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Token economy to improve adherence to activities of daily living

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Abstract

Background—Participation in key activities of daily living (ADL), including daily bathing, physical activity, and oral hygiene can decrease the risk of bloodstream infections, oral complications, and deconditioning in pediatric patients undergoing hematopoietic stem cell transplant (HSCT). However, many patients fail to perform ADL during their inpatient stay. To improve inpatient adherence to ADL, we tested a token economy to engage patients, families and the clinical team in improving adherence to these important health behaviors during this critical time.

Methods—We used a controlled before-after study design to test our hypothesis. All patients were prescribed three ADL. We used an “all or none” measurement for each component of the ADL 1-2-3 initiative to measure adherence. HSCT patients with poor ADL adherence (<20%) were eligible to receive the intervention, which consisted of rewarding patients through an ADL through a token economy.

Results—Twenty-one patients participated in the study. ADL adherence for the 14 days prior to intervention in study subjects (n=294 inpatient days) averaged 0.51 ADL per day (95% CI

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Contributor's Statement

Victoria Hickey and Christopher Dandoy conceptualized and designed the study, drafted the initial manuscript, and approved the final manuscript as submitted. Laura Flesch, Adam Lane, Ahna Pai, John Huber, Priscila Badia, and Stella Davies, assisted in the collection of data, reviewed and revised the manuscript, and approved the final manuscript as submitted.

Conflicts of Interest

The authors have no conflicts of interest relevant to this article to disclose.

0.45-0.57). In the 14 days post initiation of the token economy intervention (n=294 inpatient days), the average adherence was 2.5 ADL per day (95% CI 2.4-2.5), ($p<0.001$).

Discussion—Positive reinforcement through a token economy system is associated with improved adherence to ADL in hospitalized pediatric patients who demonstrated poor ADL adherence at baseline. We believe this intervention can positively impact adherence to targeted health behaviors with the ability to correlate with improved health outcomes.

Keywords

token economics; operant conditioning; activities of daily living; bloodstream infections; hematopoietic stem cell transplant; adherence

Introduction

High-dose chemotherapy and hematopoietic stem cell transplant (HSCT) regimens offer prospects of cure for children and young adults with high-risk and relapsed cancers¹⁻⁴. However, oncology and HSCT patients are at increased risk of developing treatment-related toxicities such as infections, oral complications, and deconditioning. Bloodstream Infections (BSI) are the most significant cause of mortality in pediatric oncology/HSCT patients, second only to relapse⁵⁻⁹. Oral complications, such as mucositis, affect up to 80% of oncology patients,¹⁰⁻¹² and have a significant impact on patient's oral function, including the basic need to eat, drink or speak¹³. Additionally, BSI from organisms originating in the oral cavity lead to significant morbidity and mortality in this population^{14,15}.

Deconditioning from prolonged immobility is associated with rapid reductions in muscle mass, bone mineral density and impairment in other body systems which can be evident within the first week of hospitalization^{16,17}. Recent studies indicate that the risk for BSIs, oral complications, and deconditioning can be reduced by participation in key activities of daily living (ADL), including daily bathing, physical activity, and oral hygiene. Despite this, many patients fail to perform these important ADL during their inpatient stay,¹⁸ at a time they are most vulnerable^{7,19-21}. There is a critical need to develop robust and sustainable mechanisms to improve ADL adherence, which will prevent BSI, oral complications and challenges related to inactivity in high-risk immune compromised pediatric oncology/HSCT patients. In the absence of such knowledge, these toxicities will continue to cause significant morbidity.

Patients undergoing HSCT are at highest risk of complications in the 2-3 weeks following stem cell infusion prior to engraftment^{8,22}. To improve inpatient adherence to ADL we tested a token economy to engage patients and families, along with the clinical team in improving adherence to these important health behaviors during this critical time. The purpose of this study was to establish preliminary efficacy for this approach using a controlled before-after trial. We predicted that patients who were previously non-adherent with ADL would demonstrate improved adherence.

Patients and Methods

The study was performed in the Bone Marrow Transplant Unit at Cincinnati Children's Hospital Medical Center. The division performs approximately 100 HSCT procedures each year. All patients are prescribed three activities of daily living ("ADL 1-2-3") including daily bathing with chlorhexidine gluconate (CHG), physical activity twice per day, and an oral hygiene regimen three times per day as previously described^{18,23}. Our current standard of care to ensure adherence to ADL includes routine education regarding the importance of ADL, reporting ADL during rounds between the nursing and physician team, and discussing non-adherence with patients and providers. We used an "all or none" measurement for each component of the ADL 1-2-3 initiative. A CHG bath must be completed one time a day, out of bed activity must be completed two times a day, and oral care must be completed three times a day. Each patient has three opportunities per day for each component of the ADL 1-2-3 initiative. For example, if the patient only participated in one oral care instead of three then the patient was measured as non-adherent for oral care.

Intervention

The intervention initiated on the Bone Marrow Transplant (BMT) unit was known as "BMT Bucks". The intervention was designed to motivate patients and engage families and staff as members of a unified team, providing positive reinforcement to patient self-management of ADL through a token economy. Patients used stickers to chart completion of ADL 1-2-3 and based upon adherence to these activities earned weekly "BMT Bucks", a special currency developed with faces of the BMT physician team. "BMT Bucks" were awarded by clinicians to patients as positive reinforcement for completion of specific ADL tasks. The unique "BMT Bucks" currency could be exchanged for token rewards. Tokens were based off subjective feedback from patients and caregivers prior to the study. Patients and caregivers had a large selection of prizes to select from which were age and gender appropriate (stickers and small toys for children, arts and crafts supplies, gift cards for adolescents). Participants were able to select from the collection of available rewards.

Study Design

We used a controlled before-after trial study design to test the token economy ADL1-2-3 intervention on patient ADL adherence. Eligibility criteria included: admission to the BMT unit, ADL adherence of less than 20% for a minimum of 14 consecutive days, four years of age or older, and anticipated admission to the hospital for a minimum of 14 additional days. After measuring adherence to ADL per current standard of care for a 14 day period, we evaluated the token economy intervention for 14 subsequent days and continued to track adherence. During the intervention period, "BMT Bucks" were awarded to patients for completion of specific ADL tasks, which could be exchanged for token rewards. This intervention was in addition to our standard of care (ADL education, reporting ADL during rounds, patient-provider discussing non-adherence, etc.). We monitored patient bloodstream infections rates during both time periods. Each of the three ADL were calculated as an all-or-none measure providing patients enrolled with 3 daily opportunities to complete each ADL category.

Comparison of mean adherence between samples during each time period was measured with a paired t-test. We calculated the mean ADL adherence of each patient, along with the group mean, in the 14 days prior to intervention and the 14 days post-intervention. Finally, we used Fisher Exact test to evaluate BSI rates before and after the intervention. Institutional Review Board approval was obtained for the proposed study.

Results

Twenty-one patients were approached to participate in the study, and all enrolled (100%). The median participant age was 8.0 years and nine (43%) were male. The majority of patients were undergoing HSCT for bone marrow failure or malignancy (43% and 28%, respectively), and the majority received a myeloablative conditioning regimen. Table 1

ADL adherence for the 14 days prior to intervention in study subjects (n=294 inpatient days) averaged 0.51 ADL per day (95% CI 0.45-0.57). In the 14 days post initiation of the BMT-Bucks initiative (n=294 interventions days), the average adherence was 2.5 ADL per day (95% CI 2.4-2.5), ($p<0.001$). Figure 1. ADL adherence was statistically higher for each individual patient from the pre-intervention to the post intervention ($p<0.001$). ADL adherence was similar at baseline between the three ADL with similar improvements post-intervention.

Subjectively, the ADL adherence was received well, many of the patients and families asked to continue the intervention after the study period. Also, several patients felt that the BMT currency with physician's faces was a sufficient reward and opted to hold on to their BMT bucks instead of trading them in for a prize.

Discussion

This study is the first to demonstrate the efficacy of a standardized token economy intervention to improve adherence to three prescribed ADL in a pediatric inpatient setting. The token economy intervention provided the clinical team with a clear and standardized process by which fundamental positive reinforcement was provided to patients increasing ADL adherence as well as promoting patient activation, self-management, and family engagement²⁴. Medical teams have previously relied on nurse or provider specific interventions including persistent encouragement and reminding when refusing to complete ADL, increasing the likelihood of patient-provider conflict and undermining patient autonomy^{18,23,25}.

Research often focuses on adherence to medication, but adherence also encompasses many other health-related behaviors and is defined as "the extent to which the patient follows medical instructions^{26,27}". Adherence results from a complex set of behaviors with multiple determinants that vary among individuals. Although there is only one way for patients to be perfectly adherent, there are many ways that patients can be nonadherent²⁸. There are minimal data on adherence with ADL in the inpatient setting. Hines et al. reported low overall adherence with daily CHG bathing (63%) despite institutional requirements of the practice, patient refusal (74%) being the major barrier to adherence²⁹. Caya et al. reported similarly low rates (57%) of CHG bathing adherence in a large academic medical center⁵⁹.

In order to identify factors leading to poor CHG bathing adherence, Musuuza et al. conducted structured interviews with nurses and technicians working in a large intensive care unit³⁰. Barriers included patient refusal, along with healthcare delivery factors such as designating an appropriate time for bathing, clinical team overload, and insufficient education of staff and caregivers on the positive impact of CHG bathing on infection prevention³⁰.

Applied Behavioral Analysis is a scientific discipline concerned with analyzing the principles of learning and behavioral control, developing usable methods from these principles, and systematically applying these methods to change behavior³¹. All actions, whether used in daily life or while during hospitalization, are simply a set of behaviors, and, as such, can be taught and reinforced using the basic tenets of operant conditioning³². Operant conditioning is a type of learning where behavior is controlled by consequences and is associated with a reinforcement that occurs after the desired behavior³². Operant conditioning specifies the functional relationship between an individual's behavior and the antecedents (the cue or reminder) and consequences (reward) of that behavior²⁴. The reinforcement is a stimulus or event applied after a response that strengthens the probability that the response will be performed again³³. It is important to determine the type of reinforcement that is necessary to effectively achieve the desired behavior. To date, we have relied on negative reinforcement to maintain ADL adherence. When patients refused to complete ADL, the provider team confronted the patient, and finally, the patient completed the ADL to stop the persistent encouragement and reminding from the staff. Our proposed intervention builds upon operant conditioning, utilizing positive reinforcement to encourage the desired behavior, ADL adherence (Figure 2). Operant conditioning methodology has been used to improve ADL adherence in adults. Through distribution of coffee and cigarette tickets for targeted ADL in geriatric adults (n=30) admitted to the psychogeriatric ward the number of target behaviors increased dramatically and many positive effects were observed³⁴. In patients with cystic fibrosis, positive reinforcement through a token economy supported improved exercise adherence³⁵. Token economics have been used successfully in pediatric populations with attention-deficit hyperactivity disorder; Coelho et al. demonstrated significant improvement in overall problematic behavior when patients were rewarded with token rewards when they exhibited improved behavior in between cognitive behavioral therapy sessions³⁶. Finally, Token economics have showed efficacy at improving memory and response inhibition performance in pediatric patients with acquired brain injuries³⁷.

There are several limitations to this study. Enrollment was limited to patients with very low adherence (less than 20%). Additionally, we are unable to determine the long-term impact of the intervention and if the improvement in adherence is sustainable. However, HSCT patients are at high risk of complication during a limited time period, and it is during this time that it is important for them to adhere to ADL. Additionally, we could not evaluate the effect of the intervention on blood stream infections because of the limited power of our sample size.

Conclusion

Our initial results show that systematically providing positive reinforcement to hospitalized pediatric patients can increase engagement in care and improve clinical outcomes.

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Abbreviations

ADL	Activities of daily living
BMT	Bone marrow transplant
BSI	Bloodstream infections
CHG	Chlorhexidine gluconate
HSCT	Hematopoietic stem cell transplant

References

1. Burdach S, Thiel U, Schöniger M, et al. Total body MRI-governed involved compartment irradiation combined with high-dose chemotherapy and stem cell rescue improves long-term survival in Ewing tumor patients with multiple primary bone metastases. *Bone Marrow Transplant.* 2010; 45(3):483–489. [PubMed: 19684633]
2. Jahnukainen K, Kallio P, Koivusalo A, Saarinen-Pihkala UM. High-dose Thiotepa as Consolidation Therapy With Autologous Hematopoietic Stem Cell Transplantation for High-risk Ewing Family Tumors: Single-institution Experience. *J Pediatr Hematol Oncol.* 2015; 37(7):536–542. [PubMed: 26207773]
3. Dourthe ME, Ternès N, Gajda D, et al. Busulfan-Melphalan followed by autologous stem cell transplantation in patients with high-risk neuroblastoma or Ewing sarcoma: an exposed-unexposed study evaluating the clinical impact of the order of drug administration. *Bone Marrow Transplant.* 2016; 51(9):1265–1267. [PubMed: 27111042]
4. DeSantis CE, Lin CC, Mariotto AB, et al. Cancer treatment and survivorship statistics, 2014. *CA Cancer J Clin.* 2014; 64(4):252–271. [PubMed: 24890451]
5. Åttman E, Aittoniemi J, Sinisalo M, et al. Etiology, clinical course and outcome of healthcare-associated bloodstream infections in patients with hematological malignancies: a retrospective study of 350 patients in a Finnish tertiary care hospital. *Leuk Lymphoma.* 2015; 56(12):3370–3377. [PubMed: 25813080]
6. Marín M, Gudíol C, Ardanuy C, et al. Factors influencing mortality in neutropenic patients with haematologic malignancies or solid tumours with bloodstream infection. *Clin Microbiol Infect.* 2015; 21(6):583–590. [PubMed: 25680311]
7. Stoma I, Karpov I, Milanovich N, Uss A, Iskrov I. Risk factors for mortality in patients with bloodstream infections during the pre-engraftment period after hematopoietic stem cell transplantation. *Blood Res.* 2016; 51(2):102–106. [PubMed: 27382554]
8. Dandoy CE, Haslam D, Lane A, et al. Healthcare Burden, Risk Factors, and Outcomes of Mucosal Barrier Injury Laboratory-Confirmed Bloodstream Infections after Stem Cell Transplantation. *Biol Blood Marrow Transplant.* 2016; 22(9):1671–1677. [PubMed: 27311966]

9. Dix D, Cellot S, Price V, et al. Association between corticosteroids and infection, sepsis, and infectious death in pediatric acute myeloid leukemia (AML): results from the Canadian infections in AML research group. *Clin Infect Dis*. 2012; 55(12):1608–1614. [PubMed: 22955431]
10. Epstein JB, Raber-Durlacher JE, Raber-Drulacher JE, Wilkins A, Chavarria MG, Myint H. Advances in hematologic stem cell transplant: an update for oral health care providers. *Oral Surg Oral Med Oral Pathol Oral Radiol Endod*. 2009; 107(3):301–312. [PubMed: 19217013]
11. Epstein JB, Thariat J, Bensadoun RJ, et al. Oral complications of cancer and cancer therapy: from cancer treatment to survivorship. *CA Cancer J Clin*. 2012; 62(6):400–422. [PubMed: 22972543]
12. Epstein L, See I, Edwards JR, Magill SS, Thompson ND. Mucosal Barrier Injury Laboratory-Confirmed Bloodstream Infections (MBI-LCBI): Descriptive Analysis of Data Reported to National Healthcare Safety Network (NHSN), 2013. *Infect Control Hosp Epidemiol*. 2015:1–6. [PubMed: 26633292]
13. Elad S, Raber-Durlacher JE, Brennan MT, et al. Basic oral care for hematology-oncology patients and hematopoietic stem cell transplantation recipients: a position paper from the joint task force of the Multinational Association of Supportive Care in Cancer/International Society of Oral Oncology (MASCC/ISOO) and the European Society for Blood and Marrow Transplantation (EBMT). *Support Care Cancer*. 2015; 23(1):223–236. [PubMed: 25189149]
14. Raber-Durlacher JE, Laheij AM, Epstein JB, et al. Periodontal status and bacteremia with oral viridans streptococci and coagulase negative staphylococci in allogeneic hematopoietic stem cell transplantation recipients: a prospective observational study. *Support Care Cancer*. 2013; 21(6):1621–1627. [PubMed: 23288398]
15. Greenberg MS, Cohen SG, McKittrick JC, Cassileth PA. The oral flor as a source of septicemia in patients with acute leukemia. *Oral Surg Oral Med Oral Pathol*. 1982; 53(1):32–36. [PubMed: 6948251]
16. Topp R, Ditmyer M, King K, Doherty K, Hornyak J. The effect of bed rest and potential of prehabilitation on patients in the intensive care unit. *AACN Clin Issues*. 2002; 13(2):263–276. [PubMed: 12011598]
17. Parry SM, Puthucheary ZA. The impact of extended bed rest on the musculoskeletal system in the critical care environment. *Extrem Physiol Med*. 2015; 4:16. [PubMed: 26457181]
18. Best D, Osterkamp E, Demmel K, et al. Increasing Activities of Daily Living Is as Easy as 1-2-3. *J Pediatr Oncol Nurs*. 2016; 33(5):345–352. [PubMed: 26721694]
19. van der Velden WJ, Herbers AH, Netea MG, Blijlevens NM. Mucosal barrier injury, fever and infection in neutropenic patients with cancer: introducing the paradigm febrile mucositis. *Br J Haematol*. 2014; 167(4):441–452. [PubMed: 25196917]
20. Gudiol C, Garcia-Vidal C, Arnan M, et al. Etiology, clinical features and outcomes of pre-engraftment and post-engraftment bloodstream infection in hematopoietic SCT recipients. *Bone Marrow Transplant*. 2014; 49(6):824–830. [PubMed: 24662420]
21. Young JA, Logan BR, Wu J, et al. Infections after Transplantation of Bone Marrow or Peripheral Blood Stem Cells from Unrelated Donors. *Biol Blood Marrow Transplant*. 2016; 22(2):359–370. [PubMed: 26409243]
22. Doss LM, Dandoy CE, Kramer K, et al. Oral health and hematopoietic stem cell transplantation: A longitudinal evaluation of the first 28 days. *Pediatr Blood Cancer*. 2017
23. Dandoy CE, Hausfeld J, Flesch L, et al. Rapid cycle development of a multifactorial intervention achieved sustained reductions in central line-associated bloodstream infections in haematology oncology units at a children's hospital: a time series analysis. *BMJ Qual Saf*. 2016; 25(8):633–643.
24. Meredith SE, Jarvis BP, Raiff BR, et al. The ABCs of incentive-based treatment in health care: a behavior analytic framework to inform research and practice. *Psychol Res Behav Manag*. 2014; 7:103–114. [PubMed: 24672264]
25. Linder LA, Gerdy C, Abouzelof R, Wilson A. Using Practice-Based Evidence to Improve Supportive Care Practices to Reduce Central Line-Associated Bloodstream Infections in a Pediatric Oncology Unit. *J Pediatr Oncol Nurs*. 2016

26. Dobbels F, Van Damme-Lombaert R, Vanhaecke J, De Geest S. Growing pains: non-adherence with the immunosuppressive regimen in adolescent transplant recipients. *Pediatr Transplant*. 2005; 9(3):381–390. [PubMed: 15910397]
27. Sabate E. Adherence to long-term therapies: Evidence for action. Switzerland: World Health Organization; 2003.
28. Kahwati L, Viswanathan M, Golin CE, Kane H, Lewis M, Jacobs S. Identifying configurations of behavior change techniques in effective medication adherence interventions: a qualitative comparative analysis. *Syst Rev*. 2016; 5:83. [PubMed: 27209092]
29. Hines AG, Nuss S, Rupp ME, Lyden E, Tyner K, Hewlett A. Chlorhexidine Bathing of Hospitalized Patients: Beliefs and Practices of Nurses and Patient Care Technicians, and Potential Barriers to Compliance. *Infect Control Hosp Epidemiol*. 2015; 36(8):993–994. [PubMed: 25899653]
30. Musuuza JS, Roberts TJ, Carayon P, Safdar N. Assessing the sustainability of daily chlorhexidine bathing in the intensive care unit of a Veteran's Hospital by examining nurses' perspectives and experiences. *BMC Infect Dis*. 2017; 17(1):75. [PubMed: 28088171]
31. Baer DM, Wolf MM, Risley TR. Some current dimensions of applied behavior analysis. *J Appl Behav Anal*. 1968; 1(1):91–97. [PubMed: 16795165]
32. Skinner B. About Behaviorism. New York, NY: Vintage Books; 1974.
33. Braungart M, Braungart R, Gramet P. Chapter 3: Applying learning theories to healthcare practice. Sudbury, MA: Jones & Bartlett Learning; 2011.
34. Gustafson R. Operant Conditioning of Activities of Daily Living on a Psychogeriatric Ward: A Simple Method. *Psychological Reports*. 1992; 70(2):603–607. [PubMed: 1598377]
35. Bernard RS, Cohen LL, Moffett K. A token economy for exercise adherence in pediatric cystic fibrosis: a single-subject analysis. *J Pediatr Psychol*. 2009; 34(4):354–365. [PubMed: 18820291]
36. Coelho LF, Barbosa DL, Rizzutti S, Muszkat M, Bueno OF, Miranda MC. Use of Cognitive Behavioral Therapy and Token Economy to Alleviate Dysfunctional Behavior in Children with Attention-Deficit Hyperactivity Disorder. *Front Psychiatry*. 2015; 6:167. [PubMed: 26635642]
37. Tatla SK, Sauve K, Jarus T, Virji-Babul N, Holsti L. The effects of motivating interventions on rehabilitation outcomes in children and youth with acquired brain injuries: a systematic review. *Brain Inj*. 2014; 28(8):1022–1035. [PubMed: 24661000]

$p < 0.001$

Figure 1. Mean adherence with ADL (n=21)

Comparison of mean ADL adherence in the 14 days prior to intervention and the 14 days post intervention in the 21 study subjects. Mean adherence over the intervention period was significantly higher for all study subjects ($p = < 0.001$). Abbreviations: ADL=activity of daily living; CI=confidence interval.

Figure 2. Operant conditioning in activities of daily living (ADL) adherence

Current practice is limited to negative reinforcement, completion of ADL stops the persistent encouragement and reminding from the staff. The ADL adherence intervention is based on positive reinforcement.

TABLE 1

Demographics of patients included in study

	Patients (n=21)
Male (n=9)	43%
Median Age in years (IQR)	8.0 years (5.1-12.8)
Diagnosis <ul style="list-style-type: none"> Bone Marrow Failure Malignancy Immune deficiency Genetic/Metabolic Benign Hematology 	9 (43%) 6 (28%) 4 (19%) 1 (5%) 1 (5%)
Conditioning Regimen <ul style="list-style-type: none"> Myeloablative conditioning Reduced intensity conditioning 	14 (67%) 7 (33%)
Donor <ul style="list-style-type: none"> Autologous Allogeneic <ul style="list-style-type: none"> Fully matched graft Unrelated donor 	3/21 (14%) 18/21 (86%) 9/18 (50%) 15/18 (83%)
Stem Cell Source <ul style="list-style-type: none"> Bone Marrow PBSC 	10 (48%) 11 (52%)

Abbreviations: IQR=inter-quartile range; PBSC=peripheral blood stem cell