Establishing an Inpatient Gym for Recipients of Stem Cell Transplantation: A Multidisciplinary Collaborative

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Background: Evidence suggests that exercise can have a profound impact on physiologic and quality-of-life outcomes for patients undergoing hematopoietic stem cell transplantation (HSCT). Despite this, implementation of a gym on inpatient HSCT units may be limited because of space, infrastructure, and budget.

Objectives: This article presents the design, implementation, and evaluation of the gym and highlights its use for individual and group patient activities.

Methods: An interprofessional team at a National Cancer Institute–designated comprehensive cancer center collaborated to design and implement gym space on an inpatient HSCT unit servicing as many as 86 beds.

Findings: Informal feedback from patients, as well as metrics on use of the space, indicates that the gym is well received and frequently used. Limitations include the absence of a designated physical therapy technician to supervise individual activity, which may limit patient access when a staff member is unavailable. The cost associated with the implementation of such space may be offset by benefits to patients, including enhanced conditioning, quality of life, and time to discharge, as evidenced in the literature.

Hook: Hematopoietic stem cell transplantation (HSCT) is a potentially curative treatment strategy used in a variety of hematologic malignancies. In this setting, high-dose chemotherapy is administered to partially or completely ablate patients’ bone marrow, followed by hematopoietic stem cell infusion to reconstitute the immune system. About 20,000 HSCTs are performed annually in the United States, and that number increases each year (U.S. Department of Health and Human Services, 2015). Intensive cancer therapies, such as HSCT, can require prolonged hospitalizations of 14–20 days or longer to manage chemotherapy toxicities and to deliver other supportive therapies until patients can be discharged safely.

During the initial transplantation period, patients often experience debilitating fatigue and diminished quality of life, are at high risk for life-threatening infections, and are dependent on regular blood and platelet transfusions (Cohen et al., 2012; Hacker et al., 2011; Lyons et al., 2011). Research suggests that interventions aimed at reducing fatigue and increasing physical activity can positively affect patient outcomes and improve quality of life in this patient population (Brassil et al., 2014; Persoon et al., 2010; Wiskemann & Huber, 2008). A systematic review of the effects of exercise in patients treated with HSCT examined eight randomized, controlled studies comparing exercise to standard of care, and, in all eight studies, exercise was found to have favorable effects on cardiopulmonary fitness, lower extremity strength, and fatigue (Persoon et al., 2013). In another study examining patterns of fatigue in patients undergoing HSCT, Hacker et al. (2011) demonstrated significant increase in fatigue and decrease in physical activity during the...
post-transplantation hospitalization period. In addition, the establishment of physical activity programs related to endurance and strength training has been shown to counteract the negative consequences of immobility and improve quality of life during the acute phase of the transplantation process (Baumann et al., 2011).

Although exercise consistently is identified as beneficial for individuals hospitalized to undergo HSCT, the challenge remains as to how to engage patients in a meaningful way. Two-way communication boards often are used to remind patients to exercise three times daily; however, consistent patient engagement is a challenge to successful implementation of these recommendations. Potential barriers to mobility in hospitalized patients have been identified in the literature as occurring in four major categories: patient-related factors (e.g., illness, comorbidities), treatment-related factors (e.g., catheters, IV lines), institution-related factors (e.g., staffing, available equipment), and attitudinal factors related to patient and staff perspectives on mobility and falling (Brown, Williams, Woodby, Davis, & Allman, 2007). In patients undergoing HSCT, barriers to physical activity often include physical impairments and fatigue resulting from chemotherapy toxicities, prolonged hospitalization with subsequent decreases in physical activity, and psychosocial changes, such as anxiety, fear, and depression.

At a National Cancer Institute–designated comprehensive cancer center, about 850 transplantsations are performed annually, nearly half of which are from allogeneic donor sources, including matched-related, matched-unrelated, cord blood, and haploidentical transplantations (cells from a half-matched human leukocyte antigen source, such as a parent). Depending on the type of transplantation and chemotherapy given, allogeneic patients typically remain hospitalized from 20–30 days, as opposed to autologous patients whose average length of stay is 18 days. Extended hospitalizations for recipients of allogeneic transplantation are related to graft source, time to engraftment and resulting period of prolonged immunosuppression, and treatment- and disease-related complications, such as graft failure (Ballen et al., 2014; Majhail, Mothukuri, Brunstein & Wesdorff, 2009).

In this setting, an interprofessional team collaborated to design and implement a gym on an inpatient HSCT unit servicing 84 inpatient transplantation beds. This effort was part of a larger initiative among nurses, rehabilitation medicine staff members, physical therapists (PTs), and occupational therapists (OTs) to improve patient participation in physical activity while hospitalized for transplantation. As part of this initiative, nurses and PTs collaborated to improve the use of safe mobility techniques among patients and providers. In addition, they developed mile-marker cards to be posted around the unit, indicating to patients the distances they walked based on different walking routes. Nurses also developed an innovative, incentive-based program designed to motivate patient participation in physical activity during hospitalization for HSCT (Brassil et al., 2014). The use of gym space was integral to these initiatives. The design, implementation, and outcomes of the gym space are presented in this article.

### Inpatient Gym Design

The inpatient gym first was conceptualized to be implemented on a 52-bed HSCT inpatient unit when a room previously used as an on-unit pharmacy was vacated. The nursing leaders from this unit requested space for the development of an inpatient gym, and staff members from facilities management at this institution identified a previously used space that could be refurbished for this purpose. With institutional support from executive leaders and departmental support from the HSCT physicians, and in collaboration with facilities management staff members and rehabilitation services colleagues, the first gym space was implemented on this unit in 2011. Within a year, the inpatient HSCT unit began plans for expansion to a new unit that was to undergo buildout. This interprofessional team looked at the opportunity to preplan gym space into the design of this new unit.

The nursing staff members presented a plan to use what had been designated as a family quiet waiting area for the new gym space. Alternate space was secured for the original purpose of the waiting area, and the plan for gym development was approved. A floor plan was developed to accommodate the

<table>
<thead>
<tr>
<th>TABLE 1. Gym Equipment and Descriptions</th>
<th>Equipment</th>
<th>Number Purchased</th>
<th>Cost</th>
</tr>
</thead>
<tbody>
<tr>
<td>8' x 6' treatment mat/plinth</td>
<td>1</td>
<td>$3,300</td>
<td></td>
</tr>
<tr>
<td>Axillary crutches (pair)</td>
<td>1</td>
<td>$70</td>
<td></td>
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<tr>
<td>BOSU®</td>
<td>1</td>
<td>$108</td>
<td></td>
</tr>
<tr>
<td>Cuff weights (ranging from 0.25–5 lbs)</td>
<td>3–4 each</td>
<td>$11–$25 each ($400 total)</td>
<td></td>
</tr>
<tr>
<td>Foam balance blocks</td>
<td>4</td>
<td>$45 each ($180 total)</td>
<td></td>
</tr>
<tr>
<td>Mirrored weight rack</td>
<td>1</td>
<td>$500</td>
<td></td>
</tr>
<tr>
<td>Nesting steps (heights ranging from 1.75”–8”)</td>
<td>5</td>
<td>$270 each ($1,350 total)</td>
<td></td>
</tr>
<tr>
<td>Exercise balls/gym balls</td>
<td>3 (various sizes)</td>
<td>$22, $28, $35 ($85 total)</td>
<td></td>
</tr>
<tr>
<td>Recumbent stationary bicycle</td>
<td>2 (1 purchased, 1 donated)</td>
<td>$4,500</td>
<td></td>
</tr>
<tr>
<td>Rolling walkers</td>
<td>2</td>
<td>$155 each ($310 total)</td>
<td></td>
</tr>
<tr>
<td>Single-point cane</td>
<td>1</td>
<td>$23</td>
<td></td>
</tr>
<tr>
<td>Small-based quad cane</td>
<td>1</td>
<td>$70</td>
<td></td>
</tr>
<tr>
<td>Tumble Forms® bolster</td>
<td>1</td>
<td>$154</td>
<td></td>
</tr>
<tr>
<td>Microsoft® Xbox Kinect system</td>
<td>1</td>
<td>$300</td>
<td></td>
</tr>
</tbody>
</table>
A multipurpose gym. The proposed layout provided designated areas for individual, PT-assisted, and group therapy activities and created a flow within the space to allow for multiple concurrent sessions. The space for the proposed gym was 474 square feet (38 feet x 17 feet), with two full-length window walls for the patients to enjoy while receiving their therapies.

A facilities planner/designer also designed cabinetry and mobile storage pieces to house all of the equipment. The longest available wall was selected as the optimal area for a mirrored wall and ballet bar. Again, the planner/designer worked closely with the rehabilitation staff to determine the height and length required to support the class activities. Flooring materials were chosen to be consistent with the new unit design, but also to be safe for physical activities. A wood-look luxury sheet vinyl surface was selected for aesthetic and functional purposes, including ease of cleaning. In addition, the gym, along with all of the inpatient units in this location, have HEPA filtration, which provides additional protection for patients who are immunosuppressed.

Once the space was secured and the layout designed, facilities representatives met with nursing and rehabilitation staff members to review all needs and requirements for the space. An inventory of all existing equipment, as well requests for new equipment, was provided, and the specifications for each item were fully explored for planning purposes. The final equipment chosen and respective pricing are presented in Table 1. The time from planning to completion was 18 months, and the total cost of the buildout was $130,450. The equipment costs totaled $11,350 for a final expense of $141,800.

### Use of the Inpatient Gym

Because patients on the HSCT unit are immunocompromised, the inpatient therapy gym provides a way for PTs and OTs to treat patients in a variety of ways without having to take patients off the unit for treatment. The gym is used for individual treatment sessions, a group exercise class held three days per week, and a music therapy group held once per week. Because of the immunocompromised state of the patients on the HSCT unit, surfaces in the gym were designed to be able to be cleaned easily between patient uses. Surfaces are cleaned using Super Sani-Cloth® Germicidal Wipes, and each piece of equipment (including chairs used during the group exercise class) is cleaned after each patient use to avoid cross-contamination.

Participation in the individual treatment sessions and group exercise class is contingent on evaluation by a physical therapist. Because patient conditions are variable, no strict parameters exist that prohibit gym use. Instead, patients are assessed by the healthcare team on a daily basis to ensure that they are stable enough to use the gym and participate in physical activity offerings. The PTs restrict the use of resistance equipment to patients with a platelet count greater than 20,000 to reduce the risk of bleeding. PT assessment includes the following.

- Discussion of a patient’s home environment and medical equipment owned
- Assessment of pain, fatigue, and dyspnea
- Manual muscle testing of upper and lower extremities
- Assessment of bed mobility, transfers, posture, and ambulation
- Education on importance of physical activity, frequent ambulation, out-of-bed activity, and participation in the group exercise program

The inpatient HSCT unit consists of 86 patient rooms, and the majority of these patients receive a consultation request for PT and OT. The assessment evaluates the patient’s need for and ability to participate in individual and group therapy sessions. About half of the patients evaluated by PT and OT are approved to participate in individual treatment sessions or the

### TABLE 2. Comparison of Individual and Group Therapy Session Components

<table>
<thead>
<tr>
<th>Variable</th>
<th>Individual</th>
<th>Group</th>
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<tbody>
<tr>
<td>Duration</td>
<td>10–60 minutes</td>
<td>60 minutes</td>
</tr>
<tr>
<td>Frequency</td>
<td>Offered one to five times per week</td>
<td>Offered three times per week</td>
</tr>
<tr>
<td>Facilitated by</td>
<td>PTs and OTs</td>
<td>PTs and OTs</td>
</tr>
<tr>
<td>Core competencies</td>
<td>• Use of the stationary bike for the lower extremities, upper extremities, or both&lt;br&gt;• Core strengthening using the treatment mat and/or exercise balls&lt;br&gt;• Strengthening exercises using cuff weights for added resistance&lt;br&gt;• Balance activities on level and uneven surfaces to improve proprioception&lt;br&gt;• Use of nesting steps to simulate stairs, curbs, and community obstacles&lt;br&gt;• Weight-bearing exercises with assistance from the therapist as needed&lt;br&gt;• Introductory activity (OT)&lt;br&gt;• Education on fatigue management and safety while in the hospital (OT)&lt;br&gt;• Deep breathing and stretching (OT)&lt;br&gt;• Short cardiovascular activity (PT), including activities, such as seated marches, flutter kicks, forward punches, and forearm circles&lt;br&gt;• Lower extremity exercises in standing (for those who can) and seated position (PT)&lt;br&gt;• Upper extremity exercises using Thera-Band® for light resistance when appropriate (PT)&lt;br&gt;• Five minutes of cool-down stretches and diaphragmatic breathing (PT)</td>
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</tr>
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</table>
group exercise program based on their levels of strength and mobility (see Table 2). Common reasons that patients do not participate include acute nausea and vomiting, large-volume diarrhea, and generalized weakness and deconditioning that would prohibit safe participation.

Clinical Considerations

All hospitalized patients undergoing HSCT are allowed to use the gym as long as they are accompanied by a staff member for safety reasons. No clinical restrictions prohibit patients from attending exercise classes (provided that they have undergone PT assessment) or using the gym space. Because most patients experience pancytopenia at some point during their hospitalization, no restrictions are based on hematologic status. To date, no patient injuries or falls have occurred in the gym space, but one patient reported some light-headedness while attending a class. The situation was managed promptly by nursing personnel, who transferred the patient back to the room for assessment. In addition to cleaning of the equipment by staff members after each patient use, housekeeping personnel clean all surfaces daily. All surfaces, including bars, door handles, and equipment, are cleaned using antimicrobial wipes with a contact time of two minutes. Floors also are swept and mopped by housekeeping personnel. At the authors’ institution, environmental cultures other than air and water are not routinely performed unless epidemiologically indicated.

Patient and Staff Engagement

The success of the use of the gym space is dependent on engagement of patients and staff members to ensure awareness of the gym and its use, including times, procedures, and eligibility. This is achieved through a two-fold educational approach. Staff members were educated about the gym and its purpose through an initial inservice program at the time of relocation to the new unit, and new staff members are educated by clinical coaches who are experienced staff members on the unit and have experience with the gym space. The HSCT medical team members were informed of the gym during staff meetings as the new unit opened. A designated PT and OT team are assigned to the unit and, therefore, are familiar with the gym space, equipment, and its use, and are responsible for facilitating the exercise class.

Patients and caregivers are educated about the gym space through several modalities, beginning with a preadmission class before HSCT in which they are told about the gym and group exercise class. In addition, on admission to the unit, patients are oriented to the gym and additional information is provided upon assessment by the PT. These two educational modalities are imperative because not all patients undergoing HSCT are admitted to the unit where the gym is located, but rather to one of three units where a total of 85 transplantation-dedicated beds are located. Regardless of the unit to which they are admitted, all patients who undergo a PT assessment and are safe to participate may use the gym. Physician orders are written, allowing patients to go to the gym for exercise class. Nurses, PTs, and OTs collaborate to develop individualized care plans specific to each patient’s PT and treatment needs. Finally, reminders and encouragement from multidisciplinary staff members are used to reinforce teaching about gym use.

Discussion

On average, the inpatient gym is used by about 30–50 patients per week for a total of 30–70 visits, including individual use supervised by a therapist, group exercise sessions, and music therapy, with an estimated 2,600 patient visits per year. The presence of the inpatient gym has increased the number of PT consultations ordered per week by stem cell physicians and, in turn, has increased the number of patients seen by PTs on a weekly basis.

In addition, the presence of the inpatient gym has increased collaboration among staff members on the HSCT unit and a multidisciplinary committee was created to improve mobility in patients on this unit. This group includes three subcommittees: patient and family education, staff education, and communication. Efforts between PTs and nursing staff members are being piloted to improve staff communication and include the patient in the process of formulating the therapy plan of care. Additional implications for PT practice include increased conditioning of patients that may lead to shorter lengths of stay and reduced costs to the patient and facility.

Advantages to having a designated gym space for patient use on the HSCT unit include providing a place to hold the PT-led group exercise classes, which can comfortably accommodate as many as 16 individuals with infusion pumps and caregivers, where patients not only engage in stretching and strengthening activities, but also engage in educational activities around fatigue management, cognitive exercises, and social interaction with other patients and staff. The nursing staff members and physicians strongly encourage exercise class attendance as a strategy to improve mobility and prevent deconditioning. Another advantage of the gym space is the opportunity to provide intensive PT to severely deconditioned patients who are unable to leave the HEPA-filtered unit because of transplantation complications. Therapists guide patients using mirrors and other equipment to enable them to safely climb stairs and practice getting in and out of cars to prepare them for discharge from the hospital.

In addition to these physical benefits, psychoemotional benefits are possible for patients as well. In the content of the class, patients have the opportunity to socialize and interact with other patients undergoing transplantation, giving them an opportunity to ask questions and talk with someone who understands the physiologic experience of undergoing HSCT. In addition, the exercise class serves as a distractor because individuals participate in structured activity. Distraction is useful in a wide range of oncology situations to relieve anxiety (Holland & Alici, 2010), as well as pain intensity and experience (Kwekkeboom, Abbott-Anderson, & Wanta, 2010). The exercise class also provides a potential benefit for caregivers in learning useful conditioning exercises to conduct with the patient if they attend or if they take often-needed break time from supporting the caregiving needs of the patients. Designated gym space offers patients an alternative to walking laps around the nursing unit, which can become redundant and may deter patients from being engaged in the physical activity necessary to maintain...
their strength and endurance throughout the transplantation process.

Despite these benefits, opportunities remain for growth and enhancement of the gym space. For safety reasons, patients only can use the gym space when accompanied by a staff member; subsequently, the space is underused for many hours of the day. Ideally, a PT aide could be hired to supervise the gym use for four to six hours each day; however, this is not currently possible because of budgetary restraints. Because of the need for patient monitoring and safe engagement with the equipment and space, volunteers would not be appropriate to assist; however, nursing, PT, or OT students potentially could supervise patient use of the gym space. The institution also does not have policies in place to allow nonpatient use of the gym by staff members or family caregivers. The institution does offer family caregivers several alternatives, such as the Integrative Medicine Center, where caregivers can take advantage of massage, yoga, and other relaxation therapies to ease stress.

**Implications for Practice**
- Create a designated gym space for patients undergoing stem cell transplantation to contribute to improved outcomes.
- Place functional physical activity space in the inpatient unit to contribute to the efficiency of physical and occupational therapy sessions.
- Provide an environment in which the physiologic and psychosocial needs of patients can be addressed by promoting engagement with other patients.

**References**


**Conclusion**

Although this article presents the development of a gym for use by patients undergoing HSCT, this resource also may be highly effective for other patients with prolonged hospitalization. In addition, although resources of space and budget may seem prohibitive, the potential benefit to patients in terms of decreased length of stay (Brassil et al., 2014) and improved fatigue and quality-of-life outcomes (Jarden, Baadsgaard, Hovgaard, Boesen, & Adamsen, 2009; Wiskemann & Huber, 2008) may offset space and equipment expenditures. Additional research should focus on measuring physiologic and quality-of-life outcomes in relation to frequency and duration of gym use. A collaborative, multidisciplinary approach to individualized care planning and engagement of patients and caregivers as key contributors to such care plans is as essential to the efficacy of an inpatient gym as the development of the gym itself. Ensuring that all members of the care team are committed to a shared goal for patient activity and rehabilitation—and patients and caregivers are aware of the resources needed to achieve these goals—is fundamental to ensure a return on investment from the development of the space.

