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Stem Cell Management is a Novel Innovation in the Health Care Sector. The Study Based on Research Conducted by Professionals in the Field

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Authors' contributions

Both authors contributed equally to the drafting of the article as well as the information gathering.

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ABSTRACT

Background: A physician offers treatments to prevent, treat, and manage sickness and to maintain mental and physical well-being. According to the World Health Organization, health care includes all raw materials and services aimed to enhance health, including "preventative health, therapeutic, and supportive interventions, either aimed to people either to nations." Stem cell is one of the innovations of health care industry. Stem cells are used to treat over 130 diseases throughout the world, and more than 500 clinical trials are ongoing to develop stem cell treatments. Henceforth, this paper aim is to enhance the stem cell role in health care industry and to find the health professional attitude towards stem cell management.
Methods: For the study purpose both primary and secondary data are used. The cross sectional study conducted among 140 doctors of the Delhi-NCR for the primary data. The secondary data collected from records of the WHO, various journals, scientific study and clinical trials. The data were analysis by the using the correlation and t-test by SPSS 21 software to find the attitude of doctors towards stem cell management.
Results: The study found that 97% of doctors are aware about the stem cell and 86% doctors have knowledge about the sources of stem cell and only 25% doctors collect the stem cell from umbilical cord. The study determine that the attitude of the health professional are positive towards stem cell

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management in India and they need government takes necessary action to developed the stem cell management for better health sector in India.

Conclusions: Thus it can be concluded that with the increases of the cases the scientists try to find the use of stem cell in the treatment of various diseases. It does clearly indicate that stem cell boost the immune system. The data analysis of the study confirms that doctors in India have a positive view toward stem cell management. As a result, if sufficient initiative is made by healthcare professionals and the government, stem cell management has a wide range of adoption and acceptance opportunities.

Keywords: Stem cell management; stem cell; clinical trials attitude; health sector; innovation.

1. INTRODUCTION

> Life improves slowly and goes wrong fast, and only catastrophe is clearly visible.
>
> **Edward Teller**

Due to certain diseases, the health is maintained by health technologies. A growing number of innovative health solutions are being produced of advances in science and technology to prevent disease. In the health care system, stem cell technologies have had a significant impact. Until now, a considerable of resources has been spent on this, and it has been extremely effective at treating the various diseases. In the field of medical science, stem cell research is without a doubt one of the most exciting and controversial areas [1]. Stem cell research has advanced significantly since the first bone marrow transplants in the 1960s and the isolation of embryonic stem cells from mice in the 1980s, when embryonic stem cells were extracted for the first time. Stem cell management is one of the most promising and emerging field of life sciences. Stem cell research shows that it acts as an internal repair mechanism, dividing to replenish other cells [2]. Several physicians are now praising stem cells as a means to relieve human suffering as the results continue to improve. "Stem cells are cells that have the potential to divide indefinitely in development and give way to specialized cell types." Unlike other cell types, stem cells are undifferentiated cells and capable of self-renewal through cell division even after long periods of inactivity; and under certain physiologic or experimental conditions, they may be transformed to become tissue- or organ-specific cells with specific roles [3]. Stem cell banking, also known as stem cell preservation, is the process of extracting, processing, and storing stem cells so that they can be used for treatment in the future. Stem cell banks are being built across the world to preserve one‘s biological features, avoid infection and degeneration, and promote their effective use in clinical and applied research, as well as current and future therapeutic applications [4]. To enhance the usage of stem cell, a better knowledge and awareness of stem cell management is needed. If doctors' attitudes toward stem cell management are favorable, it has the potential to become a significant tool for bio-insurance. The purpose of this study is to analyze doctors' attitudes about stem cell management in India, as well as to determine the importance of stem cell management in the health sector.

1.1 Stem Cell

Stem cells are a type of unspecialized cell in the human body that has the ability to transform into specialized cells in various capabilities (Becker, McCulloch and Till 1963). Stem cells are a continuous source of differentiated cells that build up animal and plant tissues and organs. Stem cells might be used to create therapies to replace defective or damaged cells affected by a variety of disorders and injuries, including Parkinson's disease, heart disease, and diabetes [5].

There are basically three sources of stem cells; bone marrow, embryonic cells and cord blood.

Bone marrow: Bone marrow is a sponge-like substance that exists within bones. These immature cells are known as hematopoietic stem cells or blood-forming stem cells. Bone marrow transplantation is a difficult and time-consuming process that needs an exact and accurate match [6].

Embryonic cells: Embryonic stem cells are pluripotent stem cells formed from the inner cell mass of a blast cyst, a pre-implantation embryo in its early stages. The therapy based on embryonic cells, on the other hand, is fraught with controversy because it necessitates the cultivation of an embryo or a waste fetus [7].

Cord blood: Cord blood is the third and richest source of stem cells. Umbilical cord blood is blood that remains in the placenta and the connected umbilical cord after birth. Cord blood is taken because it includes stem cells that can be utilized to treat haematological and genetic diseases. Umbilical cord blood provides continuous, non-controversial sources of stem cells for treatment [8].

Objective:

1. To explore the important of stem cell management in health sector
2. To analyses the attitude of health professional towards stem cell management in India.

1.2 Stem Cells are a Revolutionary Health-care Innovation

Stem cell therapy acts as an internal repair system, dividing and renewing other cells. Stem cells divide on a regular basis in some organs, such as the gut and bone marrow, to repair and replace worn out or damaged tissues. In other organs, such as the pancreas and the heart, stem cells divide only under certain conditions. These features of stem cells are encouraging scientists to develop treatments for diseases such as Alzheimer's and Parkinson's disease, which are currently incurable. Patients may be capable of regenerating a failing kidney, damaged skin, or even a defective lung if stem cell technology is fully developed [9]. In 2003, less than 30 diseases were able to get cured or supported with stem cell, but today over 85 diseases can be cured and supported [10].

Given the current state of our knowledge about stem cells and their actions, patients should continue to be counseled against medical travel for unproven stem cell–based therapies at this time [11].

According to the studies stem cells are not only kept for future, its useful for existing patients. If any family member already has a disease, the family takes a sensible decision and save a cord blood for the patient treatment and it more effective in sibling case [12].

The goal of research using stem cells is not always to produce a stem cell therapy. Basic research over the last four years has shown that stem cells can be used to understand diseases, which may help scientists create new drug therapies [13].

During the past several years there has been a vivid research in the field of stem cell [14]. Almost non-existent a few years ago in the country, stem cell banking is now a flourishing business with more and more people wishing to store their baby's cord blood as a form of bio-insurance, even though it comes at a heavy price. Cord blood storage is fast gaining momentum as a less traumatic alternative to treat neurological illnesses, and as a guarantee for the family against a host of diseases [15]. Stem cells from cord blood are much easier to get because these cells are readily obtained from the cord and the placenta at the time of delivery. The stem cells obtained from umbilical cord blood are less likely to be rejected in transplants than bone marrow stem cells [16]. Understanding stem cell is important for efforts that are designed to alleviate the risk it poses to both individual patients and the broader research field [17].

People should be made aware of such applications and government should help in providing such benefits by subsidizing them [18].

In large part, consumer demand for established and new forms of health care has traditionally been mediated through the role of the doctor acting to define demand in terms of ‘clinical need” [19]. In recent investigation, the knowledge on stem cells and its role in treatment of different diseases developed awareness among people and moved them to adopt stem cell collection and preservation techniques [20].

Use of cord blood for health problems that develop in the future, a need has arisen for the collection and storage of cord blood throughout the world as it holds promise for the treatment of many devastating diseases of humankind [21].

Private and public cord blood banks both benefit families by offering a precious and less painful alternative for stem cell sourcing [22]. Families should consider reputable and established private blood banks if they have a family member at a high risk of developing diseases treatable by cord blood stem cell with in the future, and other families should consider donating cord blood to a public bank if they would like to help save the lives of others [23].

Every day, new technology and ideas in the health sector emerge, helping to prevent disorders and promise better health [24]. Stem cell research and application are extremely powerful in the biomedical sector, with the potential to treat a wide range of diseases. It is advantageous because, first, it prevents diseases, keeping a patient disease-free, and second, it is only given once instead of as a medicine that must be given on a regular basis [25]. It has the potential to treat extremely serious diseases, thus it need strong support to progress further. India is making enormous progress in this field as compared to other developing countries. Organizations and other government agencies are also participating, but for it to be fully developed, adequate and significant funding is required. It periodically raises ethical issues on its usage, which should be regulated in such a way that they do not inhibit its growth and progress. People should be made aware of stem cell management applications, and the government should support in their availability by subsidized them [26].

1.3 Attitude

Attitude refers to a person's learned tendency to respond positively or negatively to an object, situation, concept or individual. The definition is also considered to be a belief of individuals which reflects and can sometimes be demonstrated in conduct [27].

Knowledge, belief, and perception were used to assess health professionals' attitudes in this study.

Objective:

3. To explore the important of stem cell management in health sector
4. To analyses the attitude of health professional towards stem cell management in India.

The following hypotheses were developed based on the relationship of underlying factors and attitude of physician towards stem cell management.

Null Hypothesis: Health Professionals has positive attitude towards stem cell management in India.

Alternative Hypothesis: Health Professionals has negative attitude towards stem cell management in India.

2. METHODOLOGY

2.1 Data Collection and Sampling Process

The primary data in this study consists of data collected from a questionnaire, in which stem cell information and attitudes were obtained. Doctors from several hospitals and clinics in the Delhi-NCR filled out the questionnaires. Jaypee Hospitals, Fortis Hospital, and different doctor's clinics are among the major hospitals. A total of 140 questionnaires were given, with the respondents returning 125 of them. However, ten surveys were not entered into the data set because the respondents did not match the knowledge requirements for stem cell management. After screening out the cases, 15 remaining questionnaires were deleted due to two reasons: missing values and 94 outliers. As a result, only 100 valid surveys were employed in the data analysis. The response rate was 72%. For data analysis, SPSS 21 software was used to perform several data analysis such as factor analysis, correlation test, and one sample t-test.

2.2 Sample Description

In this survey, four demographic characteristics were measured: gender, age, education, practice area, and experience. A summary of these demographic characteristics is shown in Table 1.

The study found that 38% of health professions (mainly doctors) are male and 62% are female. 14% are less than 30 years, 33% and 29% are belong to the age group of 31-40 years and 41-50 years. 24% are belongs to above 50 years.

2.3 Health Profession awareness toward Stem Cell Management: Descriptive Statistics

From the Fig. 1 the results showed that 97% of health professions are aware of stem cell management. Stem cells are derived from umbilical cord, bone marrow, tooth pulp, etc., and 86% of health professions are familiar with these sources.

2.4 Reliability Test

A reliability test performs to check the internal consistency among the items in the variables. Cronbach’s alpha, which is a common measure of internal consistency, was applied in this

research. The cronbach's alpha α ≥0.70 is considered as acceptable [28]. In this study the value of cronbach's alpha for each variable is for knowledge is .883, for attitude is .794 and perception is .770. The items used in each variable to determine the scale of attitude knowledge, have 5 items scale, belief have 4 items and perception has 4 items scale.

Table 1. Demographic characteristics data

	Category	Frequency
Gender	Male	38
	Female	62
Age	Less than 30 year	14
	31-40years	33
	41-50 years	29
	Above 50 years	24
Educational status	Graduate(MBBS)	22
	Post- Graduate (MD)	36
	MS	24
	Diploma after Graduation	18
Practicing	In Government hospital	19
	In private Hospital	26
	In own Clinic	29
	In both own clinic and private hospital	24
Experience	Less than 10 years	26
	10-20	32
	20-30	22
	More than 30 years	19

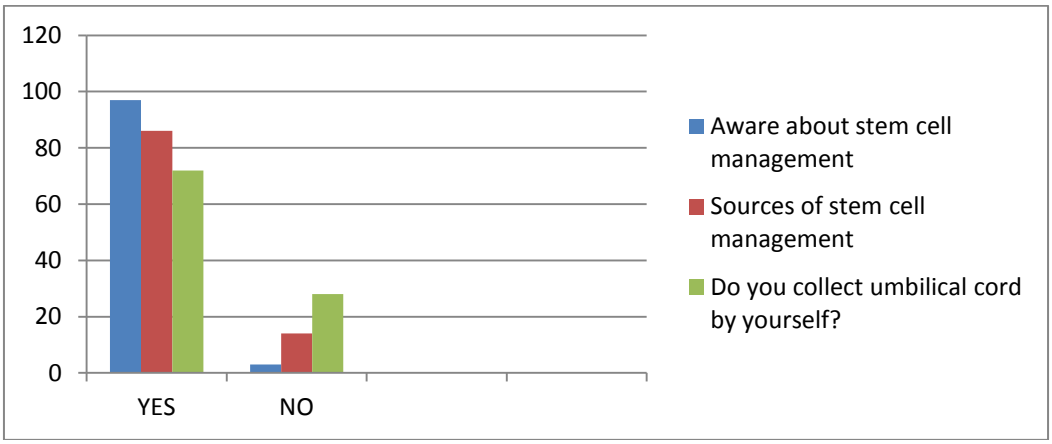

Fig. 1. Health profession awareness

Table 2. Reliability test results

Factor	Number of items	Cronbach' alpha
Knowledge	5	.883
Belief	4	.794
Perception	4	.770

Table 3. Knowledge belief perception

	Mean	Std. Deviation	N
Knowledge	2.0737	.71691	100
Belief	2.1743	.73373	100
Perception	1.6855	.59659	100

2.5 Factor Analysis

The 13 items questions were detected in three separate factors with eigen values larger than 1.0 and were thus of interest to this research. The components explained 68.45% of the overall variance, which is more than the acceptable variance explained of approximately 60%. 2007 (Naresh Malhotra).

For this investigation, the KMO (Kaiser-Meyer-Olkin) value was 0.850, and the Bartlett's Test of Sphericity (Bartlett, 1954) likewise obtained statistical significance (sig. 0.000). As a result, the scale was determined to be appropriate for exploratory factor analysis.

The factor analysis technique is used to analyse the underlined meaning of items. The factor analysis converts a set of things into new variables that are separate and emphasise the same meaning. The number of additional variables is kept to a minimum. Varimax rotation is then used to rotate the generated components. Factor analysis found three factors, as shown in Table 2 rotated components matrix. The factor loadings of these three factors are listed in the table below, which is more than. The number 5 means acceptance [27].

Factor 1: Knowledge of stem cell management– This factor explains for 26.2% of total variance. This factor consists of the statements that they would benefit in the future (.802) + use own stem cells rather than other human being stem cells (.800) + stem cell therapy research on various diseases (.759) + prevention of future disease in children (.734) + recommending stem cell patients (.688). The statements in factor show that health professions are well-versed on stem cell research and uses. According to a 2018 survey, the knowledge of stem cell management in the health profession seems to be quite good [29].

Factor 2 (Perspective and belief toward stem cell management) explains for 26.1 percent of total variance. This factor includes statements such as Indian Council of Medical Research has issued recommendations on the use of stem cells in therapy (.848) + in favor of stem cell therapy (.780) + positive response by Scientist on stem cell research (.700) + concerned about the use of stem cells found in umbilical cord due to the amount of stem cells (.585). These statements reflect the perspective of health professionals while making decisions on stem cell management. Doctors have increased their confidence in stem cell management as a result of the positive response from scientists and the government; a similar study done in 2021 revealed a favorable perspective toward stem cell research [30].

Factor 3 (Perception of stem cell management) - This factor explains for 16.1% of total variance. This factor includes statements about the collecting technique (.838), government engagement in stem cell storage (.618), and doctors actively promoted stem cell management (.563) and gave patients with an honest overview of stem cell banking (.509). These as among that pregnant women are deeply concerned about their baby's future well-being. Consumer perceptions influence health professionals' attitudes about stem cell management, which can alter the information provided to pregnant parents concerning stem cell preservation in either a positive or negative way [31]. It was found that patients who suffer from cancer have belief on stem cell are its usability in treatment [32].

2.6 Correlation

The Pearson correlation method is used to assess the link between the variables since it helps in identifying the relationship between the three variables (knowledge, perspective and perception). This study was mostly used to summaries the correlation between the existing variables.

Pearson correlation is the best approach for testing the relationship between variables. The efficiency and relevance of factor analysis will be evaluated using these coefficients, and the results will be supported for multiple regression analysis. Because the correlation coefficient has a statistical significance of less than 0.0005, all of the variables have positive relationships with one another.

The table clearly shows that all three components of overall attitude, knowledge, belief and perception, have a strong and positive connection with attitude, with p values of 0.00 for all three components, which is less than p0.05.

Table 4. Factor analysis results

	1	2	3
I feel that stem cells will have a number of benefits in the future.	.802		
Instead of using stem cells from any other human being, it is best to use own stem cells.	.800		
I'm familiar with stem cell therapy research on the various diseases.	.759		
I believe that preserving stem cells will help protect the baby from future illnesses.	.734		
I'll be recommending stem cell therapy to patients in the future.	.688		
I'm aware the Indian Council of Medical Research has issued recommendations on the use of stem cells in therapy.		.848	
I am strongly in favor of stem cell therapy.		.780	
When I see encouraging findings from stem cell clinical research conducted by scientists, it enhances my faith.		.700	
I'm worried that the number of stem cells in cord blood may not be enough for older children and adults to be treated.		.585	
I believe that collecting stem cells from the umbilical cord is a simple and painless technique.			.838
I believe that the government should be involved in stem cell storage policy that private companies must make.			.618
I believe doctors will feel comfortable to promote stem cell management once their hospitals are allowed to do so.			.563
I'm honest with our patients regarding stem cell therapy, including whether or not certain treatments have been scientifically established and should not be used as a treatment.			.509

Extraction Method: Principal Component Analysis.
Rotation Method: Varimax with Kaiser Normalization.a
a. Rotation converged in 8 iterations.

Table 5. Correlations results

		Attitude	Affective	Behavior	Cognition
Overall	Pearson Correlation	1	.889	.807	.839
Attitude	Sig. (2-tailed)		.000	.000	.000
	N	100	100	100	100
Knowledge	Pearson Correlation	.889	1	.633	.609
	Sig. (2-tailed)	.000		.000	.000
	N	100	100	100	110
Belief	Pearson Correlation	.807	.633	1	.476
	Sig. (2-tailed)	.000	.000		.000
	N	100	100	100	100
Perception	Pearson Correlation	.839	.609	.476	1
	Sig. (2-tailed)	.000	.000	.000	
	N	110	110	110	110

The correlation coefficient can be used to assess the strength of a relationship. According to the table, the correlation coefficients for all three components of attitude, knowledge, belief and perception with overall attitude were r=.889, r=.807, and r=.839. Thus, of the three components, knowledge has the greatest influence on the overall attitude of health professionals toward stem cell management in India, followed by perception and belief.

2.7 Hypothesis Analysis

Null Hypothesis: Health Professionals has positive attitude towards stem cell management in India.

Alternative Hypothesis: Health Professionals has negative attitude towards stem cell management in India.

Table 6. One-sample statistics

	N	Mean	Std. Deviation	Std. Error Mean
Attitude	100	1.9445	.57805	.06631

	Test Value = 0					
	T	Df	Sig. (2-tailed)	Mean Difference	95% Confidence Interval of the Difference	
					Lower	Upper
Attitude	29.326	75	.000	1.94452	1.8124	2.0766

The total attitude of the health professional towards stem cell management is positive. The mean of the attitude is 1.9455 that's means the alternative hypothesis for objective is accepted as there is the positive attitude towards stem cell management.

In order to explore correlation analyzed for used there is a significant relation between total attitude and other components of attitude.

3. RESULTS AND DISCUSSION

The researchers focused at health professionals' attitudes toward stem cell management in terms of their knowledge, beliefs, and perceptions. The study's findings have substantial implications for stem cell management and have added to the current body of knowledge by identifying a variable of health professional attitude toward stem cell management. The study looked into whether a health professional's attitude toward stem cell management had an impact on knowledge, belief, and perception. Furthermore, factor result supports acceptable statistical results in determining the relationship between knowledge, belief, and perception characteristics of stem cell management in India. After that, correlation analysis revealed that knowledge has the greatest impact on health professionals' attitudes, followed by belief and perception, because knowledge shows that stem cells promise a brighter future for protecting children from future illnesses. Because of the government's inadequate involvement and lack of promotion, despite having information and awareness about stem cell management, very few individuals continue to engage in the stem cell management process action. Finally, the t test gives support to the hypothesis that doctors in India support stem cell management. As a result, if the government takes the necessary steps, stem cell management has a wide range of implementation and acceptability options.

4. CONCLUSION

The health sector is regarded as one of the most vital in India, with significant investment. To strengthen India's health sector, stem cells play a critical role. Globally, stem cells are utilized to treat around 130 diseases, and it is estimated that over 500 clinical trials are being conducted to develop stem cell therapeutics. According to medical experts, stem cells obtained from a newborn's cord blood are particularly rich and can differentiate into blood and immune system tissues, as well as heart, brain, spinal, and pancreatic tissues. In India, about 70% of patients who require bone marrow transplantation do not find a match because of a lack of information and a lack of maintenance of stem cells. The cost of purchasing stem cells is higher than the cost of treatment. The number of disorders treatable with stem cells is rising rapidly. Studies have been directed at the possibility of utilizing cord blood stem cells to treat some of the most serious diseases, such as heart disease and stroke, due to their ability to transform into multiple cell types. Thus, storing the baby's cord blood now can secure the child's future access to his or her own stem cells for cell therapies and other disease treatment.

Other developed countries, such as the U. S., China, and the U.K., among others have more clinical trials than India. This study notifies the Indian government about the present state of stem cell research, which is essential in India. The Indian government has been very active in fostering stem cell research, particularly in clinical trials, basic research, and application development. The need for research is to spread knowledge about stem cells throughout society.

According to the findings, doctors have generally positive attitudes toward stem cell management. Despite the fact that experts believe stem cell management will be quite beneficial in the future. Scientists' encouraging stem cell research strengthens doctor trust. Similarly the study in 2016 shown that the most important roles of the healthcare professional caring for the expectant mother and her family is to provide unbiased, evidence-based information to assist parents in making decisions about their child's care that best suit their family's needs while also reflecting

their own values, beliefs, and priorities. Further research should focus on understanding health professionals' perspectives and attitudes, as well as how cord blood collection may influence their birth management approaches, as this may have an impact on the information provided to pregnant parents, either positively or negatively [31].

5. SUGGESTION AND RECOMMENDATION

Stem cell therapy has proven to be a highly effective and promising method of therapeutic application and improvement, since there are no effective treatments for the various serious disorders. The involvement of the government is required to drive stem cell management in the health sector further. The current study has several limitations. There are several reasons for this, including a smaller than estimated health care professional who completed the questionnaire, resulting in a small sample size. However, the findings are significant because this was the first study of this kind in Delhi-NCR on the topic of stem cell management, which is still in its beginning phases in the city. As a result of these findings, stem cell management is a preferable possibility for disease treatments. Scientists may soon be ready to initiate additional stem cell research and clinical trials for a wide range of disease possible treatments.

CONSENT

As per international standard or university standard, respondents' written consent has been collected and preserved by the author(s).

ETHICAL APPROVAL

It is not applicable.

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COMPETING INTERESTS

Authors have declared that no competing interests exist.

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