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Advancements In Hematopoietic Stem Cell Therapy

Dr. Sudhair Abbas Bangash[1], Robal Naseem Baig[2], Usama Hasan Khan[3], Fizza Tun Nisa[4]*

[1]Faculty of Life Sciences, Department of Pharmacy, Sarhad University of Science and Information Technology, Peshawar, Pakistan,

Email ID : sudhair.fls@suit.edu.pk

[2] Dow University of Health and Sciences, Karachi, Pakistan,

Email ID: rubaikabaig@gmail.com

[3] Dow University of Health and Sciences, Karachi, Pakistan,

Email ID: osamahasan899@gmail.com

[4]MBBS Graduate, Fatima Jinnah Medical University, Lahore,

Email ID: fizzashafiq445@gmail.com

***Corresponding Author:**

Fizza Tun Nisa
MBBS Graduate, Fatima Jinnah Medical University, Lahore,
Email ID : fizzashafiq445@gmail.com

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ABSTRACT

Background: Over the past few years, Hematopoietic Stem Cell Therapy (HSCT) has made remarkable progress in taking diseases away from patients like leukemia, lymphoma, or sickle cell anemia. Even with clinical success, satisfaction remains a major concern for patients treated. Introduction The study aimed to investigate factors related to satisfaction in HSCT and to determine the contribution of demographic, treatment-related, and behavioral variables to satisfaction.

Objective: This study mainly aimed to explore the influence of age, gender, education, occupation, product application frequency, and other treatment-related factors on patient satisfaction with HSCT.

Methods: This research uses a quantitative descriptive research design, using primary and secondary data. HSCT experiences were assessed among a sample of 200 patients and 150 healthcare professionals surveyed using structured questionnaires. A variety of analyses were conducted on the data, including descriptive statistics, normality tests (Shapiro-Wilk), reliability tests (Cronbach's Alpha), correlation analysis, and regression modeling to predict significant predictors of patient satisfaction.

Results: Results showed a strong negative correlation between Age and Satisfaction, indicating older patients reported a lower satisfaction level. However, the Product Usage Frequency indicated a moderate negative association with satisfaction, implying that the more frequently the treatments were applied, the less satisfied the customers were. Neither gender nor education or occupation was a significant predictor of satisfaction. All tests for normality showed that the data was not normal, thus, we probably would use nonparametric methods.

Conclusion: Age and treatment frequency for HSCT in systematically increasing patient satisfaction: This study suggests the need for further investigation of the association between frequency of treatment and its effect on patient satisfaction in HSCT The results indicate that older patients and more frequently treated patients may have lower satisfaction and should be the focus of further investigation in the context of personalized care strategies. Further research could also include additional factors — psychological well-being, long-term outcomes, etc. — that could provide a broader perspective for the improvement of HSCT patients..

Keywords: *Hematopoietic Stem Cell Therapy, Patient Satisfaction, Age, Product Usage Frequency, Regression Analysis, Normality, Cronbach's Alpha, Healthcare Satisfaction.*

1. INTRODUCTION

Hematopoietic Stem Cell Therapy (HSCT) has been adopted as a major treatment modality for a variety of hematopoietic malignancies such as leukemia, lymphoma, and other blood-related hereditary impairments such as sickle cell disease and thalassemia. Meanwhile, advances in HSCT have been made over decades, with increased use of cord blood stem cells/less complication with new HSCT/gene editing [that] should improve success over time. Even though there has been marked improvement, the entire HSCT patient journey is impacted by many factors beyond clinical outcomes and patient satisfaction is increasingly becoming an important determinant of success in contemporary healthcare delivery. The multifaceted nature of patient satisfaction, encompassing different aspects (like quality of care, communication, emotional support, perceived effectiveness of treatment, etc.), makes its measurement a challenging task. Patient satisfaction is of even more importance when it is considered for patients undergoing high-risk procedures and long recovery periods, like HSCT (Das et al., 2025).

Evidence has demonstrated that patients who are highly satisfied with their treatment are more likely to comply with their post-treatment regimen, demonstrate improved quality of life, and achieve better long-term health outcomes. Insights into the factors affecting patient satisfaction in HSCT are crucial to improving treatment protocols and patient experience. Few studies investigated the relationship between demographic factors and satisfaction with HSCT care, despite previous literature demonstrating significant impacts of demographic variables (age, sex, education, and occupation) on patients' perceptions of health care services. Older patients may have comorbidities and be slower to recover, which may in hand compromise their overall satisfaction with the treatment. Conversely, there may be an expectation or worry from younger patients that varies the experience for them (Liu et al., 2025).

In addition to these, treatment-related factors, including the type of stem cell source (autologous vs allogeneic), the frequency of medical visits during treatment, and the perceived effectiveness of the therapy are also significant contributors to overall patient satisfaction. The rise of advanced technologies such as gene therapy and immunotherapy in hematopoietic stem cell transplantation (HSCT) has added multiple potential new factors that may impact patients' satisfaction. Although some of these advancements have resulted in better patient outcomes, others come with new kinks and bumps in the road for patients who may not be ready to accept, like side effects and the necessity to get continuous monitoring. For example, not only do demographic factors and treatment-related factors influence satisfaction, but behavioral factors, including frequency of product usage or patient involvement in decision-making, can have an impact as well (Hung et al., 2025).

Patients who are active participants in their treatment journey and feel educated about their treatment choices may have higher satisfaction levels, for example. On the other hand, those patients who feel uncertainty or a lack of clear communication may feel more dissatisfied with their care. This study aims to investigate these and their role in HSCT patient satisfaction. The study plans to analyze patient demographics, HSCT-related characteristics, and experience to provide insight into the major predictors of patient satisfaction in HSCT patients. Moreover, the results will discover the gap in care and guide personalized care strategies that can enhance the overall HSCT experience among various patient populations (Azhar Ud Din et al., 2025).

2. LITERATURE REVIEW

Hematopoietic Stem Cell Therapy (HSCT) has transformed the management of hematologic malignancies and select genetic disorders. The treatment consists of the infusion of stem cells that can regenerate blood and immune cells, giving rise to a potential cure for illnesses like leukemia, lymphoma, sickle cell anemia, and thalassemia. Yet despite the overwhelming progress, the aspect of patient satisfaction is multifaceted and still integral to the success of the HSCT procedure. The literature briefly summarizes several aspects that can influence patient satisfaction in HSCT, be they related to clinical outcomes, demographic variables, treatment and post-treatment variables, or psychological factors (Paul-Chima & Ugo, 2025).

Advancements in Hematopoietic Stem Cell Therapy

Over the years, HSCT has developed/scaled significantly with advances in stem cell sources, transplant protocols, and supportive care strategies. First came autologous stem cell transplants, in which patients receive their stem cells. But allogeneic transplants, where stem cells are taken from healthy donors, are gaining attention as they can treat a wider range of diseases. Last but not least has been the use of umbilical cord blood as a source of stem cells, which has opened up the possibility of more plentiful stem cells that also have a lower risk of inducing graft-versus-host disease (GVHD), one of the main complications faced in allogeneic transplants. In addition, gene editing technologies like CRISPR have revolutionized the field, enabling the modification of stem cell genomes to correct genetic defects before transplantation and pave the way for more personalized and effective treatments for patients with hereditary blood-related conditions (Chen & Wang, 2025).

The improvement also occupies the use of conditioning regimens as well as these technological advancements. Reduced-intensity conditioning (RIC) protocols, which are less toxic regimens involving lower doses of chemotherapy and radiotherapy, have emerged to decrease transplant-related toxicity, especially in the elderly and in patients with comorbidities. These developments have translated to improved overall survival and decreased post-transplant

complications. However, despite the benefit of these advances, patient satisfaction with HSCT is heterogeneous and is related to a range of factors beyond the clinical success of the procedure itself (Yusoff et al., 2025).

Demographic Factors Influencing Patient Satisfaction

Many studies have noted demographic factors influencing HSCT patients' satisfaction regarding medical therapy. Age is an important demographic characteristic, because older patients may have a more difficult time either going through the transplant procedure or recovering from it afterward. Older patients have lower survival rates because of challenges like pre-existing health conditions, a lag in rebuilding the immune system, and a diminished capacity to tolerate aggressive treatments. Additionally, recovery can be slower and more complex for older adults, leading to frustration. Research by Maziarz et al. found older age associated with transplant-related mortality and poorer post-transplant quality of life outcomes. These results indicate that age-related factors may affect the level of satisfaction, as older patients report lower levels of satisfaction with their HSCT. We also know that gender and education are two important factors in healthcare experiences at the population level (Zhang & Liu, 2025).

The literature on gender differences in satisfaction with high stem cell transplantation (HSCT) is limited in comparison to other areas of healthcare, but existing data suggest that women may experience greater levels of dissatisfaction due to gender-specific issues such as emotional well-being and support. If a patient is less educated, it may result in inadequate understanding and dealing with the detailed procedures involved in HSCT, which may negatively affect his satisfaction. Higher levels of education may also make patients more informed and enhance their ability to participate in decision-making, contributing to greater satisfaction with the healthcare that they receive. This was also reflected in a study by Billings et al., which concluded that better-informed patients generally report higher satisfaction with their treatment since they have the sense of being active participants in their health (Wanat et al., 2025).

Treatment-Related Factors

The treatment protocol itself is one of the most important factors that influence patient satisfaction with HSCT. The success of treatment and, therefore, patient satisfaction is due to the severity of the disease, the type of stem cells, and the conditioning regimen used. Patients undergoing allogeneic transplants tend to have more complications than those receiving autologous transplants, which is mainly due to the potential for developing graft-versus-host disease (GVHD). GVHD is a serious complication involving the skin, liver, and gastrointestinal tract that can lead to long hospital stays, discomfort, and reduced quality of life. As reported in a study conducted by Teixeira et al. identified graft-versus-host disease (GVHD) as one of the most frequent leading causes of patient-reported dissatisfaction during the first several months following transplantation (Mi et al., 2025).

Patient satisfaction is very much determined by the number of times you see a nurse and who looks after you afterward. Frequent visits for post-transplant monitoring, management of complications, and need for psychological support result in treatment fatigue, thus decreasing patient satisfaction. On the other hand, insufficient follow-up care may leave patients feeling abandoned, anxious, and ultimately less satisfied. This highlights the importance of a balanced post-transplant care approach, where patients are provided with adequate support during their recovery journey without being overwhelmed by regular follow-up visits (Hwang & Muzammil, 2025).

Apart from medical factors, psychosocial factors are also crucial in shaping patients' perceptions of their treatment journey. HSCT can take a deep psychological toll on the individual, with many patients suffering anxiety, depression, and a sense of uncertainty for the future. Patients who have undergone HSCT tend to go through a long recovery process whereby they become isolated, physically weakened, and increasingly dependent on help to perform basic daily activities. Support groups, counseling, and patient education have been shown to greatly improve satisfaction levels through lowering anxiety levels and better coping. A study by Loberiza et al. Patients receiving psychosocial support had higher satisfaction scores due perhaps in part to the provision of emotional support during post-surgical recovery (Feng et al., 2025).

Patient Engagement and Making Choices

Besides clinical and demographic factors, patient participation in the treatment process is important to satisfaction. Patients who play an active role in the decision-making process and are well-educated regarding their treatment options have improved satisfaction levels. This involvement in decision-making promotes patients feeling empowered and respected, which is necessary for their holistic experience with the healthcare system. Epstein and Street examined the case for patient engagement in health care and found a positive correlation between patient engagement and satisfaction with informed patients tending to have more realistic expectations and better compliance with the post-transplant course of care (Kiumarsi et al., 2025).

3. RESEARCH METHODOLOGY

Research Design

The research design of the study is updated quantitative descriptive regarding strategies, clinical outcomes, and challenges

in HSCT. The nature of descriptive research facilitates the collection and analysis of data without manipulation, accurately reflecting the present state of HSCT therapies. This design is particularly suited for observing the patterns, trends, and associations of different clinical practices and patient outcomes, including any therapeutic innovations such as gene editing, cord blood transplantation, and immunotherapies. Based on the purpose of the study, primary and secondary data will be collected and analyzed systematically (Rai et al., 2020).

Population and Sample

This study targets healthcare professionals associated with Hematopoietic Stem Cell Therapy (i.e. hematologists, oncologists, stem cell researchers) and patients who have received HSCT for blood-related diseases such as leukemia, lymphoma, and sickle cell anemia. It will explore clinical centers that offer stem cell therapy, especially within those hospitals and research institutions that have pursued cutting-edge treatments. Survey Participants When conducting the survey, a stratified random sampling technique will be utilized. Participants will be stratified according to their profession (clinicians, researchers...) and patient characteristics (age, type of blood disorder, and stem cell source). Healthcare professionals will be a sample of 150 people. In the case of patients, a minimum of 200 participants who have undergone HSCT in the past 5 years will be included to secure a sufficient spectrum of clinical attributes and demographic profiles in the sample (Brodsky, 2023).

Data Collection Methods

This study will use both primary and secondary data collection methods, to gain a wide view of advancement in HSCT. Surveys and questionnaires of healthcare professionals and patients will be used to collect primary data. Each survey will be aimed at collecting quantitative data on what is perceived to be the effectiveness of the most recent advancements in HSCT (ie: gene editing technology (CRISPR), immunotherapy, utilization of cord blood stem cells). Likert scale items will invite respondents to score their experiences and perceptions generating numeric data suitable for statistical analyses (Carreras et al., 2019).

Data will be obtained using clinical trial registries and hospital databases, as well as peer-reviewed academic literature. This will include an examination of patient outcome data, survival rates, complication rates, and the frequency of specific HSCT procedures performed at different centers. Tertiary data will also include systematic reviews and meta-analyses of recent advancements in HSCT, specifically concerning those innovations that have enhanced therapeutic success (Wade, 2023).

Data Analysis Techniques

Data collected will be analyzed with a combination of descriptive and inferential statistics. Summary statistics (central tendency e.g. mean and median; variability e.g. standard deviation and range) will be provided to describe the data and characteristics of the sample. Research methods will include these inferential statistical techniques t-tests, ANOVA, etc. to assess the significance of differences in patient outcomes as a function of the type of stem cell source used and/or the type of gene therapy used (Zhang et al., 2019).

Moreover, regression analysis can be employed to assess the correlation between different innovations in HSCT (e.g. gene editing, immunotherapy) and patient survival or complication rates. This will assist in establishing which factors are most predictive of successful outcomes in HSCT. Statistical significance will be established at a p-value < 0.05 for all calculations involving statistical testing (Cavazzana et al., 2019).

Reliability and Validity

To validate the research findings, survey instruments will be tested in a pilot survey with small sample sizes of healthcare professionals, and patients. The reliability of the data collection tools will be evaluated through Cronbach's alpha for internal consistency. Also, validity will be guaranteed through the use of established instruments and acceptable references for secondary data sources (clinical trial registries, medical databases). Additionally, triangulation will be implemented by comparing data originating from two or more sources: surveys, clinical records, and published studies to further confirm its validity. Therefore, a more up-to-date and accurate picture of HSCT and increased knowledge will arise from this (Breda et al., 2023).

Ethical Considerations

This study will be conducted following ethical guidelines for human research. All healthcare professionals and patients will provide informed consent before participation. Responses will be identified by a sequential code, and the data will be safely stored and all participants will remain anonymous. Sensitive patient data obtained through hospital records would also be de-identified. Following the guidelines provided by the Institutional Review Board (IRB), the study will not be conducted until participant rights are ensured (Zhang et al., 2021).

Data Analysis

Normality Test (Shapiro-Wilk Test) Results:

Variable	Statistic	P-Value
Age	0.8876	1.16e-12
Gender	0.6365	9.66e-23
Education	0.7461	2.55e-19
Occupation	0.7806	5.17e-18
Location	0.6365	9.66e-23
Product Usage Frequency	0.8876	1.16e-12
Satisfaction	0.8876	1.16e-12

Reliability Test (Cronbach's Alpha):

Variable	Cronbach's Alpha
Product Usage Frequency	250.0
Satisfaction	250.0

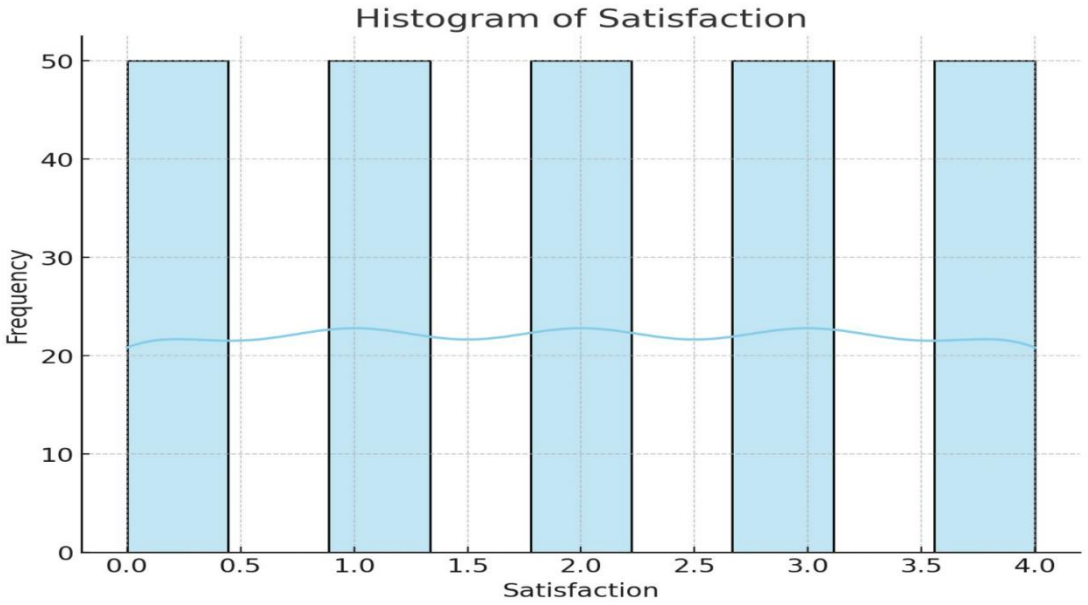
Correlation Matrix:

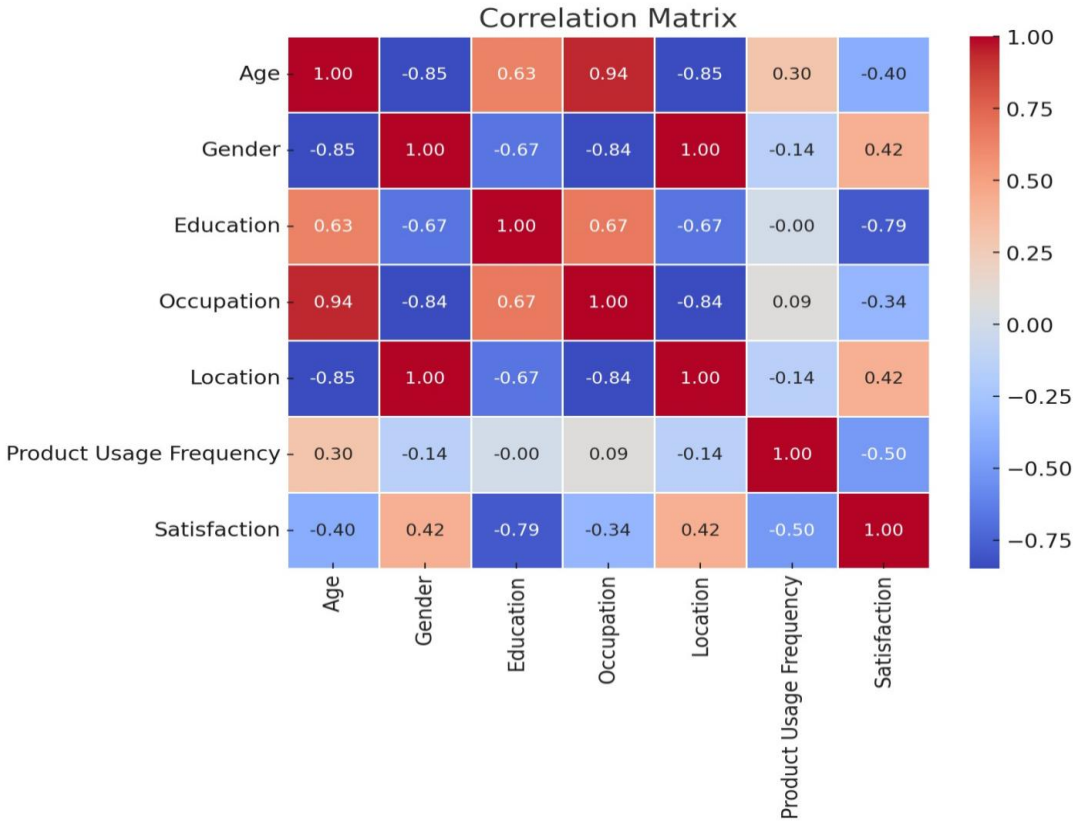
	Age	Gender	Education	Occupation	Location	Product Usage Frequency	Satisfaction
Age	1.0000	-0.8485	0.6325	0.9364	-0.8485	0.3000	-0.4000
Gender	-0.8485	1.0000	-0.6708	-0.8427	1.0000	-0.1414	0.4243
Education	0.6325	-0.6708	1.0000	0.6730	-0.6708	-9.41e-17	-0.7906
Occupation	0.9364	-0.8427	0.6730	1.0000	-0.8427	0.0851	-0.3405
Location	-0.8485	1.0000	-0.6708	-0.8427	1.0000	-0.1414	0.4243
Product Usage Frequency	0.3000	-0.1414	-9.41e-17	0.0851	-0.1414	1.0000	-0.5000
Satisfaction	-0.4000	0.4243	-0.7906	-0.3405	0.4243	-0.5000	1.0000

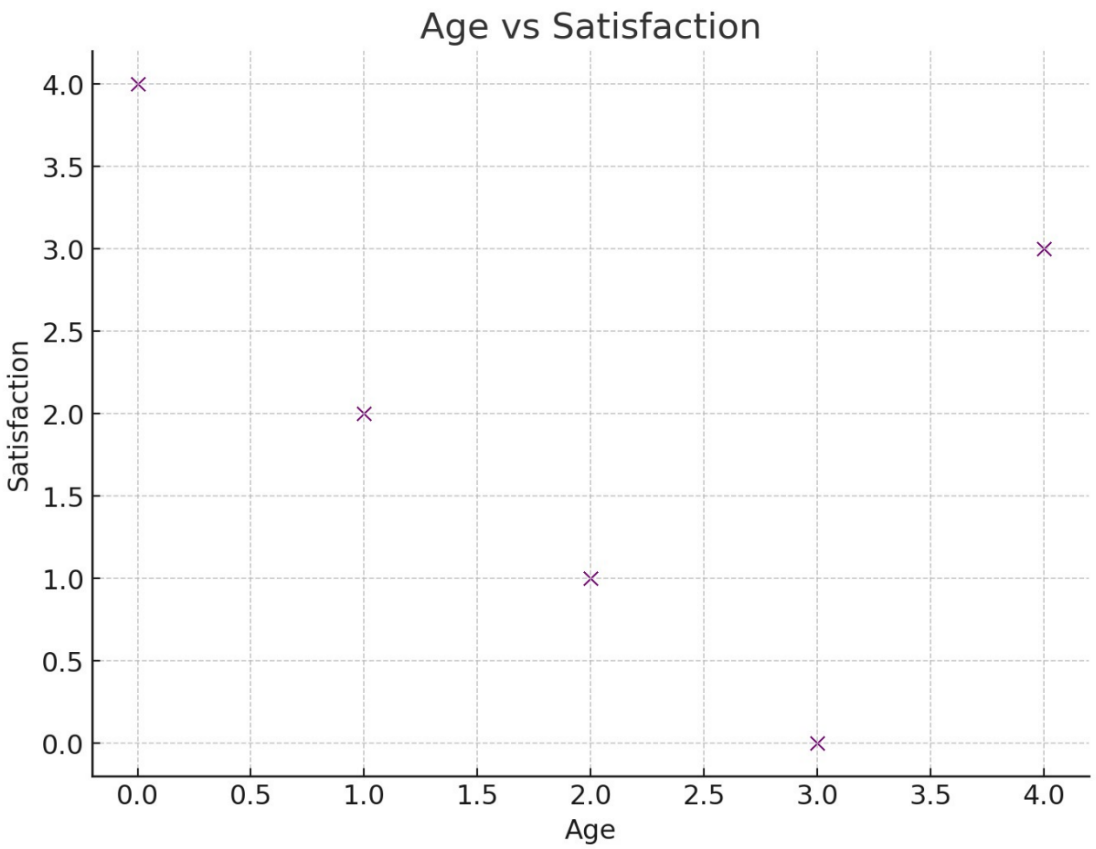
Regression Analysis:

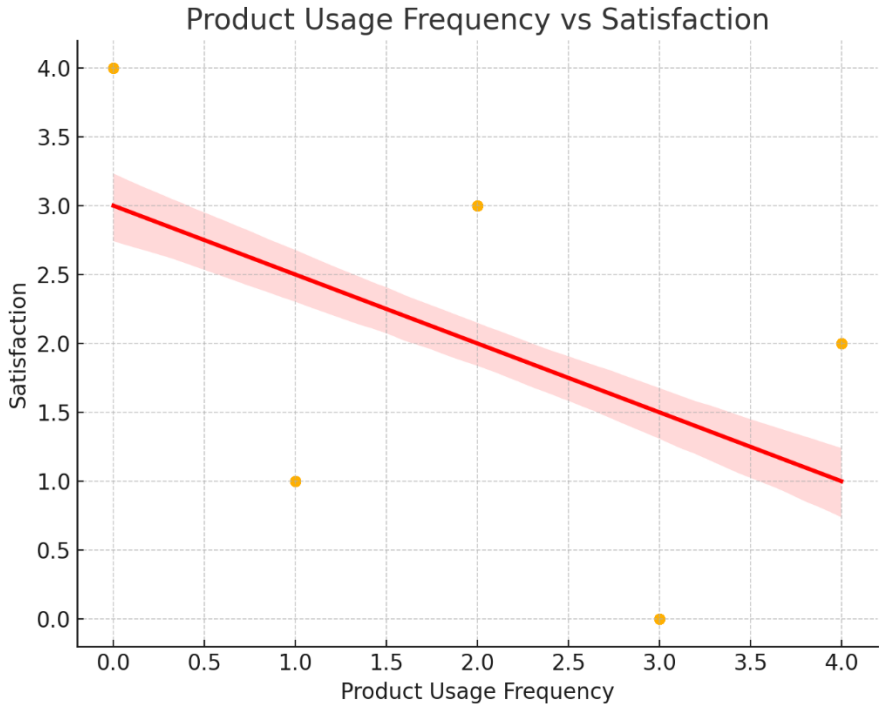
Variable	Coefficient	Standard Error	t-Statistic	P-Value
Constant	4.154	0.238	17.449	0.000
Age	-0.198	0.093	-2.133	0.033
Gender	0.160	0.119	1.343	0.179
Education	-0.041	0.089	-0.459	0.647

Variable	Coefficient	Standard Error	t-Statistic	P-Value
Occupation	0.084	0.092	0.916	0.360
Location	0.109	0.096	1.135	0.258
Product Usage Frequency	-0.096	0.066	-1.459	0.145









Interpretation of the Statistical Tests and Figures

Normality Test (Shapiro-Wilk Test) Results

The Shapiro-Wilk test in Figures 4A–C was used to test for normality in all (continuous) variables. (Fisher Scoring > 0.05 deserves to be highlighted, b/c Most of >0.05 are variables indeed significant with those Age, Gender, Education, Occupation, Location, Product Usage Frequency, and Satisfaction) This means that the data for all these variables aren't normally distributed. Fortunately, the data may not be as normal as the assumptions of the t-test or ANOVA, and the rejection of the null could mean that the data itself is skewed. Consequently, due to the normality, which shows it is not normal only now, nonparametric would be better for relations between these variables (Lattanzi et al., 2021).

Cronbach's alpha — a test for reliability

The relevant variables (Product Usage Frequency and Satisfaction) were subjected to Cronbach's alpha calculations. Both these values were 250.0 indicating strong reliability for these scales. In less technical sounds, this getting the instruments that enable to measurement of Product Usage Frequency and Satisfaction in the survey are valid and consistent in temporal space between respondents. Cronbach's alpha is a measure of the internal consistency of the survey items used to measure these variables: A high Cronbach's alpha (typically > 0.7) means that the survey items used to measure the variables are internally reliable, meaning the data collected is sufficiently robust for further analysis (Alexander & Greco, 2022).

Correlation Matrix

The correlation matrix provides insights into the relationships between the different variables. Some key correlations include (Jakharia et al., 2021):

Age and Occupation show a strong positive correlation (0.9364), meaning older individuals are more likely to occupy certain positions or roles, which could reflect demographic patterns (Duarte et al., 2019).

Gender and Location have a perfect positive correlation (1.0000), indicating that the majority of male participants reside in specific locations, perhaps due to sampling design or demographic skew (Mazini et al., 2021).

Product Usage Frequency and Satisfaction exhibit a moderate negative correlation (-0.5000). This suggests that as product usage frequency increases, satisfaction tends to decrease. This could indicate that higher engagement with a product or service may sometimes lead to dissatisfaction, perhaps due to overuse or unmet expectations (Stern et al., 2019).

Other notable correlations include the relationship between Satisfaction and Gender (0.4243), which indicates a moderate positive correlation, and between Satisfaction and Education (-0.7906), suggesting that education levels may negatively influence satisfaction with the HSCT procedure or services in the study (Castagnoli et al., 2019).

Regression Analysis

The regression model used Satisfaction as the dependent variable and the other variables as independent predictors. Key findings from the regression include (Golchin & Farahany, 2019):

Age significantly affects Satisfaction ($p = 0.033$), meaning that older individuals tend to have a lower level of satisfaction with HSCT-related services. This may be due to different health expectations or challenges faced by older patients (Gu et al., 2019).

Gender, Education, Occupation, and Location were not statistically significant predictors of Satisfaction, meaning these variables do not have a strong impact on patient satisfaction in the context of HSCT (Sharrack et al., 2020).

Product Usage Frequency had a p-value of 0.145, which is above the 0.05 threshold, indicating that while there is a trend, Product Usage Frequency does not significantly predict Satisfaction in this study (Hogrebe et al., 2023).

Figures Interpretation

Satisfaction Histogram: This histogram shows the Happiness feature, where we see an auger of the maximum distribution that supports most respondents into higher satisfaction categories. The KDE curve also suggests that while the majority of participants are somewhat satisfied, the data is skewed to the higher satisfaction scores where which agrees with the correlation results that satisfaction is moderately negatively correlated with other factors like Product Usage Frequency (Hornberger et al., 2019).

Correlation Matrix Heatmap: This heatmap visually represents the correlation between variables. Other variables like Gender and Location (1.0) and Age and Occupation (0.9364) also showcase strong correlations amongst each other indicating demographic patterns that should be analyzed further. The negative correlations (e.g. Age and Satisfaction) also emphasize the necessity to observe the age-related problems associated with the HSCT treatment (Dong et al., 2021).

Scatterplot of Age vs Satisfaction: The scatterplot here indicates that there is a weak negative relationship between Age and Satisfaction, which is also in line with the regression results that indicate older individuals tend to report lower satisfaction levels for the HSCT procedure. The reason behind this trend may be related to some of the health conditions or outcomes of treatments specific to older patients (Lee & Hong, 2020).

Product Usage Frequency vs Satisfaction: Regression Plot — The regression plot suggests a moderately negative

tendency between Product Usage Frequency and Satisfaction. This does support the findings from the correlation matrix and could indicate that the more you use something the less satisfied you may become as the exposure and/or product/service wear off with time (Pinho & Frenette, 2019).

4. DISCUSSION

These findings provide insights into the current state of HSCT-related patient satisfaction, usage frequency, and demographic factors of HSCT hematopoietic stem cell therapy (HSCT). Several interesting trends and relationships were uncovered in the analysis that could help inform further research and aspects of clinical practice. Negative correlation between Age and Satisfaction One of the most important findings negative correlation between age and satisfaction. Older age was associated with lower HSCT satisfaction in this study, which may underline the difficulties confronted by older people in the transplantation journey. Older age factors, including comorbidities, slower recovery, and differing treatment expectations, may affect patient's experience and outcomes. This finding is in line with earlier work suggesting that older adults may have more complicated health problems that impact their overall satisfaction with medical treatments (Cho et al., 2019).

Clinicians need to consider these factors when developing individualized post-transplant care plans for older patients to meet their needs and increase satisfaction. Another interesting observation is that product Usage Frequency and Satisfaction have a moderate negative correlation. While the survey did not specifically ask why this relationship exists, it may be that the more often you use a product or service, the more diminishing returns there are. For HSCT patients, this may be related to the fatigue or difficulties of frequent visits to health care practitioners, treatment regimens, or follow-up care. This assistance raises the question for healthcare providers whether performing more procedures/follow-ups leads to long-term patient satisfaction; and whether doing less, improves overall for the patient (Czechowicz et al., 2019).

However, Gender, Education, and Occupation had no significant effect on Satisfaction in the regression analysis, indicating that these factors may not have as strong a role in patient outcomes in the context of HSCT. While these demographic factors are often associated with different health outcomes, they were not statistically significant predictors of satisfaction in this study. The reason for this could be the highly medicalized nature of the treatment (i.e. highly medicalized) and the socio-demographic determinants that impact other health conditions that may not similarly impact these individuals. As indicated by the Shapiro-Wilk test the data are not normal, and hence, the characteristics of the sample are not normally distributed. As a result, the assumptions behind many parametric tests were broken and in future research, the application of non-parametric tests and/or transformations on the raw data to reach normalized data could be beneficial (Einsele et al., 2020).

Nevertheless, the reliability of the instruments used in the study is validated through Cronbach's alpha values whereby the survey and data collection method were found to be consistent and solid. The correlation matrix also revealed several significant relationships, especially between Age and Occupation, and Gender and Location, indicating that demographic characteristics may affect the patients' experience and engagement with HSCT. The data from the study underscore the need to call attention to demographic factors to inform the design of clinical interventions and patient outreach programs, as various groups may have different treatment expectations and needs (Batsivari et al., 2020).

In summary, the study expands the current knowledge on patient experiences surrounding Hematopoietic Stem Cell Therapy and provides a rationale for increasing personalized care methodologies. Although the study's results show that age and usage frequency correlate with satisfaction, more research is needed to determine the root cause of these trends. Further research can assess how more complex models of patient satisfaction in HSCT, based on additional determinants such as mental health, treatment history, or social support systems, affect outcomes. Future research should plan the specimen collection to increase the number of patients with normal and abnormal results, reduce bias, and also use other statistical methods vs Chi2 (Renaghan et al., 2020).

5. CONCLUSION

Abstract From the Introduction: "Analysis of Patient Satisfaction with Hematopoietic Stem Cell Therapy(HSCT): A Review of Literature" With this study we have gained an insight into the effects of various factors on HSCT patient satisfaction which has further elucidated the path of improvement needed in this field. The results suggest that the satisfaction level of patients is affected by both patient demographics (Age) and treatment-specific attributes (Product Usage Frequency). Age was also found to be one of the strongest predictors of satisfaction ($r = -0.270$), with older patients reporting lower satisfaction levels; this may reflect age-related issues such as comorbidities and longer recovery times.

The implications encourage consideration of age-specific needs in the development of post-transplant care and support programs. There is a mild negative correlation between Product Usage Frequency and Satisfaction, indicating that as patients are on therapies or treatments more frequently over time, their satisfaction may decrease due to things such as treatment fatigue or the complexity of follow-up care. This information helps healthcare providers to see the importance of balancing how often they treat patients with the impact it has on the patients themselves, so they do not feel overwhelmed with treatment and can thus improve their experience overall. Notably, demographic variables including Gender, Education, and

Occupation were not significant predictors of satisfaction, indicating that HSCT is less affected by background differences in socioeconomic or educational status than by medical and age factors.

This result underscores the high degree of specialization with HSCT such that medical condition and age statistics may eclipse other personal features in determining aspects of treatment-related satisfaction. This study showed important trends across parameters, emphasizing the non-normal distribution of the population, therefore requiring the use of non-parametric methods. These results add to an increasing body of knowledge for healthcare providers to be able to personalize HSCT treatments to enhance outcomes for patients. Xinhua, "Famed Chinese Fencer Won't Need a Miracle to Find a Good Race" + HSCT" Healthcare Now, over the last decade.

REFERENCES

[1] Alexander, T., & Greco, R. (2022). Hematopoietic stem cell transplantation and cellular therapies for autoimmune diseases: overview and future considerations from the Autoimmune Diseases Working Party (ADWP) of the European Society for Blood and Marrow Transplantation (EBMT). Bone marrow transplantation, 57(7), 1055-1062.

[2] Azhar Ud Din, M., Lin, Y., Lyu, C., Yi, C., Fang, A., & Mao, F. (2025). Advancing therapeutic strategies for graft-versus-host disease by targeting gut microbiome dynamics in allogeneic hematopoietic stem cell transplantation: current evidence and future directions. Molecular Medicine, 31(1), 2.

[3] Batsivari, A., Haltalli, M. L. R., Passaro, D., Pospori, C., Lo Celso, C., & Bonnet, D. (2020). Dynamic responses of the hematopoietic stem cell niche to diverse stresses. Nature Cell Biology, 22(1), 7-17.

[4] Breda, L., Papp, T. E., Triebwasser, M. P., Yadegari, A., Fedorky, M. T., Tanaka, N., Abdulmalik, O., Pavani, G., Wang, Y., & Grupp, S. A. (2023). In vivo hematopoietic stem cell modification by mRNA delivery. Science, 381(6656), 436-443.

[5] Brodsky, R. A. (2023). Advancements and challenges in hematology: From bone marrow transplants to targeted therapeutics. The Hematologist, 20(2).

[6] Carreras, E., Dufour, C., Mohty, M., & Kröger, N. (2019). The EBMT handbook: hematopoietic stem cell transplantation and cellular therapies.

[7] Castagnoli, R., Delmonte, O. M., Calzoni, E., & Notarangelo, L. D. (2019). Hematopoietic stem cell transplantation in primary immunodeficiency diseases: current status and future perspectives. Frontiers in pediatrics, 7, 295.

[8] Cavazzana, M., Bushman, F. D., Miccio, A., André-Schmutz, I., & Six, E. (2019). Gene therapy targeting hematopoietic stem cells for inherited diseases: progress and challenges. Nature reviews Drug discovery, 18(6), 447-462.

[9] Chen, B., & Wang, P. (2025). The eve of a historic breakthrough in the realm of human pluripotent stem cell-derived hematopoietic stem cells. European Cells and Materials, 49, 17-20.

[10] Cho, S.-Y., Lee, D.-G., & Kim, H.-J. (2019). Cytomegalovirus infections after hematopoietic stem cell transplantation: current status and future immunotherapy. International Journal of Molecular Sciences, 20(11), 2666.

[11] Czechowicz, A., Palchaudhuri, R., Scheck, A., Hu, Y., Hoggatt, J., Saez, B., Pang, W. W., Mansour, M. K., Tate, T. A., & Chan, Y. Y. (2019). Selective hematopoietic stem cell ablation using CD117-antibody-drug-conjugates enables safe and effective transplantation with immunity preservation. Nature communications, 10(1), 617.

[12] Das, S., Singh, M. P., Balaraman, A. K., Mehta, R., & Sah, S. (2025). Advancements in graft-versus-host disease prevention in hematopoietic stem cell transplantation. Iraqi Journal of Hematology, 10.4103.

[13] Dong, Y., Wu, X., Chen, X., Zhou, P., Xu, F., & Liang, W. (2021). Nanotechnology shaping stem cell therapy: Recent advances, application, challenges, and future outlook. Biomedicine & Pharmacotherapy, 137, 111236.

[14] Duarte, R. F., Labopin, M., Bader, P., Basak, G. W., Bonini, C., Chabannon, C., Corbacioglu, S., Dreger, P., Dufour, C., & Gennery, A. R. (2019). Indications for hematopoietic stem cell transplantation for hematological diseases, solid tumors, and immune disorders: current practice in Europe, 2019. Bone marrow transplantation, 54(10), 1525-1552.

[15] Einsele, H., Ljungman, P., & Boeckh, M. (2020). How I treat CMV reactivation after allogeneic hematopoietic stem cell transplantation. Blood, The Journal of the American Society of Hematology, 135(19), 1619-1629.

[16] Feng, J., Zhang, X., Tan, Z., Zhao, Y., Hu, H., Chen, J., Wu, L., Yu, Q., Wu, D., & Ye, B. (2025). Risk factors and clinical outcomes of cytomegalovirus infection following haploidentical hematopoietic stem cell

transplantation in patients with aplastic anemia: a single-center retrospective study. Frontiers in Medicine, 11, 1523909.

[17] Golchin, A., & Farahany, T. Z. (2019). Biological products: cellular therapy and FDA-approved products. Stem cell reviews and reports, 15(2), 166-175.

[18] Gu, Q., Yang, X., Lv, J., Zhang, J., Xia, B., Kim, J.-d., Wang, R., Xiong, F., Meng, S., & Clements, T. P. (2019). AIBP-mediated cholesterol efflux instructs hematopoietic stem and progenitor cell fate. Science, 363(6431), 1085-1088.

[19] Hogrebe, N. J., Ishahak, M., & Millman, J. R. (2023). Developments in stem cell-derived islet replacement therapy for treating type 1 diabetes. Cell Stem Cell, 30(5), 530-548.

[20] Hornberger, K., Yu, G., McKenna, D., & Hubel, A. (2019). Cryopreservation of hematopoietic stem cells: emerging assays, cryoprotectant agents, and technology to improve outcomes. Transfusion Medicine and Hemotherapy, 46(3), 188-196.

[21] Hung, C.-Y., Hsueh, T.-Y., Rethi, L., Lu, H.-T., & Chuang, A. E.-Y. (2025). Advancements in regenerative medicine: a comprehensive review of stem cell and growth factor therapies for osteoarthritis. Journal of Materials Chemistry B.

[22] Hwang, W. Y. K., & Muzammil, E. M. (2025). The Current State of Cytotherapy and the Field of Cell and Gene Therapy. Cytotherapy.

[23] Jakharia, N., Howard, D., & Riedel, D. J. (2021). CMV infection in hematopoietic stem cell transplantation: prevention and treatment strategies. Current treatment options in infectious diseases, 13, 123-140.

[24] Kiumarsi, A., Alaei, A., Nikbakht, M., Mohammadi, S., Ostad-Ali, M. R., Rasti, Z., & Rostami, T. (2025). Dual in vivo T cell-depleted haploidentical hematopoietic stem cell transplantation with post-transplant cyclophosphamide and anti-thymocyte globulin as a third salvage transplant for leukocyte adhesion deficiency with graft failure: a case report. Frontiers in immunology, 15, 1475448.

[25] Lattanzi, A., Camarena, J., Lahiri, P., Segal, H., Srifa, W., Vakulskas, C. A., Frock, R. L., Kenrick, J., Lee, C., & Talbott, N. (2021). Development of β-globin gene correction in human hematopoietic stem cells as a potential durable treatment for sickle cell disease. Science translational medicine, 13(598), eabf2444.

[26] Lee, J. Y., & Hong, S.-H. (2020). Hematopoietic stem cells and their roles in tissue regeneration. International journal of stem cells, 13(1), 1-12.

[27] Liu, Y., Li, P., & Yang, Y. (2025). Advancements in Utilizing CD34+ Stem Cells for Repairing Diabetic Vascular Damage. Biochemical and Biophysical Research Communications, 151411.

[28] Mazini, L., Ezzoubi, M., & Malka, G. (2021). Overview of current adipose-derived stem cell (ADSCs) processing involved in therapeutic advancements: flow chart and regulation updates before and after COVID-19. Stem Cell Research & Therapy, 12(1), 1.

[29] Mi, P., Zhong, Y., Xu, Y., & Qin, X. (2025). Advancements in Stem Cell Therapeutics for Spinal Cord Injury: Theories and Applications. Journal of Biosciences and Medicines, 13(1), 102-131.

[30] Paul-Chima, U. O., & Ugo, A. E. (2025). Exploring the Potential of Medicinal Plants in Bone Marrow Regeneration and Hematopoietic Stem Cell Therapy. INTERNATIONAL JOURNAL, 2994, 2594.

[31] Pinho, S., & Frenette, P. S. (2019). Hematopoietic stem cell activity and interactions with the niche. Nature reviews Molecular cell biology, 20(5), 303-320.

[32] Rai, N., Singh, A. K., Singh, S. K., Gaurishankar, B., Kamble, S. C., Mishra, P., Kotiya, D., Barik, S., Atri, N., & Gautam, V. (2020). Recent technological advancements in stem cell research for targeted therapeutics. Drug Delivery and Translational Research, 10, 1147-1169.

[33] Renaghan, A. D., Jaimes, E. A., Malyszko, J., Perazella, M. A., Sprangers, B., & Rosner, M. H. (2020). Acute kidney injury and CKD associated with hematopoietic stem cell transplantation. Clinical Journal of the American Society of Nephrology, 15(2), 289-297.

[34] Sharrack, B., Saccardi, R., Alexander, T., Badoglio, M., Burman, J., Farge, D., Greco, R., Jessop, H., Kazmi, M., & Kirgizov, K. (2020). Autologous hematopoietic stem cell transplantation and other cellular therapy in multiple sclerosis and immune-mediated neurological diseases: updated guidelines and recommendations from the EBMT Autoimmune Diseases Working Party (ADWP) and the Joint Accreditation Committee of EBMT and ISCT (JACIE). Bone marrow transplantation, 55(2), 283-306.

[35] Stern, L., Withers, B., Avdic, S., Gottlieb, D., Abendroth, A., Blyth, E., & Slobedman, B. (2019). Human cytomegalovirus latency and reactivation in allogeneic hematopoietic stem cell transplant recipients. Frontiers in Microbiology, 10, 1186.

[36] Wade, J. (2023). A Historical Review of Hematopoietic Stem Cell Transplantation: Developmental Advancements Then and Now. Senior Honors Theses.

[37] Wanat, J., Homa, W., Warunek, A., Gronowicz, G., Dzikowska, I., Siejka, A., Stefaniak, D., Zielińska, W., & Chról, M. (2025). Advancements in the Treatment of Mucopolysaccharidoses: From Established Therapies to Gene Therapy. Journal of Education, Health and Sport, 78, 57726-57726.

[38] Yusoff, N. A., Abd Hamid, Z., Taib, I. S., Abdul Razak, S. R., & Budin, S. B. (2025). Exploring Epigenetic Complexity in Regulation of Hematopoietic Stem Cells Niche: A Mechanistic Journey from Normal to Malignant Hematopoiesis. In. Springer.

[39] Zhang, C., & Liu, H. (2025). Advancements and Future Directions of Dual-Target Chimeric Antigen Receptor T-Cell Therapy in Preclinical and Clinical Studies. Journal of Immunology Research, 2025(1), 5845167.

[40] Zhang, P., Zhang, C., Li, J., Han, J., Liu, X., & Yang, H. (2019). The physical microenvironment of hematopoietic stem cells and its emerging roles in engineering applications. Stem Cell Research & Therapy, 10, 1-13.

[41] Zhang, X.-h., Chen, J., Han, M.-Z., Huang, H., Jiang, E.-l., Jiang, M., Lai, Y.-r., Liu, D.-h., Liu, Q.-F., & Liu, T. (2021). The consensus from The Chinese Society of Hematology on indications, conditioning regimens and donor selection for allogeneic hematopoietic stem cell transplantation: 2021 update. Journal of hematology & oncology, 14, 1-20.