

2013

# Comparison of the approval process between private and public payers in hematopoietic stem cell transplantation

---

<https://hdl.handle.net/2144/12053>

*"Downloaded from OpenBU. Boston University's institutional repository."*

BOSTON UNIVERSITY  
SCHOOL OF MEDICINE

Thesis

**COMPARISON OF THE APPROVAL PROCESS BETWEEN PRIVATE AND  
PUBLIC PAYERS IN HEMATOPOIETIC STEM CELL TRANSPLANTATION**

by

**STEPHANIE A. BENNINGTON**

B.S., University of Nebraska-Lincoln, 2011

Submitted in partial fulfillment of the  
requirements for the degree of

Master of Arts

2013

Approved by

First Reader

---

Theresa A. Davies, Ph.D.  
Director, M.S. in Oral Health Sciences Program  
Adjunct Assistant Professor of Biochemistry

Second Reader

---

Fausto R. Loberiza Jr., M.D., M.S.  
Professor of Hematology/Oncology  
University of Nebraska Medical Center

## **DEDICATION**

For my Mother, Carolyn

## **ACKNOWLEDGEMENTS**

I would like to thank some wonderful people for helping me complete this thesis. First, I thank Dr. Fausto Loberiza for taking me in as his mentee and helping me through every step of this process. I also want to thank him for helping me learn how to write in a scientific manner and for being so patient during this learning process. I would not have been able to complete this thesis without his guidance and support. Second, I want to thank Dr. Julie Vose for allowing me to assist in her lymphoma research. The amount of knowledge I acquired the past six months is something I will never forget. Last, and certainly not least, I would like to thank Dr. Theresa Davies for her help and guidance throughout the thesis and writing process. Without her, I would have been lost, especially since I completed this in a different state. This thesis came together because of her continuous help. I thank you all from the bottom of my heart.

# COMPARISON OF THE APPROVAL PROCESS BETWEEN PRIVATE AND PUBLIC PAYERS IN HEMATOPOIETIC STEM CELL TRANSPLANTATION

STEPHANIE A. BENNINGTON

Boston University School of Medicine, 2013

Major Professor: Theresa A. Davies, Ph.D., Director, M.S. in Oral Health Sciences Program and Adjunct Assistant Professor of Biochemistry

## ABSTRACT

**Objectives:** The increased use of hematopoietic stem cell transplant (HSCT) for its potentially curative properties has led to studies examining the quality of care that is currently received. More specifically, research examining the timeliness aspect of quality of care is being addressed. This study was therefore designed to examine timeliness of obtaining HSCT on two levels, the approval time period, and the time it takes to receive the transplant, based off of payer type.

**Methods:** University of Nebraska Medical Center (UNMC) patients recommended for a HSCT were analyzed according to payer type (private vs. Medicare/Medicare) between the years of 2007 and 2011. Within this time period, 1389 patients were recommended for a HSCT. This sample size was divided into two cohorts of patients: not-transplanted and transplanted. Of these patients, 559 received the transplant. For statistical analysis purposes of this

study, we used data from the patients that had the procedure and had it funded by either a public payer (Medicare/Medicaid) or private payer. It was found that 421 of these patients that were transplanted were covered by private insurance while 97 were on Medicare/Medicaid. We compared the patient-, disease-, and transplant-related characteristics according to payer. Univariate analyses were completed using Wilcoxon and Chi-square tests, while multivariate analyses were performed using multiple linear regression analysis.

**Results:** Delays are currently seen during the approval process and the waiting period for receiving a HSCT, depending on the type of payer. It was found that patients who used public payers have a shorter time getting approved for the transplant; however, this group also took more time to receive transplant from the time of approval when compared to patients who used private payers. Other factors found to have a statistically significant association with timeliness of transplant included place of residence (urban vs. rural) and year of transplant.

**Conclusion:** This study highlights areas in the process of receiving a HSCT that currently need changes. Differences in both the time to approval process and the time to receive the transplant depending on the payer type were observed. These disparities in the timeliness of receiving a potentially life-saving procedure suggest disparity in quality of care received, according to health care payer. System changes from the payer and the hospital to improve or eliminate the delays is recommended.

## TABLE OF CONTENTS

Title	i
Reader's Approval Page	ii
Dedication Page	iii
Acknowledgements	iv
Abstract	v
Table of Contents	vii
List of Tables	ix
List of Figures	x
List of Abbreviations	xi
Introduction	1
Hematopoietic Stem Cell Transplantation	1
Timeliness of HSCT as Indicator for Quality of Care	5
Objectives	8
Methods	10
Data Source	10
Patients	11
Variables Evaluated	12
Study Endpoints Evaluated	12
Statistical Analysis	13
Results	15

Summary of Patients Evaluated	15
Characteristics of HSCT Patients According to Payer	18
Indices of Timeliness of HSCT	21
Multivariate Analysis	24
Discussion	27
Not-transplanted Cohort	27
High Percentage of Uninsured Patients in the United States	29
Medicare/Medicaid Delay	31
Private Payer Approval	33
Fixing Healthcare Delays	35
Strengths and Limitations to Current Study	35
Future Research and Recommendations	37
References	39
Vita	43

## LIST OF TABLES

Table	Title	Page
1	Patient Characteristics According to Payers	19
2	Multivariate Analysis	26

## LIST OF FIGURES

Figure	Title	Page
1	Schema for Subject Selection in Payer Process for HSCT	17
2	Time from Initiation of Payer Approval to Actual Approval by Payer Type	22
3	Time from Approval to Transplant by Payer Type	23

## ABBREVIATIONS

Allo-HSCT	Allogeneic Hematopoietic Stem Cell Transplantation
BCBS	BlueCross BlueShield
CIBMTR	Center for International Blood and Marrow Transplant Registry
CR1	First Complete Remission
CR2+	Second Complete Remission
GVHD	Graft-versus-Host Disease
HD	Hodgkin's Disease
HLA	Human Leukocyte Antigen
HSCT	Hematopoietic Stem Cell Transplantation
IOM	Institute of Medicine
IRB	Institutional Review Board
MDS	Myelodysplastic Syndromes
MM	Multiple Myeloma
NHL	Non-Hodgkin's Lymphoma
NMDP	National Marrow Donor Program
PIF	Primary Induction Failure
REL	Relapse
RUCA	Rural Urban Commuting Area Codes
SES	Socio-economic Status
TBI	Total Body Irradiation
UNMC	University of Nebraska Medical Center

## **INTRODUCTION**

### **Hematopoietic Stem Cell Transplantation**

Hematopoietic stem cell transplantation (HSCT) offers the best curative method for certain types of cancers involving blood and bone marrow (Gratwohl et al., 2010). It was first introduced over fifty years ago and is now widely used today, allowing patients the greatest chance of cancer-free, long-term survival (Copelan, 2006). However, HSCT is a high risk and life-threatening procedure. It involves transplanting stem cells into the body to specialize into the necessary cells of the hematopoietic system. The hematopoietic stem cells used in this type of transplant are cells that are isolated from blood, bone marrow or umbilical cord blood and have the capability of maturing and/or differentiating into different cells of the hematopoietic system (Copelan, 2006). This process is usually completed after an individual has completed high dose chemotherapy, with or without radiation, to destroy all circulating malignant, as well as healthy hematopoietic cells. It is expected that the newly introduced stem cells will replenish the individual's hematopoietic system thus rendering them cancer-free (NCI, 2010).

One of the major benefits of receiving this type of transplant is that it allows the patient to undergo more intense chemotherapy or radiation treatments. An individual's bone marrow has a limit before it is permanently damaged by the cancer treatments. By having this transplant as a treatment option, physicians are less limited in the intensity of the chemotherapy and

radiation treatments which allows for greater success in destroying the cancer causing cells (NCI, 2010; Perumbeti, 2012).

Because HSCT is a high-risk procedure in all stages of the transplant (pre-, peri-, short-term post-, and long-term post), in order to achieve successful results, many crucial steps are performed prior to the actual transplant. The type of HSCT that the patient will receive needs to be firstly established. There are generally two types of HSCT used in today's hospitals: autologous and allogeneic transplantation (Copelan, 2006). An autologous transplant uses one's own stem cells. Cells are extracted from the patient prior to the high intensity chemotherapy and/or radiation and then transplanted. This may not always be the best option due to the possibility of re-introducing cancer causing stem cells back into the body; however, it poses less threat of graft rejection since the cells introduced are not foreign stem cells (ACS, 2012).

An allogeneic stem cell transplant involves transplanting matching donor cells with the recipient cell. Donors can be related or unrelated to the recipient. Because the potential for rejection and post-transplant complications is higher for this type of transplant, patients must be healthy enough to undergo this type of treatment (NIH, 2011). Thus, highly medically co-morbid and elderly patients are generally not recommended for this type of HSCT. The next crucial process once allo-HSCT is considered is finding the right donor. Usually siblings are first matched against the patient's human leukocyte antigen (HLA) and followed by non-relatives when a sibling match is not found (Dzierzak-Mietla et al., 2012).

Finding a donor can be a timely process if a sibling donor is not available. According to the aplastic anemia and myelodysplastic syndromes (MDS) foundation (AAMDS, 2012), only about 3 in 10 people find a matched related donor. If no related donor is available, it can take a considerable amount of time to find a matched unrelated donor. To find a matched unrelated donor in the United States, the patient's human leukocyte antigen (HLA) profile is compared against registries such as the National Marrow Donor Program (NMDP), to check for any suitable matches (NCI, 2010). This process can take an average of three months, but in some instances can take up to a year. In the end, some patients may receive the transplant from a donor that only partially matches their HLA profile, presenting a greater possibility of rejection (NMDP, 2013).

During a HSCT, stem cells are administered usually in the form of an intravenous line lasting approximately an hour. This procedure usually causes no pain. The cells, after infusion, are expected to make their way to the bone marrow to begin reestablishing normal production of blood cells, also known as engraftment. Until normal levels of white blood cells, red blood cells and platelets are found within the body, the patient is generally required to stay in the hospital. Growth factors may be used to enhance this process if any delay is expected or seen (Copelan, 2006). This step can be an uneventful process or the persistence of non-engraftment could cause death. Patients are kept in the restricted hospital environment for usually two to four weeks to prevent contracting opportunistic infections since the immune system is compromised at this point. The

immunocompromised state of the patient renders them vulnerable to multiple complications (Spitzer, 2001).

There are numerous side effects or complications from the treatments involved in HSCT. For example, there are numerous side effects initially that are associated with the administration of chemotherapy/radiation including nausea, vomiting, mucositis, loss of hair, infertility, organ toxicity and secondary cancers, to name a few (Spitzer, 2001). There are also numerous possible complications with the transplant itself. For example, graft-versus-host disease (GVHD) occurs in 10-50% of patients post allogeneic HSCT (NIH, 2011). This involves the donor cells attacking the cells and organs of the patient. Due to this being the greatest threat involved in allogeneic HSCT, medications are given to help prevent this from happening. GVHD is not a threat in autologous HSCT since donor cells are not used. Any of these above medical events can cause treatment failure and/or death with HSCT (Andre-Schmutz, 2002).

Post-transplantation, patients are admitted on the average of three weeks depending on the complications. Patients are generally followed weekly up to 100 days and gradually spreading out to every two weeks, then once a month for one year. During the post-transplantation period, patients can remain disease free, develop further complications, progress or relapse, or die (NIH, 2011).

## **Timeliness of HSCT as Indicator for Quality of Care**

As described above, HSCT can be a prolonged process and usually starts from carefully examining the type of patients who may benefit from it. It is also a very expensive procedure that can cost up to \$102,574 (Saito et al., 2008). Because of the prohibitive cost of the procedure, not only is patient selection tedious, but also the payer's prior approval is required. The payer approval process involves a series of communication between the medical team and the payer and usually entails a significant amount of paperwork. Typically, a patient being considered for HSCT is referred to a transplant physician by a hematologist/oncologist. An initial physician visit and pre-transplant testing ensues and would determine if the HSCT is indeed recommended. This process involves analyzing previous medical records, obtaining an accurate medical history, and undergoing a comprehensive medical physical exam. The pre-transplant testing also involves numerous tests to assess the status of the patient's disease and to make certain that the patient would in fact benefit from a HSCT. The information obtained from the initial visit and the pre-transplant testing is generally enough to allow the insurance company to make an approval decision. If the patient is deemed a good candidate for a transplant, the necessary paperwork is sent to the insurance company with the recommendation that the patient should be approved for a transplant (NMFF, 2013). To date, it is not known how lengthy is the waiting period from initiation of payer approval to obtaining payer approval and to the actual performance of the HSCT. The

expectation is that this time frame is rather quick since the need for HSCT may be time-sensitive. This time frame is referred to as 'timeliness' of care. Timeliness is defined as the ability to obtain necessary care, and minimizing avoidable delays to obtaining the care (Envisioning the National Health Care Report, 2001). Timeliness is also a measure of the quality of care a patient receives. The issue of timeliness is a critical component to care, especially for patients being treated for cancer. Payers can potentially play a major role in determining the timeliness of care. The Institute of Medicine (IOM) Committee on the Quality of Health Care in America considers timeliness to be one of four categories for measuring quality of care, with the other three being safety, effectiveness, and patient centeredness (Envisioning the National Health Care Report, 2001). The IOM further describes timeliness as

“composed of three points: 1) Access to the system of care, 2) Timeliness in getting to care for a particular problem, and 3) Timeliness within and across episodes of care” (Envisioning the National Health Care Report, 2001).

Studies have shown various factors determine one's ability to access the system of care. These factors included: age, sex, race/ethnicity, and socio-economic status (SES) (Ward et al., 2008; Hwang et al., 2004; Li et al., 2003; Majhail et al., 2010; Mandelblatt et al., 1999; Bradley et al., 2011; Penson et al., 2001; Halpern et al., 2008; Khera et al., 2011; Bryce et al., 2010; Gornick, 1999; & Carlisle et al., 1997). Other studies also indicate, even among individuals who have access to health care, the many issues involved in obtaining the

appropriate care needed depending on their medical payer type (Ayanian et al., 1993; Ward et al., 2008; Kwok et al., 2010; Chen et al., 2007; Mandelblatt et al., 1999; Khera et al., 2012; Bradley et al., 2012; Penson et al., 2001; Halpern et al., 2008; Harlan et al., 2005; Schweitzer et al., 2003; Bryce et al., 2010; Laurentine et al., 2010; & Carlisle et al., 1997). This has also been shown to have affected clinical outcomes, including among cohort who underwent HSCT (Ayanian et al., 1993; Ward et al., 2008; Kwok et al., 2010; & Li et al., 2003). This study was therefore designed to describe the timeliness of HSCT according to payer in a cohort of patients with hematologic malignancies being evaluated for possible HSCT. Additionally, we sought to determine if patient-, disease- and treatment factors affect timeliness of HSCT. By gaining more knowledge about timeliness in receiving HSCT, we are identifying areas where delays can be avoided and thus providing patients better quality of healthcare.

## OBJECTIVES

Today, it is established that every patient deserves the best quality of care, regardless of the patient's individual characteristics. However, research has shown that many variables can affect the quality of care received by specifically affecting the timeliness. Studies have provided adequate evidence showing that payer type can impact the quality of care and clinical outcomes (Ayanian et al., 1993; Ward et al., 2008; Kwok et al., 2010; Chen et al., 2007; Mandelblatt et al., 1999; Khera et al., 2012; Bradley et al., 2012; Penson et al., 2001; Halpern et al., 2008; Harlan et al., 2005; Schweitzer et al., 2003; Bryce et al., 2010; Laurentine et al., 2010; & Carlisle et al., 1997). However, in HSCT, the association between timeliness of receiving HSCT according to payer type is unknown. Examining this issue allows for better understanding of the role payers have in potentially causing a delay in an individual's ability to receive HSCT. Additionally, this study will identify factors that may be associated with such delay.

This study has the following three objectives:

- 1) To compare the patient-, disease-, and transplant-related characteristics of HSCT patients with hematological malignancies according to the type of healthcare payers (private payer versus public payer - Medicare/Medicaid).

- 2) To compare time from initiation of payer approval to actual payer approval according to healthcare payer while adjusting for patient-, disease-, and transplant-related factors.
- 3) To compare time from payer approval to performance of HSCT according to type of healthcare payer while adjusting for patient-, disease-, and transplant-related factors.

The findings of the study should guide transplant programs and payers in designing a system that better guarantees efficient delivery of HSCT among patients with hematological malignancies.

## **METHODS**

### **Data Source**

Two databases were used in this study: 1) the stem cell transplant database, and 2) the transplant insurance database. Both databases are housed in a web-based secure password-protected, Oracle-based database, known as ONCOBASE. The stem cell transplant database started in the early 1980s when the University of Nebraska Medical Center (UNMC), located in Omaha, Nebraska, began performing HSCT. To date, this database contains detailed information on all patients who have undergone HSCT at UNMC. The database contains detailed patient-, disease-, and treatment-related variables, as well as systematic evaluations of clinical outcomes of patients after HSCT. These evaluations include post-transplant complications, disease reoccurrence, progression, and survival status of the patients which are ascertained on all patients at least once a year. The evaluation information is collected annually on the patient anniversary date by trained clinical research associates. This same data are also reported to the Center for International Blood and Marrow Transplant Registry (CIBMTR). All patients who are kept in this database signed informed consent releases allowing their information to be collected and added to the database. The transplant insurance database is a separate database that UNMC maintains on all patients referred for possible HSCT. Information on patient's insurance or payer coverage and status are gathered and entered in the

database at the time a patient is referred to the hematology/oncology service for evaluation of possible transplant. The database is maintained by one nurse coordinator who tracks all significant events as the patient gets further evaluation. It also contains all pertinent communication between UNMC and the insurance/payer as it relates to all aspects of the payer approval process. Entry on every patient evaluated for possible transplant is maintained and updated systematically. Patient and clinical information on patients who did not undergo transplant are not collected but minimal information regarding insurance/payer information is kept, including reason for not proceeding to transplant. This study has been reviewed and approved by the Institutional Review Board (IRB) at UNMC.

## **Patients**

The study included two population sets. The first set included all patients who were seen at UNMC between the years 2007 and 2011 for evaluation of possible HSCT for any malignant and non-malignant disease. This set of patients was used to evaluate the proportions of patients who undergo transplant from an unbiased pool of patients referred for possible HSCT. This population was also used to evaluate the reasons why patients did not proceed to HSCT. A second population set, a subset of patients from the above population who underwent HSCT, was used to compare the timeliness of HSCT according to insurance/payer type. Since we do not collect detailed information on the patients

who did not proceed to HSCT, only those in the second cohort are described in detail in this study.

### **Variables Evaluated**

The primary variable evaluated in our study was the type of healthcare payer the patients used for the funding of their HSCT. We compared the patient-, disease-, and transplant-related characteristics according to payer: private insurance or public payer (Medicare/Medicaid). Evaluation according to individual type of private insurers was not performed. The following variables were compared according to healthcare payer: age, sex, race, median household income (based on residential ZIP code), location of residence (based on the Rural Urban Commuting Area Codes (RUCA)), HCT-Co-morbidity Index, transplant type, disease type, disease stage at transplant, year of transplant, and the use of total body irradiation (TBI) as part of the conditioning regimen.

### **Study Endpoints Evaluated**

The outcome of interest in this study is timeliness of care. Timeliness of care was operationally defined in this study using two time points. First, is the time frame to payer approval defined as time from initiation of payer approval to receipt of actual approval in days. Initiation of payer approval was abstracted from the transplant insurance database as the time the UNMC coordinator submitted the necessary forms to the payer and an acknowledgement of receipt

was made by the payer. The second endpoint is time of payer approval to actual transplant, also measured in days.

### **Statistical Analysis**

Proportion of patients who proceeded to transplant and those who did not were expressed in percentages. Proportion of patients who did not proceed to transplant were also determined according to reasons and expressed in percentages. Patient-, disease- and transplant-related characteristics were described in median and range for continuous variables and percentages for categorical variables. Univariate comparisons of the characteristics of the patients who proceeded to transplant according to type of payer (private versus public) were performed using Wilcoxon test for continuous data and Chi-square test for categorical data. Multivariate analysis was performed using linear regression model. Separate model building was performed for the two time points of the study endpoint; that is time to payer approval and time from approval to transplant. In the model building, the covariate for payer type (private versus public) was held in all model building. All covariates listed in Table 1 were entered one at a time. Only covariates with a p-value of 0.05 were retained in the final model. As shown in Table 2, three separate multivariate analyses were performed to test for consistency of the results: 1) first model utilized all patients who proceeded to transplant, 2) second model consisted only of patients with lymphoma who received autologous transplants, and 3) third model consisted of

only patients with multiple myeloma who received autologous transplant. No models on patients receiving allogeneic transplant was performed since they were too few in number.

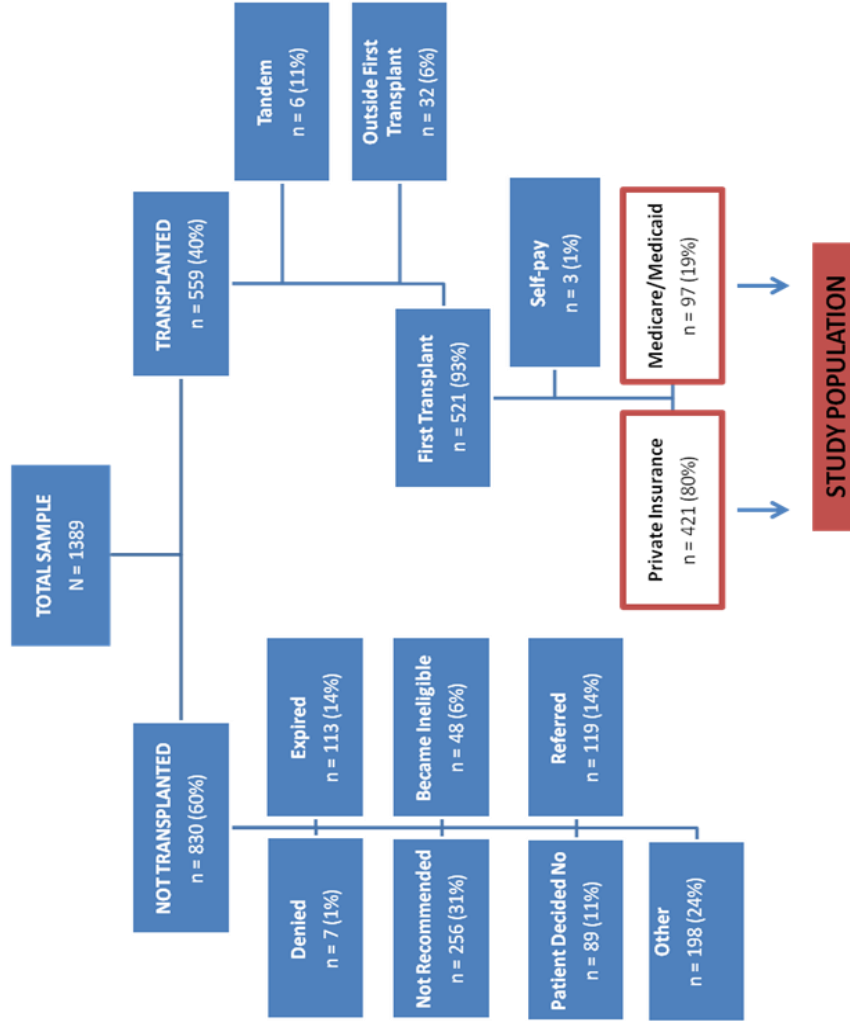
## RESULTS

### Summary of Patients Evaluated

Figure 1 shows how the overall population was evaluated in the study. This population represents all the patients that were referred to the transplant program at UNMC from the years 2007 to 2011. Within the five year study period, a total of 1389 were evaluated for possible HSCT. Of these, 830 (60%) patients did not proceed to HSCT. Reasons for not proceeding to HSCT as noted from the remarks in the insurance database included the following: 1) HSCT plan was denied by payer and no alternative payer was available; 2) patient expired during the time period of being evaluated for HSCT ( n = 113, 4%); 3) the clinical indication and/or patient's medical condition did not warrant HSCT ( n = 256, 31%); 4) patient's condition deteriorated making the patient ineligible to receive HSCT ( n = 48, 6%); 5) patient refused to proceed to HSCT ( n = 89, 11%); 6) patient sought referral to other institutions ( n = 119, 14%), and 7) other unknown reasons ( n = 198, 24%). The remaining 559 patients (40%) proceeded to received HSCT. Of the 559 patients, 521 (93%) received their first transplant at UNMC, 6 (1%) received a planned tandem transplant, while 32 (6%) received their second or third HSCT. Among the 521 who received HSCT for the first time, 421 (80%) were financed by private insurers, while 97 (19%) were financed by public payers (Medicare or Medicaid). Three patients (1%) paid out of pocket for their transplant. The patient cohort further studied in this study included the 519

patients who proceeded to receive their first HSCT and were financed by either private insurers or public payers.

**Figure 1: Schema for Subject Selection in Payer Process for Hematopoietic Stem Cell Transplantation (HSCT)**



**Figure 1: Schema for Subject Selection in Payer Process for HSCT.** This table represents how our study population was first divided and the process we used to choose the final population for statistical analysis purposes.

### **Characteristics of HSCT Patients according to Payer**

Table 1 below shows the comparison of the patient-, disease-, and transplant-related characteristics of the 518 patients who underwent a HSCT according to payer type. Patients whose HSCT were financed by private health insurance were more likely to be younger (median age of 53 years vs. 58) more likely to be Caucasians (95% vs. 90%), more likely to have a higher median income (\$21,991 vs. \$20,553), more likely to live in urban areas (63% vs. 46%), and more likely to have no medical comorbid illnesses (50% vs. 32%) compared to patients whose HSCT were financed by public payers. Patients in the two payer groups were comparable in terms of sex, type of disease, disease stage at the time of HSCT, type of HSCT, use of TBI as part of conditioning regimen, and year of transplant. .

**Table 1: Patient Characteristics according to Payer.** This table shows the variables that were examined in this study, according to the type of payer used to fund the HSCT (private or public).

Variables	Private	Medicare/Medicaid	p-value
N	421	97	
Median age in yrs. (range)	53 (14-74)	58 (22-77)	<0.0001
< 40 (%)	79(19)	12(12)	<.0001
40 – 60 (%)	237(56)	18(19)	
≥ 60 (%)	105(25)	67(69)	
Sex (%)			0.7370
Female	164(39)	36(37)	
Male	257(61)	61(63)	
Race/Ethnicity (%)			0.0346
Caucasians, non-Hispanic	401(95)	87(90)	
Non-Caucasians	20(5)	10(10)	
Median income* (range)	21991 (9121-40564)	20553 (11422-33947)	<0.0001
≤ 20000 (%)	100 (24)	39 (40)	0.0052
20000 – 30000 (%)	248 (59)	48 (50)	
30000 – 40000 (%)	63 (15)	6 (1)	
> 40000 (%)	6 (1)	2 (2)	
Unknown (%)	4 (1)	2 (2)	
RUCA (%)			0.0027
Rural	156(37)	52(54)	
Urban	265(63)	45(46)	
Comorbidity Index (%)			0.01
0	210 (50)	31 (32)	
1 , 2	128 (30)	38 (39)	
> 2	79 (19)	27 (28)	
Missing	4 (1)	1 (1)	
Diagnosis (%)			.0559
Non-Hodgkin lymphoma (NHL)	212(50)	41(42)	
Hodgkin lymphoma (HD)	39(9)	5(5)	
Multiple Myeloma (MM)	89(21)	33(36)	
Leukemia/Myelodysplastic syndrome (MDS)	74(18)	15(15)	
Other	7(2)	3(3)	

**Table 1 Continued: Patient Characteristics according to Payer.**

Disease stage at transplant (%)			0.0758
1 <sup>st</sup> Complete remission / Chronic phase	118 (28)	17 (18)	
≥ 2nd Complete Remission / Chronic phase	85 (20)	22 (23)	
Primary Induction Failure	58 (14)	11 (11)	
Relapse / Accelerated	64 (15)	12 (12)	
Multiple Myeloma	89 (21)	33 (34)	
Other	7 (2)	2 (2)	
Year of Transplant (%)			0.6707
2007	65 (15)	13 (13)	
2008	100 (24)	25 (26)	
2009	84 (20)	14 (14)	
2010	101 (24)	25 (26)	
2011	71 (17)	20 (21)	
Use of total body irradiation for conditioning (TBI) (%)			0.7427
TBI	30 (7)	6 (6)	
No TBI	391 (93)	91 (94)	
Type of transplantation (%)			0.3028
Autologous	326 (77)	82 (85)	
Unrelated	49 (12)	8 (8)	
Related	46 (11)	7 (7)	
Median time from initiation of payer approval to approval, days (range)	4 (0 – 90)	0 (0 – 28)	<0.0001
Median time from approval to actual transplant, days (range)	39 (-6 – 402)	65 (14 – 277)	<0.0001
Median total time from initiation of payer approval to transplant, days (range)	48 (1-407)	66 (14-277)	<0.001

\*Median income inferred from median household income based on residential ZIP codes.

## **Indices of Timeliness of HSCT**

Figures 2 and 3 shows the graphical representation of the time in days it took from initiation of payer approval to receipt of actual payer approval (Figure 2) and the time in days it took from payer approval to performance of actual HSCT (Figure 3) according to individual insurance companies and public payers. As shown in Figure 2, patients who had private health insurance had a longer median time to wait from initiation of payer approval to the actual approval compared to patients who were Medicare or Medicaid eligible (median time in days 0 (range 0 to 28) vs. 4 (range 0 to 90);  $p < 0.001$ ). Figure 2 also shows the relatively wide variation in the time to payer approval among private insurers from 1 to 6 days and with a wide range of 0 to 90 days. Alternatively, public payers take 0 to 2 days with a range of 0 to 28 days. Figure 3 shows the graphical representation of the time period from payer approval to receipt of the actual HSCT. As shown in this figure, there is a significantly longer wait time for patients funded by public payers compared to private payers (median time in days 65 (range 14-277) vs. 39 (range -6 to 402);  $p < 0.001$ ). The negative value depicts patients who actually proceeded to HSCT without having received yet final approval from the insurance company. The graph also shows that while the median time from payer approval to actual HSCT is significantly longer for patients funded by public payers, the variation in range is much narrower among those funded by public payers than those among private payers (maximum wait time of 277 days vs. 402 days).

Figure 2 Time from Initiation of Payer Approval to Actual Approval by Payer Type

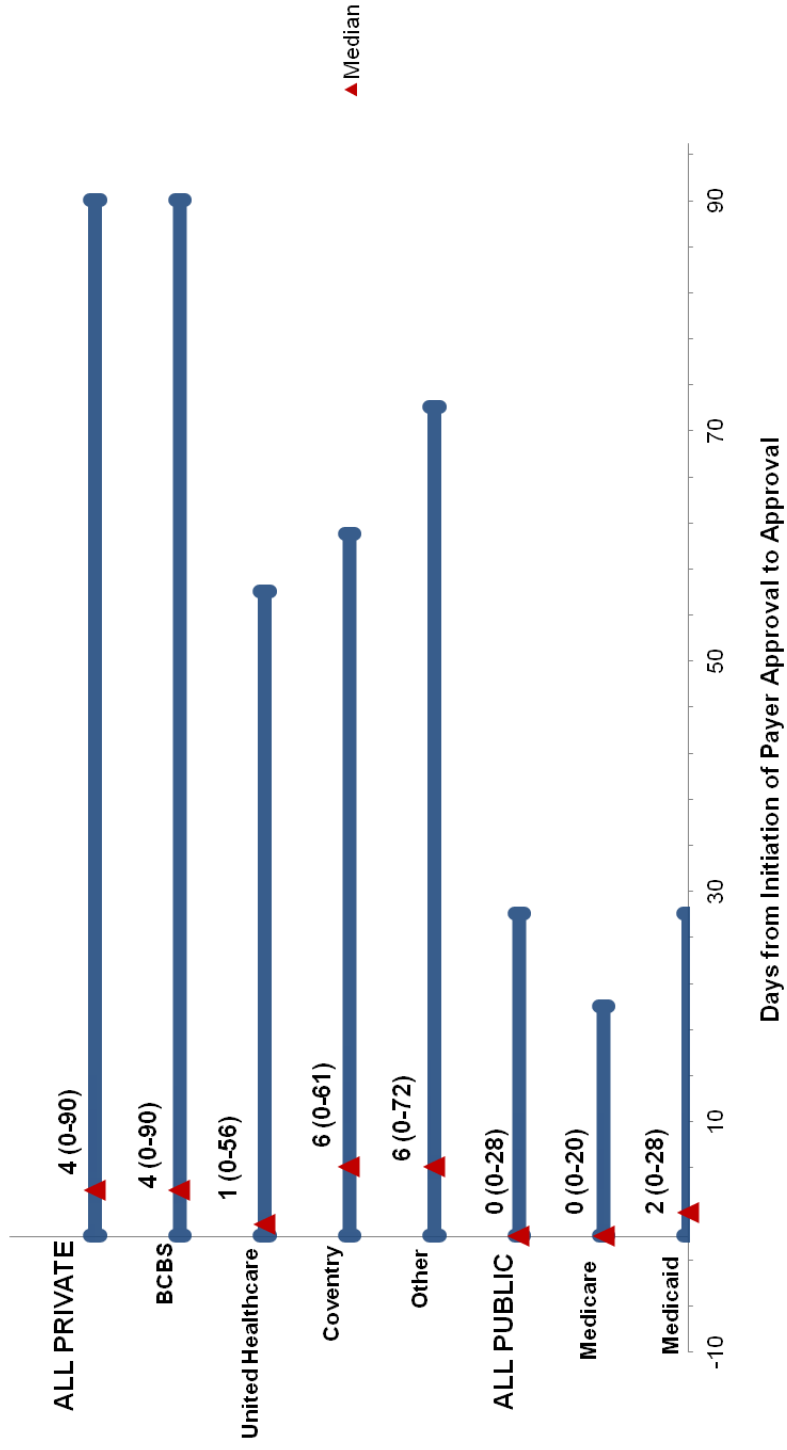


Figure 2: Time from Initiation of Payer Approval to Actual Approval by Payer Type. This figure shows the average delay (in days) for getting approved for a HSCT for both private and public payers.

Figure 3. Time from Approval to Transplant by Payer Type

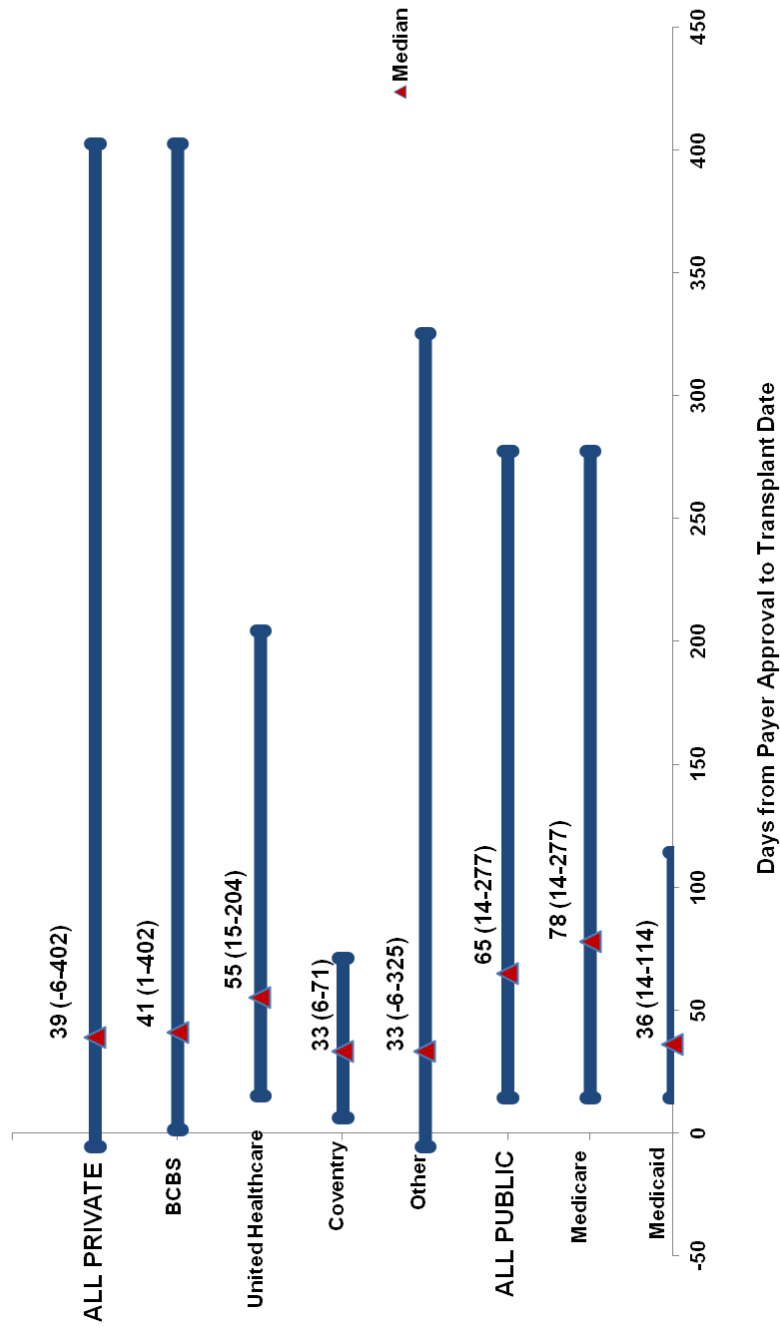


Figure 3: Time from Approval to Transplant by Payer. This figure shows the average delay (in days) in receiving a HSCT transplant after the patient has already been approved, based off of payer type.

## **Multivariate Analysis**

Table 2 shows the results of the multivariate analysis evaluating the association between the types of payer (private versus public) with the two outcomes or indices of timeliness (time to payer approval and time from payer approval to HSCT). In the first model, where all patients who proceeded to HSCT were included, the analysis showed that public payers were significantly faster in approval process time by a coefficient of 5.69 days compared to private payers (p value of <0.0001). Only year of transplant was significantly associated with this index of timeliness, such that there was a significant modest decrease in the time to payer approval over the years (coefficient of -0.77 days). On the other hand, the time it took to proceed to transplant after payer approval was significantly longer among HSCT funded by public payers compared to private payers at a coefficient of 24.69 days, p <0.0001. Interestingly no other patient-, disease-, and transplant-related variables were associated with this outcome aside from place of residence. The table shows that patients who lived in rural areas took longer to proceed to HSCT after payer approval at a coefficient of 9.38 days, p = 0.0365. This suggests that the delay in actual receipt of HSCT may be related to the logistics of having to reside in an area farther from the transplant center.

To better evaluate the association between the indices of timeliness and payer type we evaluated this relationship using two other more homogenous disease models. Model 2 consisted of patients that had non-Hodgkin lymphoma (NHL) who proceeded to autologous HSCT, and Model 3 consisted of patients

with multiple myeloma who are at least 60 years of age and also received autologous HSCT. No models on allogeneic HSCT were tested because we did not have adequate sample to carry a robust multivariate analysis.

As shown in Table 2, Models 2 and 3 also found similar results to those of Model 1, that is, public payer approval took significantly less time, but also took significantly longer time to proceed to HSCT after payer approval when compared to private payer. Again, place of residence was found to be associated with time to actual HSCT in the NHL model, such that patients living in rural areas took significantly longer time to undergo HSCT after payer approval at a coefficient of 14.19 days. No other factors were found to be associated with the indices of timeliness.

**Table 2: Multivariate analysis evaluating association between time from payer processing to transplant according to type of healthcare payer.** The table compares these variables to each model, which is dependent on patient disease. **Legends:** <sup>a</sup> Aside from type of healthcare payer, only year of transplant was associated with time to payer approval, while place of residence was associated time from payer approval to transplant; <sup>b</sup> Model limited to patients with non-Hodgkin lymphoma (NHL). No other variables were associated with time to payer approval, aside from type of healthcare payer; place of residence was associated with time from payer approval to transplant; <sup>c</sup> Model limited to elderly subjects with multiple myeloma (autologous transplantation), no other variables were associated with time to payer approval and time from payer approval to transplant.

	Model 1: <sup>a</sup> All Patients		Model 2: <sup>b</sup> NHL Patients only		Model 3: <sup>c</sup> =60y, Multiple Myeloma	
	n	Parameter estimate (std. error)	p-value	n	Parameter estimate (std. error)	p-value
<b>A. Payer Approval</b>						
Type of healthcare payer	421	Reference		212	Reference	
Private insurance	97	-5.69 (1.20)	<0.0001	41	-6.40 (1.97)	0.0013
Medicare / Medicaid						Reference
<b>Other significant covariate:</b>						
Year of transplant (2007 to 2011)	518	-0.77 (0.35)	0.0380		NS	NS
<b>B. Approval to Transplant</b>						
Type of healthcare payer	421	Reference		214	Reference	
Private insurance	97	24.69 (5.62)	<0.0001	41	38.15 (8.36)	<0.0001
Medicare / Medicaid						Reference
<b>Other significant covariate:</b>						
Place of residence	310	Reference		153	Reference	
Urban	208	9.38 (4.48)	0.0365	100	14.19 (6.30)	0.0252
Rural						NS

## **DISCUSSION**

This study showed some relatively novel findings related to the timeliness of care in the process of obtaining payer approval and receipt of HSCT. Specifically, we showed that the approval time for patients having a public payer (Medicare/Medicaid) had, on average, less of a waiting period compared to patients using private health insurance. Alternatively, these same patients that used public payers had a longer delay in receiving the actual transplant, when compared to the patients having private health insurance. Since timeliness of care is one parameter of quality of care, one can argue that there appears to be a wide variation in the quality of care received by HSCT patients according to payer type. Given these findings, it is important to understand what this delay potentially means and develop ways to potentially improve the quality of care and perhaps experience of HSCT patients. Based on our findings, there is room for improving the timeliness of obtaining HSCT across the type of payer.

### **Not-transplanted Cohort**

As seen in Figure 1, from the original sample size of 1389 patients, only 559 patients (40%) were actually transplanted, leaving 830 (60%) not transplanted. As mentioned, this procedure possesses potentially curative qualities, allowing patients with malignant and non-malignant disorders a better than usual chance of long-term, cancer-free survival. The 60% of patients who

were not transplanted for varied reasons, including denied, expired, not recommended, became ineligible, patient decided not to, referred, or other. With the substantial potential benefits to receiving HSCT, it would seem more likely that the proportion of patients transplanted would be greater than 40%, however this is not the case. An important question here is if the timeliness of care had any effect on the rather high percentage of patients that ended up not receiving HSCT. We were not able to study the characteristics of the not-transplanted cohort, but it would be interesting to evaluate if the characteristics of these patients have any associations with the type of payer they had. An interesting question to be made is if the delay in time from approval to receiving the transplant in both payer types was not observed or is non-existent, would more patients actually receive HSCT?

Another interesting point to make among this cohort of not-transplanted patients is that the number of patients denied for the HSCT procedure was quite low. Only 7 patients (1%) of this cohort were not able to receive a HSCT due to insurance denial. This is a rather surprising finding that bodes well about how the payers view HSCT as a potentially useful treatment modality for diseases of the hematopoietic system. If a patient has medical coverage or is eligible for public financing, payers do, in fact, work with hospitals to ensure that their patient gets the recommended treatment and not get unduly denied.

## **High Percentage of Uninsured Patients in the United States**

This study evaluated a representative sample of patients with malignant and non-malignant disorders recommended for HSCT to a university center in the state of Nebraska between the years of 2007 and 2011. We identified two cohorts: not-transplanted and transplanted and used data from patients who underwent HSCT to evaluate how the payer approval process affect the timing of HSCT given the many anecdotal stories about how unreasonable insurance companies are in denying access to care. This study question is rather unexplored and for the most part unknown in the setting of HSCT. The study showed that a higher percentage of patients who eventually went into HSCT had private insurance other than Medicare/Medicaid (421 (80%) vs. 97 (19%)). According to Census Bureau Data (2010), approximately 48 million Americans do not possess healthcare insurance. As mentioned, HSCT is an expensive procedure. Thus, our findings suggest that individuals with health insurance preferentially have access to this treatment modality. While Medicare covers individuals who are at least 65 years of age or have permanent disability (HHS, 2013), this procedure is less used in the older population because of its associated toxicities. Medicaid, which is dedicated to elderly, disabled or low income people and families, specifies that to be considered low income, a family/person must have an income up to 133% of the poverty line, as well as meeting other requirements (HHS, 2013). Few people qualify for this. Thus, there

is a possibility that the low proportion of public financed HSCTs in our population reflects disparity in access to HSCT.

According to the Census Data Report (2010), 18% of employed workers in the United States are uninsured do not qualify for Medicare/Medicaid and do not have available health care coverage at work. Of the unemployed citizens, 46.2% are uninsured and do not qualify for Medicaid/Medicare. These are rather large percentages of uninsured people currently in the United States. The reality of these statistics is that uninsured Americans are not able to obtain the appropriate care they may need due to its high costs. This is certainly something that can be said on in HSCT setting. Many studies have found that uninsured patients do not seek the proper health care that they need. A study done by Ayanian et al. (1993) found that uninsured patients with breast cancer had a higher percentage for mortality compared to insured patients. This study showed significant outcomes associated with breast cancer, early diagnosis and survival. Uninsured patients delay seeking medical care, thus presenting with a later staged cancer. A similar study carried out by Ward et al. (2008) also examined how insurance was associated with cancer care utilization and outcomes. They found that uninsured patients were half as likely as patients possessing private insurance to receive cancer screening tests. This showed that health insurance status affects screening, which affects the time to diagnosis and the time to receive a transplant, if necessary. Overall, this affects the quality of care by affecting timeliness.

The above studies that showed differences in cancer stages, screening tests, and mortality between according to payer type may explain the low percentage of patients that were covered by Medicare/Medicaid in our study. Are patients that may potentially benefit from this treatment not seeking medical attention because they are uninsured and do not meet the requirements for obtaining Medicaid or Medicare? This may mean that the requirements of the Medicaid/Medicare system are too strict and perhaps changes need to be made within this system of healthcare to allow patients to obtain the proper medical care.

### **Medicare/Medicaid Delay**

As shown in Figures 2 and 3, patients having Medicare or Medicaid had quick approval of receiving a HSCT, compared to those having private insurance; however, there was a significant delay in receiving the transplant. This could be due to many reasons, including financial reasons. According to a study done in 2003, 59% of hospitals actually lose money treating Medicare patients and 61% lose money treating Medicaid patients (AHA, 2003). This financial burden may explain why a significant delay in receiving HSCT for Medicare/Medicaid patients. Approximately only 48% of the cost of certain medical procedures is covered by Medicare, leaving the rest of the financial burden on the patient and the hospital. Hospitals are frequently losing money due to the patient's inability to cover the remaining costs. Hospitals could therefore be presenting patients having public

coverage with longer delays to ensure that the patient would, in fact, medically benefit from the procedure, and that the financial loss they would be almost required to take by treating the patient will be worth it to both the hospital and patient. By examining them for a longer period of time, the hospital is given more time to ensure that the patient would remain healthy enough for this type of treatment. It would be interesting to examine the percentage of patients that had public assistance that were approved for the transplant, but did not obtain the procedure.

As shown in Table 1 of the patient characteristics according to payer type, the majority of the patients (54%) that were covered by public payers resided in rural areas. This was a significant finding we found to be associated with the delay among patients using public financing. Rural areas have poor access to care and often require distant travelling to acquire tertiary level type of care. With longer distances to hospitals, patients are not always able to seek the proper health care that is needed, thus possibly explaining the delays we found in our study.

The longer distance to receive care also imposes a financial burden on patients using public assistance. As shown in Table 1, patients having public assistance, on average, have less income compared to patients having private health insurance. Less income can present patients with challenges on getting to the hospital and maintaining the necessary health status to receive the transplant. Having less money for example does not allow patients the freedom

to always eat healthy, and lack of nutrition can potentially result in a delay in treatment due to diminished health status.

Another important issue involving rural healthcare is that individuals residing in rural areas tend to be older than those from urban areas (AHA, 2013). Older patients generally have a greater number of health issues compared to younger populations. According to the CDC (2011), in the population of people 65 years or older, 24.4% of this population were in poor health, compared to 10% of the entire population. Additionally, it was found that 30.4% had heart disease (compared to 11.8% of people 18 years and older), and 18.1% had cancer (compared to 6.3% of people 18 and over). These statistics show the decrease in health of elderly patients compared to the younger population. The delay found for Medicare/Medicaid patients in receiving HSCT may therefore be correlated to rural populations having older residents and decreased health status.

### **Private Payer Approval**

In Figure 2, examining the differences between approval times of the various private health insurance companies also leads us to ask various questions regarding how private insurance companies work in approving patients for this type of high-cost procedure. With private health insurance operating within the same system, it would seem more likely that their approval time would be similar, rather than being spread out between 1 to 5 days. What is also noteworthy, is that the range of approval times among the different private

insurers is vastly different, ranging from 0 to 90 days. This leads us to wonder how companies, for example BlueCross BlueShield, have an approval time of 0 days for some patients, and yet take as long as 90 days for other patients. The same can be asked of the other private insurers. Although this can also be said of public payers, the range in time to approval is not as wide as private insurers. These findings suggest that there are no universal criterion set to approve or deny patients for this treatment. Instead, the variation in practices among private insurers reflects differing systems that may be unduly delaying receipt of HSCT at least in some cases. One can only imagine how comorbid factors such as pre-existing conditions, medications patient are currently taking, obesity, ethnic status, and level of income are possibly being used and may affect the decision process and thus causing greater delays than others.

Starting in January, 2014, this difference in approval within and across insurance companies may no longer be seen with the affordable care act that is expected to take effect. This care act has been structured to allow patients similar coverage across private insurance companies, if they chose to use a private over a public program. This program will prevent insurance companies from denying patients the treatment due to co-existing conditions, and thus altered health statuses; however, whether or not it's going to make it a more universal system across insurance groups, regarding issues such as this, remains unknown (Schwartz & Claxton, 2010). A primary goal of this program is to place limitations on the decision-making role of private companies. It is an

obvious area that needs addressed and further examined to understand why these differences in approval delay are seen.

### **Fixing Healthcare Delays**

A second option for fixing the differences seen across approval and receiving transplant delays would be to develop a system of healthcare that is universal for each patient in the United States. The concept of single payer system may potentially further limit if not eliminate delays because insurance companies would no longer be allowed to compete for revenue. Approving patients based off of personal characteristics and approving patients for financial reasons would no longer be allowed since patients would receive treatments based off their medical need and not on their ability to pay for the treatment (PNHP, 2013). Each person would receive high-quality, comprehensive medical care and would not be forced to experience longer delays for treatments and would not be forced to pay higher co-pays for personal characteristics.

### **Strengths and Limitations to Current Study**

This study, to our knowledge, is the first to have demonstrated the potential delay in obtaining HSCT according to payer. We used a representative sample of a rather unbiased patient pool with malignant and non-malignant hematologic disorders who have been referred for possible HSCT at UNMC. The data source used is the study included all patients referred within the five year study period. The population size is rather large and the cohorts were divided

according to how patients were managed in real time. The data also contained detailed dates and transaction details that allowed us to study closely the payer approval process in HSCT, something that has not been described before. We accounted for personal characteristics of each patient and found areas such as income, ethnicity, co-morbid index and patient disease to not have any significant correlation between the delays seen for being approved and receiving a HSCT. This study examined many variables and found differences in the timing of payer approval according to payer and place of residence.

Given that our population represents only the experience of a single larger transplant center situated in Nebraska, our study may possess some limitations. We did not have an ethnically or racially diverse group of patients since Nebraska consists predominantly of Caucasian population. Our results indicate that only place of residence and year of transplant have any significant association to the timeliness of receiving HSCT. Perhaps, if our sample was more diverse, our results may have been different. Our cohort also consisted mostly of patients who underwent autologous transplant. The delays we found may not necessarily be true if more allogeneic transplants were included. Another limitation of our study is our inability to correlate how the delays we found in our study correlate with the experience of patients as they proceed into HSCT.

## **Future Research and Recommendations**

An interesting area that could be further examined involves the second cohort of patients, the not-transplanted cohort. It would be worthwhile to examine the patient characteristics according to payer type as was done with the transplanted cohort. It would allow us to understand if any patient characteristics and/or payer type are associated with the reasons for not being transplanted. This is an area we plan on further analyzing.

Another area we anticipate further study is to assess the effect (if any) that the delays seen in our study have on the outcome of HSCT, such as survival. However, it is important to note that timeliness in itself is noteworthy as it deals with actual processes that affect quality of care. While our study showed significant variations in the approval process of payers in HSCT, we still do not understand how much of these variations can be improved. Without system wide changes in approval process across types of payers, improvements designed at the hospital level may not necessarily improve timeliness. Making private insurers aware of the delay we found in our study may promote policy reviews among insurance companies and help improve the approval process. On the other hand, hospitals can also make changes within their system to eliminate the transplant delay seen for patients using a public payer. This study has made it apparent that there is a significant delay for the patients having public assistance, and by making it known, more time and energy can be spent towards speeding up the process of this timeliness of care. One of the areas that needs fixed, and

was found as a significant factor in our study, is rural healthcare. If patients in rural Nebraska are seeing more of delay, then a larger emphasis needs to be placed on rural medicine than what it is today, to allow patients in rural areas the same quality of care as those in urban areas. This study has allowed us to see areas of weakness within both the insurance company and hospital systems. The hope is that by having this knowledge, it will encourage the medical community and payer companies to begin examining ways to overcome these issues.

## REFERENCES

- American Cancer Society. (2012). Stem Cell Transplant (Peripheral Blood, Bone Marrow, and Cord Blood Transplants). Retrieved on February 2, 2013 from <http://www.cancer.org/treatment/treatmentsandsideeffects/treatmenttypes/bonemarrowandperipheralbloodstemcelltransplant/stem-cell-transplant-types-of-transplant>.
- Andre-Schmutz, I., Deist, F., Hacein-Bey-Abina, S., Vitetta, E., Schindler, J, et al. (2002). Immune Reconstitution without Graft-Versus-Host Disease after Hematopoietic Stem-Cell Transplantation: A Phase 1/2 Study. *The Lancet*, 360(9327):130-137.
- Aplastic Anemia & MDS International Foundation. (2012). Bone Marrow and Stem Cell Transplantation. Retrieved on January 28, 2013 from <http://www.aamds.org/node/79>.
- Ayanian, J.Z., Kohler, B., Abe, T., & Epstein, A. (1993). The Relation between Health Insurance Coverage and Clinical Outcomes among Women with Breast Cancer. *New England Journal of Medicine*, 329(5):326-331.
- Bradley, C.J., Dahman, B., & Bear, H.D. (2012). Insurance and Inpatient Care: differences in Length of Stay and Costs Between Surgically Treated Cancer Patients. *Cancer*, 118(20):5084-5091.
- Bryce, C.L., Chang, C.C., Angus, D.C., Arnold, R.M. Farrell, M. et al. (2010). The Effect of Race, Sex, and Insurance Status on Time-to-Listing Decisions for Liver Transplantation. *Journal of Transplantation*, Epub, doi: 10.1155/2010/467976.
- Carlisle, D.M., Leake, B.D., & Shapiro, M.F. (1997). Racial and Ethnic Disparities in the Use of Cardiovascular Procedures: Association with Type of Health Insurance. *American Journal of Public Health*, 87(2):263-267.
- Census Data Report. (2010). Health Insurance. Retrieved on March 1, 2013 from <http://www.census.gov/hhes/www/hlthins/>.
- Centers for Disease Control and Prevention. (2011). Health, United States, 2011, with Special Feature on Socioeconomic Status and Health. Retrieved on March 8, 2013 from <http://www.cdc.gov/nchs/data/hs/hs11.pdf>.
- Chen, A.Y., Schrag, N.M., Halpern, M.T., & Ward, E.M. (2007). The Impact of Health Insurance Status on Stage at Diagnosis of Oropharyngeal Cancer. *Cancer*, 110(2):395-402.

- Committee on the National Quality Report on Health Care Delivery. (2001). *Envisioning the National Health Care Quality Report*. Washington, D.C.: National Academy Press, pg. 41-44.
- Copelan, EA. (2006). Hematopoietic Stem Cell Transplantation. *The New England Journal of Medicine*, 354:1813-1826.
- Department of Health and Human Services. (2013). Long Term Care Information. Retrieved on March 8, 2013 from [http://www.longtermcare.gov/LTC/Main\\_Site/Paying/Public\\_Programs/Medicaid/Eligibility.aspx#General](http://www.longtermcare.gov/LTC/Main_Site/Paying/Public_Programs/Medicaid/Eligibility.aspx#General).
- Dzierzak-Mietla, M., Markiewicz, M., Siekiera, U., Mizia, S., Koclega, A., et al. (2012). Occurrence and Impact of Minor Histocompatibility Antigens' Disparities on Outcomes of Hematopoietic Stem Cell Transplantation from HLA-Matched Sibling Donors. *Bone Marrow Research*, Epub, doi: 10.1155/2012/257086.
- Gornick, M.E. (1999). The Association of Race/Socioeconomic Status and Use of Medicare Services: A Little-Known Failure in Access to Care. *Annals of New York Academy of Sciences*, 896:497-500.
- Gratwohl, A., Baldomero, H., Aljurf, M., Pasquini, M., Fernando, L., et al. (2010). Hematopoietic Stem Cell Transplantation A Global Perspective. *Journal of the American Medical Association*, 303(16):1617-1624.
- Halpern, M.T., Ward, E.M., Pavluck, A.L., Schrag, N.M., Bian, J., et al. (2008). Association of Insurance Status and Ethnicity with Cancer Stage at Diagnosis for 12 Cancer Sites: A Retrospective Analysis. *Lancet Oncology*, 9(3):222-231.
- Harlan, L.C., Greene, A.L., Clegg, L.X., Mooney, M., Stevens, J.L. et al. (2005). Insurance Status and the Use of Guideline Therapy in the Treatment of Selected Cancers. *Journal of Clinical Oncology*, 23(36):9079-9088.
- Hwang, J.P., Lam, T.P., Cohen, D.S., Donato, M.L., & Geraci, J.M. (2004). Hematopoietic Stem Cell Transplantation among Patients with Leukemia of All Ages in Texas. *Cancer*, 101(10):2230-2238.
- Khera, N., Chow, E.J., Leisenring, W.M., Syrjala, K.L., Baker, K.S., et al. (2011). Factors Associated with Adherence to Preventative Care Practices among Hematopoietic Stem Cell Transplantation (HCT) Survivors. *Biology of Blood and Marrow Transplantation*, 17(7):995-1003.

- Khera, N., Zeliadt, S.B., & Lee, S.J. (2012). Economic of Hematopoietic Cell Transplantation. *Blood*, 120(8):1545-1551.
- Kwok, J., Langevin, S.M., Argiris, A., Grandis, J.R., Gooding, W.E. et al. (2010). The Impact of Health Insurance Status on the Survival of Patients with Head and Neck Cancer. *Cancer*, 116(2):476-485.
- Laurentine, K.A. & Bramstedt, K.A. (2010). Too Poor for Transplant: Finance and Insurance Issues in Transplant Ethics. *Progress in Transplantation*, 20(2):178-185.
- Li, C.I., Malone, K.E., & Daling, J.R. (2003). Differences in Breast Cancer Stage, Treatment, and Survival by Race and Ethnicity. *Archives of Internal Medicine*, 163(1):49-56.
- Majhail, N.S. & Omondi, N.A. (2010). Access to Hematopoietic-Cell Transplantation in the United States. *Biology of Blood and Marrow Transplantation*, 16(8):1070-1075.
- Mandelblatt, J.S., & Yabroff, R.K. (1999). Equitable Access to Cancer Services: A Review of Barriers to Quality Care. *Cancer*, 86(11): 2378-2390.
- National Cancer Institute. (2010). Bone Marrow Transplantation and Peripheral Blood Stem Cell Transplantation. Retrieved on February 18, 2013 from <http://www.cancer.gov/cancertopics/factsheet/Therapy/bone-marrow-transplant>.
- National Institutes of Health. (2011). Hematopoietic Stem Cells. Retrieved on January 28, 2013 from <http://stemcells.nih.gov/info/scireport/pages/chapter5.aspx>.
- National Marrow Donor Program. (2013). The Search Process. Retrieved on January 18, 2013 from [http://marrow.org/Patient/Transplant\\_Process/Search\\_Process/The\\_Search\\_Process.aspx](http://marrow.org/Patient/Transplant_Process/Search_Process/The_Search_Process.aspx).
- Northwestern Medical Faculty Foundation. (2013). Stem Cell Transplant Program. Retrieved on February 18, 2013 from [http://www.nmff.org/documents/Patient\\_Education\\_Booklet2.pdf](http://www.nmff.org/documents/Patient_Education_Booklet2.pdf).
- Penson, D.F., Stoddard, M.L., Pasta, D.J., Lubeck, D.P., Flanders, S.C., et al. (2001). The Association Between Socioeconomic Status, Health Insurance Coverage, and Quality of Life in Men with Prostate Cancer. *Journal of Clinical Epidemiology*, 54(4):350-358.

- Perumbeti, A. (2012). Hematopoietic Stem Cell Transplantation. Retrieved on January 6, 2013 from <http://emedicine.medscape.com/article/208954-overview>.
- Physicians for a National Health Program. (2013). What is a single payer? Retrieved on March 3, 2013 from <http://www.pnhp.org/facts/what-is-single-payer>.
- Saito, A., Cutler, C., Zahrieh, D., Soiffer, R., Ho, V., et al. (2008). Costs of Allogeneic Hematopoietic Cell Transplantation with High-Dose Regimens. *Biology of Blood and Marrow Transplantation*, 14(2):197-207.
- Schwartz, K. & Claxton, G., (2010). The patient protection and affordable care act: how will it affect private health insurance for cancer patients? *Cancer Journal*, 16(6):572-576.
- Schweitzer, J., Fairman, N., Schreyer, K., & Waxman, K. (2003). Appendicitis, 2002: Relationship Between Payers and Outcome. *The American Surgeon*, 69(10):902-908.
- Spitzer, TR. (2001). Engraftment Syndrome Following Hematopoietic Stem Cell Transplantation. *Bone Marrow Transplant*, 27(9):893-898.
- Ward, EW, Halpern, M., Schrag, N., Cokkinides, V., DeSantis, C., et al. (2008). Association of Insurance with Cancer Care Utilization and Outcomes. *CA Cancer Journal Clinic*, 58(9):9-31.

VITA

[REDACTED]

[REDACTED] [REDACTED]  
[REDACTED]  
[REDACTED]

[REDACTED] [REDACTED]

[REDACTED] [REDACTED]

[REDACTED] [REDACTED]  
[REDACTED] [REDACTED]

[REDACTED]  
[REDACTED]

[REDACTED]  
[REDACTED] [REDACTED]

- [REDACTED]  
[REDACTED]
- [REDACTED]  
[REDACTED]
- [REDACTED]  
[REDACTED]
- [REDACTED]  
[REDACTED]
- [REDACTED]  
[REDACTED]

[REDACTED] [REDACTED]  
■ [REDACTED]  
■ [REDACTED]  
[REDACTED]  
[REDACTED]  
[REDACTED]  
[REDACTED]  
[REDACTED]  
[REDACTED]  
■ [REDACTED]  
[REDACTED]

[REDACTED] [REDACTED]  
■ [REDACTED]  
■ [REDACTED] [REDACTED] [REDACTED] [REDACTED]  
[REDACTED]  
[REDACTED]  
[REDACTED]



