table). Recipients of allo HCT for AML CR1 and CML CP1 using Bu-Cy conditioning are at risk of developing solid cancers,

especially those with older age, chronic GVHD and recipients of peripheral blood grafts. The incidence for solid cancers continues to increase with time and life-long cancer surveillance is warranted in this population.

Risk factors for solid cancers

Risk factor	RR (95%CI)
Age (years)	
<20	1.0
20-40	2.4 (0.7-8.1)
>40	6.2 (1.9-20.4)**
Chronic GVHD	
No	1.0
Yes	2.6 (1.5-4.6)**
Graft type	
Bone marrow	1.0
Peripheral blood	2.5 (1.3-4.5)**
GVHD prophylaxis	
T-cell depletion (ex-vivo)	1.0
ATG/campath	0.5 (0.1-2.4)
MTX + CSA	0.3 (0.1-0.9)*

*P < 0.05, **P < 0.01.

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A NEW MEASURE OF SYMPTOM BURDEN IN CHRONIC GRAFT-VERSUS-HOST DISEASE

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Significance: Chronic graft-versus-host disease (cGVHD) can cause debilitating symptoms after allogeneic hematopoietic stem cell transplantation (alloHSCT). A major barrier to effective treatment of the symptom burden of cGVHD is inadequate assessment.

Problem and Purpose: The symptom burden of cGVHD cannot be effectively assessed for research and clinical management without a psychometrically sound, easily administered measure. The purpose of this research was to develop a valid, reliable, and sensitive measure of cGVHD symptom burden, based on the M. D. Anderson Symptom Inventory (core MDASI).

Methods: 116 patients with cGVHD and 58 patients without cGVHD >3 months after alloHSCT completed the 13 symptom severity and 6 interference items of the core MDASI and 14 additional cGVHD-specific symptom items, generated from patient interviews and expert panel ratings. Severity and interference were measured on a 0-10 scale, with 0 meaning none and 10 meaning the worst imaginable. Patients with cGHVD answered a single quality-of-life question and 3 days later repeated the symptom burden assessment. Demographic and disease information was collected on all patients. Psychometric techniques reduced the number of symptom items and examined the reliability, validity, and sensitivity of the MDASI for cGVHD (MDASI-GVH).

Results: Sample demographics, disease characteristics, and symptom severity and interference are shown in Table 1. Five new cGVHD-related items (see Table 1) were found to be clinically significant and were retained in the MDASI-GVH. The reliability index (Cronbach alpha) and test-retest reliability of all 18 symptom items were 0.90 and 0.82 respectively and of the 6 interference items were 0.91 and 0.75 respectively. Factor analysis showed the cGVHD-related symptom items to be a unique factor. The MDASI-GVH was sensitive to the presence of cGHVD, was able to discriminate between patients with good and poor performance status, and was significantly correlated with patient report of overall quality of life. Symptom severity explained 77.2% of the variance in interference, with the core symptoms explaining 76.1% and the cGVHD-related symptoms explaining 55.9%.

Table 1. Sample Characteristics and Symptom Burden Means

	cGVHD (N = 116)	No cGVHD (N = 58)	
	Mean (SD)	**Mean (SD)**	**P**
Age in yrs	49.7 (12.33)	50.6 (15.32)	0.700
Education in yrs	14.7 (1.85)	14.4 (1.97)	0.340
All symptom items	2.65 (1.69)	1.67 (1.46)	<0.0001*
Core symptom items	2.34 (1.73)	1.77 (1.62)	0.040*
cGVHD symptom items	3.46 (2.08)	1.39 (1.44)	<0.0001*
Muscle weakness	3.92 (2.74)	1.57 (1.98)	<0.0001*
Changes in sexual function	3.70 (3.69)	1.57 (2.70)	<0.0001*
Skin problems	3.37 (2.99)	0.83 (1.58)	<0.0001*
Eye problems	3.31 (3.09)	1.22 (2.52)	<0.0001*
Joint stiffness of soreness	3.06 (3.20)	1.74 (@.32)	0.006*
Interference items	3.05 (2.37)	2.38 (2.38)	0.080
	Number (%)	**Number (%)**	
Gender			0.023*
Male	73 (62.9)	26 (44.8)	
Female	43 (37.1)	32 (55.2)	
Race/Ethnicity			0.472
Black/Hispanic	21 (18.1)	8 (13.8)	
White	95 (81.9)	50 (86.2)	
Employment Status			0.433
Employed	48 (41.4)	27 (46.6)	
Unemployed	68 (58.6)	31 (53.4)	
Marital Status			0.356
Married	82 (70.7)	37 (63.8)	
Single	34 (29.3)	21 (36.2)	
Performance Status			0.297
Good (0-1)	77 (66.4)	43 (74.1)	
Poor (2-4)	39 (33.6)	15 (25.9)	
Underlying Disease			0.652
Leukemia	72 (62.1)	38 (65.5)	
Lymphoma	33 (28.4)	13 (22.4)	
Other	11 (9.5)	7 (12.1)	
Donor			0.024*
Related	71 (61.2)	25 (43.1)	
Unrelated	45 (38.8)	33 (59.9)	
Type of Cells			0.249
Peripheral Stem Cells	83 (71.6)	45 (77.6)	
Bone Marrow	29 (25.0)	9 (15.5)	
Cord Blood	4 (3.4)	4 (6.8)	
Occurrence of Acute GVHD			<0.0001*
Yes	77 (66.4)	13 (22.4)	
No	39 (33.6)	45 (77.6)	

*significant at <0.05 level N=number of subjects P=probability SD=standard deviation.

Implications: We have validated a new analytic tool, the MDASI-GVH, for quantifying symptom burden produced by cGVHD. The MDASI-GVH has the potential to be utilized for quantitatively assessing response in cGVHD treatment trials and monitoring the course of cGVHD in clinical care.

LEUKEMIA

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EXTRAMEDULLARY RELAPSE IN ACUTE LEUKEMIA FOLLOWING ALLOGENEIC HEMATOPOIETIC STEM CELL TRANSPLANTATION: INCIDENCE, RISK FACTORS AND OUTCOMES

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Extramedullary (EM) relapse after allogeneic hematopoietic cell transplantation (HCT) for acute leukemia has not been extensively studied. Therefore, we analyzed 365 consecutive patients (pts) who