Understanding the Process and Challenges for Return-to-Work Post-Hematopoietic Cell Transplantation from a Musculoskeletal Perspective: A Narrative Review

Jaleel Mohammed,1,2 Anne Gonzales,2,3 Hadeel R. Bakhsh4,5 Volkova Alisa Georgievna,2,5 Jayanti Rai,2,6 Bindu Kancharla,2 and Shahrukh K. Hashmi2,7

1Lincolnshire Community Health Services NHS Trust, Lincoln LN5 7JH, UK
2Rehabilitation Association for Hematopoietic Cell Transplantation, Gloucester, UK
3Clinical Therapies, Nationwide Children’s Hospital, Columbus, OH, USA
4Department of Rehabilitation, College of Health and Rehabilitation Sciences, Princess Nourah Bint Abdulrahman University, Riyadh, Saudi Arabia
5Raisa Gorbacheva Memorial Institute of Children’s Oncology, Hematology and Transplantation First I. Pavlov State Medical University of St. Petersburg, Saint-Petersburg, Russia
6Maidstone & Tunbridge Wells NHS Trust, UK
7Department of Internal Medicine, Mayo Clinic, Rochester, Minnesota, USA

Correspondence should be addressed to Hadeel R. Bakhsh; hadeel@mail.net.sa

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The current paper seeks to inform healthcare professionals on how adapting various components of return to work (RTW) programs that are already in use by other musculoskeletal rehabilitation settings can help optimize return to work process for patients with or without musculoskeletal manifestations, posthematopoietic cell transplantation. Since there is no universally agreed RTW structure for hematopoietic cell transplant patients, a narrative approach has been taken utilizing evidence from the existing musculoskeletal return to work assessment publications to help draw parallel for the hematopoietic cell transplant patients. Databases were searched including PUBMED, CINHAL, AMED, SCOPUS, and Cochrane using keywords RTW, functional restoration program, hematopoietic cell transplant, bone marrow transplant, stem cell transplant, and musculoskeletal functional assessment. The authors have managed to outline and propose a structured RTW assessment and monitoring program which can aid in getting patients back to employment by utilizing the functional capacity and job evaluation to help hematopoietic cell transplantation patients reintegrate socially. Patients undergoing hematopoietic cell transplant require additional support and a robust assessment system to allow safe RTW. The proposed model of RTW assessment can prove to be beneficial in helping patients return to work safely. Clinical Significance. To acknowledge the individuality in functional limitation is important in determining not only the rehab needs but also the RTW capabilities. The proposed RTW plan not only promotes an individualized approach to patients but also provides a structure for return to work assessments for hematopoietic cell transplantation patients, thus, eliminating the need for guess work by healthcare professionals. In line with the International Classification of Functioning, Disability, and Health (ICF) recommendations, a RTW assessment combined with a job evaluation helps healthcare professionals and stakeholders to understand the unique challenges and strengths of a patient and thereby design an individualized therapy approach.
1. Introduction

For patients with blood cancers, participation in activities of daily living and returning to work (RTW) have been considered among the main goals of patients post hematopoietic cell transplantation (HCT) and rehabilitation programs [1, 2]. However, RTW process is complex and dependent on many factors including patients’ physical and psychological health and functional capacity [3]. HCT patients can suffer from long-term life changing manifestations, both physical and mental, which can have a great impact on patients’ functional performance [4]. Manifestations that may impact functional capacity can include fasciitis, neuropathy, bone necrosis, contractures, muscle weakness, fatigue, and reduced cognitive ability [5]. Developing a universal and adaptable return to work (RTW) framework for post-HCT patients is an evolving process with a lack of consensus among healthcare professionals around the globe. Furthermore, post-HCT, acute graft versus host disease (aGVHD), and chronic graft versus host disease (cGVHD) patients can be classified as at greater risk of reduced function, disability, and poor health as per the International Classification of Functioning, Disability, and Health (ICF) Framework, a unified and standard framework for the description of health and health-related issues developed by the World Health Organization (WHO) [6–8]. In the ICF framework, post-HCT patients can face challenges resulting from HCT and posttransplant aGVHD or cGVHD. These are summarized in Table 1, which highlights the ICF classification and common deficits, impairments, and functional limitations experienced by HCT patients.

In line with the ICF recommendations in assessing function and disability as a complex interconnection between the body functions and structure, the component of task and activities versus individual participation level, and the impact of external factors such as environment and severity of task, an RTW assessment combined with a job evaluation can provide healthcare professionals and other stakeholders with an understanding of the unique challenges and strengths of a patient that can help in designing an individualized therapy approach. A comprehensive network of professionals involving transplant consultants, occupational health advisors, physical therapists, occupational therapists, social workers, employers, and patient participation is required for a successful RTW plan. Assessing patients’ physical functional capacity and matching it with potential job requirements have been a responsibility of work-related musculoskeletal injury rehabilitation teams for a long time [9].

2. Return-to-Work Model from Musculoskeletal Perspective

The widely used RTW model uses a multidisciplinary team approach which can involve professionals including physiotherapist, occupational therapist, occupational physician, caregiver, employer, and patient’s doctor and consultants. The patients who are deemed as ready for RTW by their doctor/consultant are referred to occupational health department where a complete assessment is carried out by a qualified physiotherapist/occupational therapist/occupational physician which includes physical psychological and work station assessment. Following the assessment, a detailed report is produced and made available to the referring doctor/consultant and the employer (if consented by the patient). This report outlines in detail the functional capacity of the patient and what they can and cannot do when they start the employment, whether they can start a full-time job or need graded RTW plan in place with gradual progression [10–12].

It must be emphasised that the competencies required to conduct the two most important components in an RTW assessment, namely, the functional capacity evaluation (FCE) and the job evaluation (JE), can only be conducted by appropriately trained healthcare professionals, and they are the ones to make recommendations for a successful transition from unemployment and/or underemployment to employment or vice versa [13]. Furthermore, depending on the working regulations and laws of the individual country, advising patients on RTW without appropriate training could carry legal implications for healthcare professionals as such recommendations could be considered as operating out of the scope of one’s practice [14].

Hence, in countries like the United States (US), United Kingdom (UK), and other European countries, RTW assessments and recommendations are generally made only by suitably qualified and experienced occupational therapists, physiotherapists, and/or healthcare professionals working in occupational health settings [15, 16]. These healthcare professionals are also trained to deliver customized rehabilitation interventions aimed at specific job demands and requirements; these interventions enhance patients’ and employers’ experience throughout the RTW process and assist in designing RTW policies and framework [17, 18]. We believe that using the MSK model of RTW will be both appropriate and safe for HCT patients as it is a holistic approach which takes into account the changing medical, physical, and psychological aspect of the individual patient, thus, helping in making safe recommendations when designing RTW plan. Consequently, an electronic search was undertaken to cover the period of the last 20 years (2001 to 2021) using Boolean logic with the following terms: hematopoietic stem cell transplant, physiotherapy, exercise, occupational therapy, return to work, musculoskeletal, functional restoration program, and functional capacity evaluation. Text word and thesaurus searches were used to minimize the chances of missing relevant articles. The search database included PUBMED, Medline via Ovid, Cochrane, and Scopus. Papers addressing allogenic transplant patients with or without GVHD and targeted populations above 16 years old were considered. Studies addressing autologous Transplant or neurological conditions were excluded.

The current paper seeks to inform HCT healthcare professionals on the various components of RTW programs that are widely used in musculoskeletal rehabilitation settings and widely accepted by various stakeholders including insurance companies, doctors, and patients. Incorporating these components into an RTW program for the HCT population could optimize RTW for this population.
### 3. Return to Work

Patients with haematological cancers and post-HCT patients tend to have reduced RTW rates due to various factors including fatigue, neurocognitive function, anxiety, reduced functional capacity, lack of appropriate workplace accommodation, and cGVHD [19–21]. The majority of patients can take up to 5 yrs to recover from HCT-related complications [22]. Not being able to work during that period places a huge financial burden on patients and their families, forcing many to sell or remortgage their homes or to survive on their retirement money [23]. The added emotional and psychological impact on the patient, in turn, can have a detrimental effect, causing patients to withdraw from society and become socially isolated [24, 25].

RTW assessments and job-focused rehabilitation comprise a patient-centred process aimed at providing an overall picture of each patient’s functional capacity, thereby enabling employers to match returning employees with appropriate jobs. However, even though decades of data are available through RTW research, what constitutes a successful RTW remains unclear and poorly defined [26]. In addition, in the case of HCT survivors, RTW can be especially challenging considering the array of novel and sometimes unpredictable pathways that patients navigate towards RTW.

### Table 1: Example of HCT impact on a patient according to the ICF classification.

| ICF components | Subcomponent | Description in the context of HCT patients |
|----------------|--------------|------------------------------------------|
| Functioning and disability | Body structure and function: refers to the anatomical and physiological function of the human body (i.e., motor function, cognition, and emotion) [82–89] | Musculoskeletal, neurologic, and cardiopulmonary manifestations, GVHD and skin involvement including maculopapular rash and pruritic, and in the more severe forms, erythrodermic (stage III), and bullae formation (stage IV), avascular necrosis of the bone, infections, neurological (critical illness myopathy/neuropathy) complications, steroid myopathy as a side-effect of GVHD treatment, chemotherapy-induced cognitive dysfunction, and significant fatigue |
| | Activities and participation: refers to the person’s level of task execution (i.e., communication, mobility, interpersonal interactions, self-care, and learning) [5, 90–92] | Diminished activities of daily life, reduced functional capacity, and altered speech. |
| Contextual factors | Environmental factors: the social and physical factors in the person’s life which facilitate or hinder the function (i.e., family, work, government agencies, laws, and cultural beliefs) [93–98] | Support from the employer, healthcare providers, and caregivers. |
| | Personal factors: the characteristics which is unique to the person (i.e., race, gender, age, educational level, and coping styles. Personal factors are not specifically coded in the ICF because of the wide variability among cultures) | Age, depression, anxiety, social withdrawal, and poor quality of life. |

### Table 2: Commonly used terminologies for RTW assessment and rehabilitation.

| Terminology | Explanation |
|-------------|-------------|
| Phased RTW  | A graduated RTW plan where the employee is given time to get adjusted to his work environment. The employee can start work on reduced hours and gradually build up over a fixed period |
| RTW with restrictions | The employee is placed on specific work-related restrictions based on his initial medical and physical examination. For example, the restrictions can be either a physical one that restricts the employee from doing a certain physical movement in the job process or it can be limiting the amount of time he/she can work or a combination of various restrictions depending upon the severity of his condition. |
| Job evaluation | A process that involves studying the job process by breaking down the tasks involved in detail into various functional parameters and demands, thereby allowing the rehabilitation team to make an informed decision on whether the employee will be able to perform the job with no restrictions or with specific restrictions. |
| Functional capacity evaluation (FCE) | A process that involves gathering patient’s medical history and current symptoms and carrying out various functional assessments involving but not limited to cardiovascular fitness, upper and lower limb strength and movement study, identifying yellow flags, and making a report which a true reflection of patients functional capacity. |
| Functional restoration program (FRP) | A rehabilitation program which involves focused physical training alongside psychological counseling, cognitive and behavioral therapy, and educational sessions. |
| Multidisciplinary RTW team | The team involved in the management of RTW planning and monitoring and involves but is not limited to physicians, physiotherapists, occupational therapists, speech therapists psychologists social/care workers, patient caregivers, employer, insurance companies, and government/nongovernmental agencies. |
Table 3: Factors influencing return to work [36–42, 44–46, 51].

| Influencing factor                        | Description                                                                                                                                 |
|-----------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------|
| Environmental factors                   | Nonsupportive work environment, lack of support from a supervisor, employees understanding of the importance of being at work on his own health, and lack of moral support from work colleagues. Work adjustments to accommodate the employee’s functional and medical condition. |
| Physical factors                        | Fatigue, amount of manual work involved, functional incapacities, and lack of sleep.                                                                 |
| Psychological factors                   | Patient’s perception of his own ability, self-confidence, ability to communicate, and work-related stress.                                                                 |
| Guidance from healthcare professionals  | Knowledge on RTW process among the healthcare professionals, lack of communication between healthcare professionals and employers, and lack of multidisciplinary team approach. |

Figure 1: Recommended stages for return-to-work rehabilitation.

Although the factors influencing RTW are numerous, for the sake of this paper, Table 3 outlines some of the major factors that need to be acknowledged in planning for RTW. Finally, Figure 1 illustrates the process of RTW, which can be divided into phases or stages; some of this has already been covered under the ICF above [35–46].
3.1. Return to Work Plan. Although the RTW plans can commence during the patients’ hospital stays, it is highly recommended that patients undergo a full functional capacity evaluation prior to HCT as many patients suffer from pre-transplant comorbidities which can have a direct influence on posttransplant overall outcome [47, 48]. This evaluation can help clarify the baseline values for patients’ strength, endurance, psychological status, and functional capacity, all of which can be very useful when determining post-HCT RTW plans, workability, and physical workload [43, 49–51].

In general HCT, a multidisciplinary approach involving the transplant consultant, nursing team, physiotherapist, occupational therapist, employer, and patient is important in the planning phase to help avoid pitfalls in the RTW process. The multidisciplinary team along with the patient will determine if the patient is ready to start RTW evaluation. Any RTW recommendations provided must be objective with clearly defined timeframes and an end outcome goal; these need to be constantly monitored and, if necessary, modified and adapted as per progress or decline in health and/or functional status. Employers and colleagues should be made aware that while the patient’s RTW progress is unlikely to be linear, with support, understanding, and cooperation, the chances of sustainability for the patient can be high [43, 49–51].

An individual patient approach is important to prevent blanket restrictions on patients’ RTW time frames. RTW is a dynamic and fluid process that is respective to individual patient factors as well as to the occupation involved. For example, patients working desk/computer jobs may be able to start working from home safely, even during their isolation period, thereby enhancing their RTW experience [43, 49–51].

3.2. Patient Evaluation. Functional capacity evaluation (FCE) is not the gold standard when it comes to predicting RTW and being at work. Nonetheless, FCE does provide the stakeholders involved in the RTW process with useful information to address work demands. FCE should take functional and psychological factors into consideration and usually include a series of tests of cardiovascular fitness, upper and lower limb strength, endurance and movement capacity, fatigue factors, and overall functional performance of the patient [52–56]. Various methodologies and tools have been mentioned in the literature for evaluating functional capacity, e.g., the work well system (WWS) (formally the Isernhagen Work System) [57], the Blankenship FCE [58], the ERGOS work simulator [59], the WRULD FCE, and the Ergo-Kit functional capacity evaluation [60, 61]. In patients with HCT and in those suffering from GVHD, the functional tests must take into consideration the myofascial chain pattern to capture a true picture of functional limitations. Clinicians may also utilize, if relevant and accessible, imaging such as ultrasound in order to measure the thickness of the fascia and the size of the muscle as well as X-ray/MRI/bone scanning to determine any bone-related complications. The images can be useful for not only monitoring any changes in the organs but also prompting early intervention in case of any deterioration/development of symptoms.

3.2.1. Components of Functional Capacity Evaluation (FCE). The kind of job a patient will be returning to determine the optimal combination of tests to be used in the functional evaluation. The FCE process can be broadly divided into two categories: patient interview and functional assessment.

The patient interview helps to identify patients’ readiness and willingness for RTW, patients’ perceptions of what they can and cannot do in a given job process, and yellow/blue flags indicating any psychological barriers to RTW [62, 63].

The functional assessment includes a series of conventional and nonconventional tests. Tests for strength and endurance in the upper and lower limbs include walking, climbing, lifting various loads from different levels, carrying, pushing, and pulling. Tests for positional tolerance activities include sitting, standing, walking, balancing, reaching, stooping, kneeling, crouching, crawling, object handling/manipulation, fingering, hand grasping, and hand manipulation. Pain monitoring is frequently performed during the FCE to document client-reported levels of pain during various activities as well as to manage pain. The FCE may also include the evaluation of an individual’s hand dexterity, hand coordination, endurance, and other job-specific functions [64–66].

3.2.2. Functional Capacity Evaluation (FCE) Report. The results of the FCE and job evaluation are incorporated into a formal official report which includes the patient’s overall functional capacity in the context of a specified job’s demands. The report should summarize the results and put forth recommendations on the patient’s job-specific physical abilities and how best to move forwards with the RTW process. The patient can then be enrolled in a Functional Restoration Program (FRP), a program that stresses on function: it mixes targeted exercise progression with disability management, psychosocial interventions (e.g., individual or group therapy), education, and cognitive behavioural therapy to achieve predetermined outcomes [67–69], a rehabilitation program that is widely used in other chronic musculoskeletal problems and RTW programs with an emphasis on teamwork between various healthcare professionals. The FRP is aimed at preventing deconditioning and improving general functional capacity in patients.

3.3. Job Evaluation. Job evaluation helps match a patient’s functional evaluation to the job process, ensuring that all parties involved make an informed decision about whether the patient will be able to carry out the required duties given the patient’s current medical and functional ability. Based on the job evaluation, a patient may be advised to RTW on full duties, restricted duties, reduced hours, or modified duties [28, 70–72].

3.4. Return-to-Work Communication. Efficient, timely, proactive, and multidisciplinary team communication is key to a successful RTW program. Employers, healthcare providers, colleagues, and insurance providers understanding patients’ work-related restrictions and medical conditions, as well as extending appropriate support, are vital during the initial RTW period. A flexible work pattern which allows patients to gradually return should be considered to prevent work-
Table 4: Example job evaluation report for patient RTW as a bricklayer.

**Job description:**
The current job is an 8-hour shift starting from 7 am to 4 pm with 1-hour lunch break between 12 pm to 1 pm. As a bricklayer, the individual has to assume various positions during the day ranging from standing, stooping from the lumbar area up to 90 degrees of flexion, squatting with both knees flexion up to 60 degrees, lung position with either leg, kneeling on the floor, and sitting on the floor.
The employee must use various tools and include hammer, vibration tools, lifting heavy objects, and pushing/pulling heavy objects. The weight of the tools ranges between 1 kg and 6 kg.
The amount of weight the employee is expected to lift/carry is up to 18 kg. The amount of weight for push and pull is up to 50 kg on a trolley. 
The % of time for each activity has been divided by calculating the total amount of time spent on performing the specific activity through the day.

**Recommendations:**
Based on the patient’s physical, medical, and disease condition, phased RTW starting with 2 hrs a day is recommended for this patient for the first 3 weeks with the following restrictions.

Note: the patient will be under weekly checks with the rehabilitation team for any graft versus host disease (GVHD) symptoms, in particular hand/wrist GVHD. The RTW plan might change if the patient develops GVHD which might impact on his/her functional ability.

| Activity                  | Actions involved                                      | % of the job process | RTW recommendations                      |
|---------------------------|-------------------------------------------------------|-----------------------|------------------------------------------|
| Standing bricklaying      | Standing on both feet                                  | 40%                   | Standing bricklaying (total time during the shift = 1 hr 30 min) |
| (total time during the shift = 3hrs.) | Stooping between 0 to 60 degrees' lumbar flexion       | 10%                   |                                          |
|                           | Gripping heavily with both hands                        | 30%                   |                                          |
|                           | Lifting weights up to 15 kgs manually                   | 20%                   |                                          |
| Floor tiling              | Kneeling on the floor                                  | 70%                   | Floor tiling (total time during the shift = 20 min)            |
| (total time during the shift = 1 hrs.) | Stooping while kneeling with lumbar in 90 flexion | 20%                   |                                          |
|                           | Hammering the floor                                    | 10%                   |                                          |
| Using of vibration tools  | Heavy gripping                                         | 60%                   | Using of vibration tools (total time during the shift = 10 min) |
| (total time during the shift = 1 hrs.) | Vibration to the hands                               | 40%                   |                                          |
related physical injury or a negative psychological impact. During the RTW period, especially the initial few months, patients must be encouraged to share their concerns and ideas with multidisciplinary team members, including employers, without fear of being confronted [46, 73–75].

The RTW recommendations must be presented via a customized report that is thereafter embedded in the organization’s strategies, framework, and policies to advise employers and employees on the process. The report should be a true reflection of a patient’s ability to do the proposed job as it has been described by the employer, and when possible and applicable, the report should include any necessary restrictions to safeguard the patient. Table 4 gives an example of what should be included in the report.

3.5. Monitoring Progress. The patient will need the most support during the initial stages of RTW not only to integrate back into the workplace but also to face work challenges and make sustainable progress. HCT patients’ medical and physical condition can be unpredictable due to underlying diseases, including GVHD; therefore, the rehabilitation team may need to conduct constant monitoring, and the patient will need to be encouraged to report any changes in their health condition [76–78]. One of the necessary aspects to consider at the initial stages of RTW is the involvement of an occupational therapist to conduct activity and job analysis in order to gain full understanding of the nature of work and its demands [79]. An activity and job analysis can facilitate the identification of equipment, tools, and materials required for the work activity as well as the environmental and social demands of the tasks. Accurate recognition of such factors allows for suitable adaptations and modifications of the rehabilitation programme that would help facilitate a successful RTW. Lack of full understanding of job demands, work environment, and the attitude of the employer, the rehabilitation team will be unable to deliver recommendations that are practical or constructive [79]. Thus, we recommend the monitoring phase to last between 12 to 18 months considering that patients can develop GVHD-related complications up to 2 years posttransplant [80].

4. Limitations

It is important to note that the current paper is based on an existing RTW recommendation model, and expert consensus recommendations that has been adapted from the existing literature that has a proven record in other MSK and disability evaluations for RTW. This is largely attributed to the limited literature on RTW following post-HCT patients and lack of prospective studies and randomized control trials for this targeted patients group and RTW [81]. Furthermore, the current paper falls short by not addressing RTW challenges in terms of the psychological impact due to the disease, quality-of-life complications (e.g., fatigue, depression, and sleep disturbances), and patients who are immunocompromised and suffering from GVHD of internal organs. It is acknowledged that RTW post-HCT is a vast topic, and the current paper attempted to mainly focus on HCT patients returning-to-work for from the rehabilitation professionals’ point of view.

5. Conclusion

The RTW process is a dynamic, individualized process that seeks to optimize a patient’s return to employment. The multidisciplinary team of healthcare professionals, patients, caregivers, and other stakeholders involved in HCT patient care often highlights the many personal and external factors that affect the successful reintegration of patients into the workforce. Variability in current programs and recommendations highlights the lack of clear guidance on when and how to conduct an RTW assessment and on the components that should be included in the assessment. The current paper provides a general overview of various components of the RTW process and the challenges faced by HCT patients. Future research directions include the development of RTW recommendations for HCT patients that can be applied both in the US and abroad. Additionally, future research needs to explore how HCT patients’ presentation fits into the ICF classification system as well as the applicability of this classification in RTW recommendations.

Conflicts of Interest

None of the authors declare any relevant conflicts of interest.

Authors’ Contributions

JM, SH, and AG worked on the first draft of the manuscript. All authors contributed substantially to the analysis and interpretation of the data for the work.

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References

[1] E. Johansson, J. Larsen, T. Schempp, L. Jonsson, and J. Winterling, “Patients’ goals related to health and function in the first 13 months after allogeneic stem cell transplantation,” Supportive Care in Cancer, vol. 20, no. 9, pp. 2025–2032, 2012.
[2] E. A. Copelan, “Hematopoietic stem-cell transplantation,” The New England Journal of Medicine, vol. 354, no. 17, pp. 1813–1826, 2006.
[3] A. E. Young, “An exploration of alternative methods for assessing return-to-work success following occupational injury,” Disability and Rehabilitation, vol. 36, no. 11, pp. 914–924, 2014.
[4] K. Kenzik, L.-C. Huang, J. D. Rizzo, E. Shenkman, and J. Wingard, “Relationships among symptoms, psychosocial factors, and health-related quality of life in hematopoietic stem cell transplant survivors,” Supportive Care in Cancer, vol. 23, no. 3, pp. 797–807, 2015.
[5] S. R. Smith and A. Asher, "Rehabilitation in chronic graft-versus-host disease," *Physical Medicine and Rehabilitation Clinics of North America*, vol. 28, no. 1, pp. 143–151, 2017.

[6] H. Goker, I. C. Haznedaroglu, and N. J. Chao, "Acute graft-vs-host disease: pathobiology and management," *Experimental Hematology*, vol. 29, no. 3, pp. 259–277, 2001.

[7] S. J. Lee, G. Vogelsang, and M. E. D. Flowers, "Chronic graft-versus-host disease," *Biology of Blood and Marrow Transplantation*, vol. 9, no. 4, pp. 215–233, 2003.

[8] T. B. Üstün, S. Chatterji, J. Bickenbach, N. Kostanjsek, and M. Schneider, "The international classification of functioning, disability and health: a new tool for understanding disability and health," *Disability and Rehabilitation*, vol. 25, no. 11-12, pp. 565–571, 2003.

[9] N. Krause, L. K. Dasinger, and F. Neuhauser, "Modified work and return to work: a review of the literature," *Journal of Occupational Rehabilitation*, vol. 8, no. 2, pp. 113–139, 1998.

[10] I. Z. Schultz, A. W. Stowell, M. Feuerstein, and R. J. Gatchel, "Models of return to work for musculoskeletal disorders," *Journal of Occupational Rehabilitation*, vol. 17, no. 2, pp. 327–352, 2007.

[11] C. Briand, M.-J. Durand, L. St-Arnaud, and M. Corbière, "Work and mental health: learning from return-to-work rehabilitation programs designed for workers with musculoskeletal disorders," *International Journal of Law and Psychiatry*, vol. 30, no. 4-5, pp. 444–457, 2007.

[12] M. T. Knauf, I. Z. Schultz, A. M. Stewart, and R. J. Gatchel, "Models of return to work for musculoskeletal disorders: advances in conceptualization and research," in *Handbook of musculoskeletal pain and disability disorders in the workplace*, pp. 431–452, Springer, New York, NY, 2014.

[13] M. Bains, J. Yarker, Z. Amir, P. Wynn, and F. Munir, "Helping cancer survivors return to work: what providers tell us about the challenges in assisting cancer patients with work questions," *Journal of Occupational Rehabilitation*, vol. 22, no. 1, pp. 71–77, 2012.

[14] F. P. Froment, K. A. Olson, T. L. Hooper et al., "Large variability found in musculoskeletal physiotherapy scope of practice throughout WCPT and IFOMPT affiliated countries: an international survey," *Musculoskeletal Science & Practice*, vol. 42, pp. 104–119, 2019.

[15] H. A. Désiron, P. Donceel, L. Godderis, E. van Hoof, and A. de Rijk, "What is the value of occupational therapy in return to work for breast cancer patients? A qualitative inquiry among experts," *European Journal of Cancer Care*, vol. 24, no. 2, pp. 267–280, 2015.

[16] M. Lydell, B. Grahn, J. Månsson, A. Baigi, and B. Marklund, "Predictive factors of sustained return to work for persons with musculoskeletal disorders who participated in rehabilitation," *Work*, vol. 33, no. 3, pp. 317–328, 2009.

[17] H. A. Désiron, A. de Rijk, E. van Hoof, and P. Donceel, "Occupational therapy and return to work: a systematic literature review," *BMC Public Health*, vol. 11, no. 1, 2011.

[18] C. Poullain, S. Kernéis, S. Rozenberg, B. Faurel, P. Bourgeois, and V. Foltz, "Long-term return to work after a functional restoration program for chronic low-back pain patients: a prospective study," *European Spine Journal*, vol. 19, no. 7, pp. 1153–1161, 2010.

[19] F. L. Wong, A. Bosworth, R. Danan et al., "Neurocognitive Function and its Impact on Return to Work in Patients Treated with Hematopoietic Cell Transplantation (HCT)," *American Society of Hematology*, vol. 114, no. 22, p. 521, 2009.

[20] A. M. Braamse, J. C. Yi, O. J. Visser et al., "Developing a risk prediction model for long-term physical and psychological functioning after hematopoietic cell transplantation," *Biology of Blood and Marrow Transplantation*, vol. 22, no. 3, pp. 549–556, 2016.

[21] T. A. Horsboel, U. Bültmann, C. V. Nielsen, B. Nielsen, N. T. Andersen, and A. de Thurah, "Are fatigue, depression and anxiety associated with labour market participation among patients diagnosed with haematological malignancies? A prospective study," *Psycho-Oncology*, vol. 24, no. 4, pp. 408–415, 2015.

[22] K. L. Syrjala, S. L. Langer, J. R. Abrams et al., "Recovery and long-term function after hematopoietic cell transplantation for leukemia or lymphoma," *Journal of the American Medical Association*, vol. 291, no. 19, pp. 2335–2343, 2004.

[23] S. F. Huntington, B. M. Weiss, D. T. Vogl et al., "Financial toxicity in insured patients with multiple myeloma: a cross-sectional pilot study," *Lancet Haematol.*, vol. 2, no. 10, pp. e408–e416, 2015.

[24] T. Svensson, U. Müssener, and K. Alexander, "Pride, empowerment, and return to work: on the significance of promoting positive social emotions among sickness absentees," *Work*, vol. 27, no. 1, pp. 57–65, 2006.

[25] A. Bryngelson, "Long-term sickness absence and social exclusion," *Scandinavian Journal of Public Health*, vol. 37, no. 8, pp. 839–845, 2009.

[26] G. Pransky, R. Gatchel, S. J. Linton, and P. Loisel, "Improving return to work research," *Journal of Occupational Rehabilitation*, vol. 15, no. 4, pp. 453–457, 2005.

[27] A. Haag, C. M. Kalina, R. Tourigian, and M. L. Wassel, "What are restricted duty, light duty, and transitional duty, and the implications of each for case management practice?" *AAOHN Journal*, vol. 50, no. 10, pp. 437–440, 2002.

[28] S. J. Isernhagen, "Job matching and return to work: occupational rehabilitation as the link," *Work*, vol. 26, no. 3, pp. 237–242, 2006.

[29] G. C. C. Chien, B. M. England, and A. Haroutunian, "Functional capacity evaluation," in *Pain*, pp. 1081–1083, Springer, Cham, 2019.

[30] S. A. Burke, C. K. Harms-Constas, and P. S. Aden, "Return to work/work retention outcomes of a functional restoration program. A multi-center, prospective study with a comparison group." *Spine*, vol. 19, no. 17, pp. 1880–1885, 1994, discussion 6.

[31] L. M. Wu, N. Kuprian, K. Herbert et al., "A mixed methods analysis of perceived cognitive impairment in hematopoietic stem cell transplant survivors," *Palliative & Supportive Care*, vol. 17, no. 4, pp. 396–402, 2019.

[32] A. C. Kirchhoff, W. Leisenring, and K. L. Syrjala, "Prospective predictors of return to work in the 5 years after hematopoietic cell transplantation," *Journal of Cancer Survivorship*, vol. 4, no. 1, pp. 33–44, 2010.

[33] S. Paltrinieri, S. Fugazzaro, L. Bertozzi et al., "Return to work in European cancer survivors: a systematic review," *Supportive Care in Cancer*, vol. 26, no. 9, pp. 2983–2994, 2018.

[34] A. G. E. M. de Boer, T. K. Taskila, S. J. Tamminga et al., "Interventions to enhance return-to-work for cancer patients," *Cochrane Database of Systematic Reviews*, no. 9, 2015.

[35] M. I. Fitch and I. Nicoll, "Returning to work after cancer: survivors’, caregivers’, and employers’ perspectives," *Psycho-Oncology*, vol. 28, no. 4, pp. 792–798, 2019.
[36] E. R. Spelten, M. A. G. Sprangers, and J. H. A. M. Verbeek, “Factors reported to influence the return to work of cancer survivors: a literature review,” Psycho-Oncology, vol. 11, no. 2, pp. 124–131, 2002.

[37] N. Hoefsmit, I. Houkes, and F. Nijhuis, “Environmental and personal factors that support early return-to-work: a qualitative study using the ICF as a framework,” Work, vol. 48, no. 2, pp. 203–215, 2014.

[38] E. Spelten, J. Verbeek, A. Uitterhoeve et al., “Cancer, fatigue and the return of patients to work—a prospective cohort study,” European Journal of Cancer, vol. 39, no. 11, pp. 1562–1567, 2003.

[39] S. Q. Fantoni, C. Peugniez, A. Duhamel, J. Skrzypczak, V. Albert, and the return of patients to work and the return of patients to work in cancer patients,” Psycho-Oncology, vol. 22, no. 3, pp. 659–667, 2013.

[40] A. G. E. M. de Boer, J. Verbeek, E. Spelten et al., “Work ability and return-to-work in cancer patients,” British Journal of Cancer, vol. 98, no. 8, pp. 1342–1347, 2008.

[41] S. J. Tammings, A. G. E. M. de Boer, J. H. A. M. Verbeek, and M. H. W. Frings-Dresen, “Breast cancer survivors’ views of factors that influence the return-to-work process—a qualitative study,” Scandinavian Journal of Work, Environment & Health, vol. 38, no. 2, pp. 144–154, 2012.

[42] F. Schaafsma, N. Hugenholtz, A. de Boer, P. Smits, C. Hulshof, and F. J. H. van Dijk, “Enhancing evidence-based advice of occupational health physicians,” Scandinavian Journal of Work, Environment & Health, vol. 33, no. 5, pp. 368–378, 2007.

[43] G. S. Pransky, W. S. Shaw, R. L. Franche, and A. Clarke, “Disability prevention and communication among workers, physicians, employers, and insurers—current models and opportunities for improvement,” Disability and Rehabilitation, vol. 26, no. 11, pp. 625–634, 2004.

[44] J. Yarker, F. Munir, M. Bains, K. Kalawsky, and C. Haslam, “The role of communication and support in return to work following cancer-related absence,” Psycho-Oncology, vol. 19, no. 10, pp. 1078–1085, 2010.

[45] J. Mohammed, A. AlGhamdi, and S. K. Hashmi, “Full-body physical therapy evaluation for pre- and post-hematopoietic cell transplant patients and the need for a modified rehabilitation musculoskeletal specific grading system for chronic graft-versus-host disease,” Bone Marrow Transplantation, vol. 53, no. 5, pp. 625–627, 2018.

[46] J. A. Fein, A. Shimoni, M. Labopin et al., “The impact of individual comorbidities on non-relapse mortality following allelogeneic hematopoietic stem cell transplantation,” Leukemia, vol. 32, no. 8, pp. 1787–1794, 2018.

[47] M.-J. Durand, M. Corbière, M.-F. Coutu, D. Reinharz, and V. Albert, “A review of best work-absence management and return-to-work practices for workers with musculoskeletal or common mental disorders,” Work, vol. 48, no. 4, pp. 579–589, 2014.

[48] K. Nieuwenhuijsen, D. Bruinvels, and M. Frings-Dresen, “Psychosocial work environment and stress-related disorders, a systematic review,” Occupational Medicine, vol. 60, no. 4, pp. 277–286, 2010.

[49] S. Tammings, A. G. E. M. de Boer, J. H. A. M. Verbeek, and M. H. W. Frings-Dresen, “Return-to-work interventions integrated into cancer care: a systematic review,” Occupational and Environmental Medicine, vol. 67, no. 5, pp. 639–648, 2010.

[50] M. Stergiou-Kita, C. Pritlove, D. L. Holness et al., “Am I ready to return to work? Assisting cancer survivors to determine work readiness,” Journal of Cancer Survivorship, vol. 10, no. 4, pp. 699–710, 2016.

[51] M. Streibelt, C. Blume, K. Thren, M. F. Reneman, and W. Mueller-Fahrnow, “Value of functional capacity evaluation information in a clinical setting for predicting return to work,” Archives of Physical Medicine and Rehabilitation, vol. 90, no. 3, pp. 429–434, 2009.

[52] D. P. Gross and M. C. Battié, “Functional capacity evaluation performance does not predict sustained return to work in claimants with chronic back pain,” Journal of Occupational Rehabilitation, vol. 15, no. 3, pp. 285–294, 2005.

[53] M. Edelaar, P. R. Oesch, D. P. Gross, C. L. James, and M. F. Reneman, “Functional capacity evaluation research: report from the fourth international functional capacity evaluation research meeting,” Journal of Occupational Rehabilitation, vol. 30, no. 3, pp. 475–479, 2020.

[54] R.-L. Franche and N. Krause, “Readiness for return to work following injury or illness,” in Handbook of complex occupational disability claims, pp. 67–91, Springer, Boston, MA, 2008.

[55] S. J. Isernhagen, “Functional capacity evaluation: rationale, procedure, utility of the kinesiophysical approach,” Journal of Occupational Rehabilitation, vol. 2, no. 3, pp. 157–168, 1992.

[56] P. N. Brubaker, F. J. Fearon, S. M. Smith et al., “Sensitivity and specificity of the Blankenship FCE system’s indicators of submaximal effort,” The Journal of Orthopaedic and Sports Physical Therapy, vol. 37, no. 4, pp. 161–168, 2007.

[57] H. KaiserFaller, M. Kersting, and H. M. Schian, “Der Stellenwert des Arbeitssimulationsgerätes ERGOS als Bestandteil der leistungsdiagnostischen Begutachtung,” Die Rehabilitaion, vol. 9, no. 3, pp. 173–184, 1990.

[58] R. Soer, E. Gerrits, and M. Reneman, “Test-retest reliability of a WRULD functional capacity evaluation in healthy adults,” Work, vol. 26, no. 3, pp. 273–280, 2006.

[59] V. Gouttebarg, H. Wind, P. P. Kuijer, J. K. Sluiter, and M. H. Frings-Dresen, “Reliability and agreement of 5 ergo-kit functional capacity evaluation lifting tests in subjects with low back pain,” Archives of Physical Medicine and Rehabilitation, vol. 87, no. 10, pp. 1365–1370, 2006.

[60] W. S. Shaw, D. A. van der Windt, C. J. Main, P. Loisel, S. J. Lint, and the “Decade of the Flags” Working Group, “Early patient screening and intervention to address individual-level occupational factors ("blue flags") in back disability,” Journal of Occupational Rehabilitation, vol. 19, no. 1, pp. 64–80, 2009.

[61] H. Gray and T. Howe, “Physiotherapists’ assessment and management of psychosocial factors (yellow and blue flags) in individuals with back pain,” The Physical Therapy Review, vol. 18, no. 5, pp. 379–394, 2013.

[62] N. Hollak, R. Soer, L. H. van der Woude, and M. F. Reneman, “Towards a comprehensive functional capacity evaluation for hand function,” Applied Ergonomics, vol. 45, no. 3, pp. 686–692, 2014.
[65] G. S. Fisher, “Administration and application of the worker role interview: looking beyond functional capacity,” *Work*, vol. 12, no. 1, pp. 13–24, 1999.

[66] R. Soer, C. P. van der Schans, J. W. Groothoff, J. H. B. Geertzen, and M. F. Reneman, “Towards consensus in operational definitions in functional capacity evaluation: a Delphi Survey,” *Journal of Occupational Rehabilitation*, vol. 18, no. 4, pp. 389–400, 2008.

[67] S. Fardjad, et al., “A functional restoration program (FRP) in chronic low back pain is efficient both in labours and in sedentary workers,” *Annals of Physical and Rehabilitation Medicine*, vol. 61, 2018.

[68] I. Caby, N. Olivier, F. Janik, J. Vanvelcenaher, and P. Pelayo, “A Controlled and Retrospective Study of 144 Chronic Low Back Pain Patients to Evaluate the Effectiveness of an Intensive Functional Restoration Program in France,” *Healthcare*, vol. 4, no. 2, p. 23, 2016.

[69] T. G. Mayer and R. J. Gatchel, *Functional Restoration for Spinal Disorders: The Sports Medicine Approach*, Lea and Febiger, Philadelphia, PA, 1999.

[70] W. Kuijer, P. U. Dijkstra, S. Brouwer, M. F. Reneman, J. W. Groothoff, and J. H. B. Geertzen, “Safe lifting in patients with chronic low back pain: comparing FCE lifting task and Niosh lifting guideline,” *Journal of Occupational Rehabilitation*, vol. 16, no. 4, pp. 579–589, 2006.

[71] W. Karwowski, R.-L. Jang, D. Rodrick, P. M. Quesada, and S. N. Cronin, “Self-evaluation of biomechanical task demands, work environment and perceived risk of injury by nurses: a field study,” *Occupational Ergonomics*, vol. 5, no. 1, pp. 13–27, 2005.

[72] R. L. Heneman and P. V. LeBlanc, “Work valuation addresses shortcomings of both job evaluation and market pricing,” *Compensation and Benefits Review*, vol. 35, no. 1, pp. 7–11, 2003.

[73] K. Nieuwenhuijzen, B. Bos-Ransdorp, L. L. J. Uitterhoeve, M. A. G. Sprangers, and J. H. A. M. Verbeek, “Enhanced provider communication and patient education regarding return to work in cancer survivors following curative treatment: a pilot study,” *Journal of Occupational Rehabilitation*, vol. 16, no. 4, pp. 647–657, 2006.

[74] Å. Tjulin, E. Maceachen, E. E. Stiwe, and K. Ekberg, “The social interaction of return to work explored from co-workers experiences,” *Disability and Rehabilitation*, vol. 33, no. 21-22, pp. 1979–1989, 2011.

[75] A. Bender and P. Farvolden, “Depression and the workplace: a progress report,” *Current Psychiatry Reports*, vol. 10, no. 1, pp. 73–79, 2008.

[76] A. E. Young, R. Wasiak, R. T. Roessler, K. M. McPherson, J. R. Anema, and M. N. M. van Poppel, “Return-to-work outcomes following work disability: stakeholder motivations, interests and concerns,” *Journal of Occupational Rehabilitation*, vol. 15, no. 4, pp. 543–556, 2005.

[77] S. Brouwer, M. F. Reneman, U. Bültmann, J. J. L. van der Klink, and J. W. Groothoff, “A prospective study of return to work across health conditions: perceived work attitude, self-efficacy and perceived social support,” *Journal of Occupational Rehabilitation*, vol. 20, no. 1, pp. 104–112, 2010.

[78] PEARL and University of Plymouth PERRL, 2017, https://pearl.plymouth.ac.uk/bitstream/handle/10026.19870/RTW%20pain%20poster.pdf?sequence=1.

[79] M. Joss, “The importance of job analysis in occupational therapy,” *British Journal of Occupational Therapy*, vol. 70, no. 7, pp. 301–303, 2007.

[80] K. Atkinson, M. Cohen, and J. Biggs, “Avascular necrosis of the femoral head secondary to corticosteroid therapy for graft-versus-host disease after marrow transplantation: effective therapy with hip arthroplasty,” *Bone Marrow Transplantation*, vol. 2, no. 4, pp. 421–426, 1987.

[81] N. S. Bhatt, J. D. Rizzo, and N. S. Majhail, “Screening and prevention guidelines for hematopoietic cell transplant survivors,” in *Blood and Marrow Transplantation Long Term Management*, pp. 80–91, Wiley, 2021.

[82] D. Couriel, H. Caldera, R. Champlin, and K. Komanduri, “Acute graft-versus-host disease: pathophysiology, clinical manifestations, and management,” *Cancer*, vol. 101, no. 9, pp. 1936–1946, 2004.

[83] S. R. Smith, A. J. Haig, and D. R. Couriel, “Musculoskeletal, neurologic, and cardiopulmonary aspects of physical rehabilitation in patients with chronic graft-versus-host disease,” *Biology of Blood and Marrow Transplantation*, vol. 21, no. 5, pp. 799–808, 2015.

[84] G. B. Vogelsang, L. Lee, and D. M. Bensen-Kennedy, “Pathogenesis and treatment of graft-versus-host disease after bone marrow transplant,” *Annual review of medicine*, vol. 54, no. 1, pp. 29–52, 2003.

[85] X. Li, R. Brazauskas, Z. Wang et al., “Avascular necrosis of bone after allogeneic hematopoietic cell transplantation in children and adolescents,” *Biology of Blood and Marrow Transplantation*, vol. 20, no. 4, pp. 587–592, 2014.

[86] M. Kopp, B. Holzner, V. Meraner et al., “Quality of life in adult hematopoietic cell transplant patients at least 5 yr after treatment: a comparison with healthy controls,” *European journal of haematology.*, vol. 74, no. 4, pp. 304–308, 2005.

[87] M. Tomblyn, T. Chiller, H. Einsele et al., “Guidelines for preventing infectious complications among hematopoietic cell transplant recipients: a global perspective,” *Bone marrow transplantation*, vol. 44, no. 8, pp. 453–455, 2009.

[88] A. A. Pruitt, F. Graus, and M. R. Rosenfeld, “Neurological complications of transplantation: part I: hematopoietic cell transplantation,” *The Neurohospitalist*, vol. 3, no. 1, pp. 24–38, 2013.

[89] A. Cieza, N. Fayad, J. Bickenbach, and B. Prodinger, “Refinements of the ICF linking rules to strengthen their potential for establishing comparability of health information,” *Disability and Rehabilitation*, vol. 41, no. 5, pp. 574–583, 2019.

[90] H. S. Jim, G. P. Quinn, C. K. Gwede et al., “Patient education in allogeneic hematopoietic cell transplant: what patients wish they had known about quality of life,” *Bone marrow transplantation*, vol. 49, no. 2, pp. 299–303, 2014.

[91] H. S. Jim, K. L. Syrjala, and D. Rizzo, “Supportive care of hematopoietic cell transplant patients,” *Biology of Blood and Marrow Transplantation*, vol. 18, no. 1, pp. S12–S16, 2012.

[92] N. Treister, X. Chai, B. Kurland et al., “Measurement of oral chronic GVHD: results from the chronic GVHD consortium,” *Bone marrow transplantation*, vol. 48, no. 1128, pp. 1123–1128, 2013.

[93] L. Cooke, R. Gemmill, K. Kravits, and M. Grant, “Psychological Issues of Stem Cell Transplant,” *Seminars in Oncology Nursing*, vol. 25, no. 2, pp. 139–150, 2009.

[94] R. Gemmill, L. Cooke, A. C. Williams, and M. Grant, “Informal caregivers of hematopoietic cell transplant patients: a review and recommendations for interventions and research,” *Cancer Nursing*, vol. 34, no. 6, 2011.
[95] K. J. Wells, M. Booth-Jones, and P. B. Jacobsen, “Do coping and social support predict depression and anxiety in patients undergoing hematopoietic stem cell transplantation?,” *Journal of psychosocial oncology.*, vol. 27, no. 3, pp. 297–315, 2009.

[96] E. P. Alyea, H. T. Kim, V. Ho et al., “Comparative outcome of nonmyeloablative and myeloablative allogeneic hematopoietic cell transplantation for patients older than 50 years of age,” *Blood*, vol. 105, no. 4, pp. 1810–1814, 2005.

[97] T. Hahn, P. L. McCarthy Jr., A. Hassebroek et al., “Significant improvement in survival after allogeneic hematopoietic cell transplantation during a period of significantly increased use, older recipient age, and use of unrelated donors,” *Journal of Clinical Oncology*, vol. 31, no. 19, pp. 2437–2449, 2013.

[98] R. B. Salit, S. J. Lee, L. J. Burns et al., “Guidelines and support for return to work after hematopoietic cell transplantation,” *Biology of Blood and Marrow Transplantation*, vol. 25, no. 3, pp. S376–S377, 2019.