

# An Evaluation of the Impact of a Structured Teaching Program on Nursing Officers' Knowledge of Stem Cell Therapy for Neurological Disorders at a Selected Hospital in Bangalore

Babie Zothanmawii<sup>1,\*</sup>, Shwetha B.L.<sup>1</sup>

## Abstract

**Background of the study:** A stem cell is an undifferentiated cell in a multicellular organism that can proliferate indefinitely to produce more cells of the same type and can differentiate into various other types of cells. So, stem cell therapy is also called as regenerative medicine, it promotes the repair response of diseased and dysfunctional or injured tissue it has an ability to cure the neurological disorders Hence, the present study attempts to assess the effectiveness of structured teaching program on knowledge of nursing officers regarding stem cell therapy in neurological disorders. **Aim:** The purpose of the study is to evaluate the impact of a structured teaching program on nursing officers' knowledge of stem cell therapy for neurological disorders. **Methods:** The study adopted a quasi-experimental design, utilizing a one-group pretest and posttest method. Participants were selected through purposive sampling, a nonprobability technique, from a group of 60 nursing officers at KIMS. Data collection was carried out using a structured knowledge questionnaire. After 8 days, a posttest was conducted, using the same structured questionnaire to assess changes in knowledge. **Expected Result:** The results will be evaluated through paired t-tests and chi-square tests to determine the impact of the structured teaching program. The study aims to assess the initial knowledge of nursing officers, illustrate how the structured questionnaire improves their knowledge, and explore the correlation between posttest knowledge levels among the participants. **Conclusion:** This study will demonstrate that the structured teaching program significantly improved nursing officers' understanding of stem cell therapy for neurological disorders.

**Keywords:** Effectiveness, structured teaching program, stem cell therapy in neurological disorders

## INTRODUCTION

In the human body, all cells trace their origin back to a fertilized egg created through the union of sperm and egg. Despite this, the body contains more than 200 unique cell types, each originating from a set of stem cells present during the early stages of embryonic development [1].

### \*Author for Correspondence

Babie Zothanmawii  
E-mail: zothanmawiibabie143@gmail.com

Researcher, Department of Medical Surgical Nursing,  
Kempegowda Institute of Nursing, Rajiv Gandhi University of  
Health Science, Bengaluru, Karnataka, India

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During both early development and throughout life, various types of stem cells produce specialized or differentiated cells that carry out specific functions in the body, such as skin, blood, muscle, and nerve cells. The stem cell timeline includes single-cell embryos (totipotent), embryos that are 5–7 days old (embryonic stem cells), cord/placental stem cells (multipotent), and infant/adult stem cells (multipotent) [2].

Stem cells are a collection of undifferentiated cells capable of extensive replication (self-renewal), usually originating from a single cell

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(clonal), and having the potential to differentiate into various cell types and tissues (potency). These cells are derived from different sources and vary in their potency levels. Pluripotent cells, like embryonic stem cells, come from the inner cell mass of an embryo, while induced pluripotent cells are generated by reprogramming somatic cells [3].

Pluripotent cells have the capability to differentiate into tissues from all three germ layers – endoderm, mesoderm, and ectoderm. On the other hand, multipotent stem cells can generate tissues from only one germ layer, such as mesenchymal stem cells, which can produce adipose tissue, bone, and cartilage. Tissue-resident stem cells are considered oligopotent, as they can generate only the differentiated cells of a specific tissue. Stem cells hold potential in cellular therapy, either by replacing damaged cells or aiding in the regeneration of organs [3].

The discovery of stem cells is considered one of the most groundbreaking advancements in modern medicine, thanks to their extraordinary ability to both self-replicate and produce new tissues as they grow and divide. This rapidly advancing field, propelled by the collaborative efforts of cell biologists, geneticists, and clinicians, offers significant potential for the effective treatment of various malignant and nonmalignant diseases [1].

Stem cells can be obtained from sources, such as bone marrow, peripheral blood, and umbilical cord blood. Hematopoietic stem cells, essential for life, are found in the bone marrow and are responsible for generating all types of blood cells. These stem cells have proven to be an invaluable treatment for a range of serious diseases [4].

In certain cases, a patient's own cells are transplanted. However, allogeneic stem cell transplantation has become a standard treatment for conditions like bone marrow failure and blood cancers, such as leukemia. Donor stem cells are used to restore immune function in patients after undergoing radiation and/or chemotherapy. In the UK, the regulatory guidelines established for bone marrow transplants have now been expanded to include the use of other tissues and organs [5].

Humans possess a regenerative ability shared with certain animals, such as starfish and newts. While we cannot grow back a lost limb or finger, our bodies continually regenerate tissues like blood and skin. The discovery of stem cells, which enable this regenerative process, began in the 1950s through bone marrow experiments. This breakthrough led to the development of bone marrow transplantation, a widely used medical treatment today. The revelation of stem cells sparked hope for further regenerative treatments, allowing doctors for the first time to repair damaged tissue by harnessing stem cells' unique ability to produce various specialized cell types [6].

Stem cell research originated from a desire to understand how tissues are maintained throughout adult life, rather than focusing on how various cell types form during embryonic development. Historically, the study of adult tissues was within the domain of pathologists and was often linked to disease, particularly cancer. Stem cells have the remarkable ability to differentiate into specialized cell types, such as muscle, blood, and nerve cells [7].

There are strong indications that over the next five decades, our comprehension of stem cells will revolutionize medicine. One of the most thrilling aspects of stem cell research is its interdisciplinary nature, bringing together biologists, clinicians, and experts from various fields, such as physical sciences and mathematics. This collaboration fosters partnerships between academia, the biotech sector, and pharmaceutical industries. Unlike the golden era of developmental biology, stem cell research is characterized by a strong focus on advancing human health [8–13].

Stem cell therapy, a type of regenerative medicine, seeks to repair damaged cells by decreasing inflammation and regulating the immune system. This therapeutic ability makes stem cell treatments applicable to various medical conditions. Stem cell therapies have shown success in treating

autoimmune disorders, inflammatory diseases, neurological disorders, orthopedic problems, and traumatic injuries. Research has also been explored for conditions, such as Crohn's disease, multiple sclerosis, lupus, COPD, Parkinson's disease, ALS, and stroke recovery [14–17].

Stem cell therapy holds great promise in transforming healthcare and offering hope for patients dealing with diseases and injuries that currently lack effective treatments. Stem cells play a unique role in the human body by repairing damaged tissues and regenerating new cells to replace those lost during their natural lifespan.

Currently, in India, over 30 clinical trials are underway focused on umbilical cord stem cell therapy, with positive results from previous phases validating their potential. Many of these trials target neurological conditions, such as autism, cerebral palsy, Parkinson's disease, spinal cord injuries, hearing loss, hypoxic ischemic encephalopathy, and autoimmune diseases like multiple sclerosis, lupus, diabetes, rheumatoid arthritis, and cardiovascular disorders. These trials also focus on gene therapies and orthopedic conditions [18–21].

Stem cell therapy offers a wide array of benefits for neurological disorders. In spinal cord injuries, stem cells aid in repairing damaged tissue; in Parkinson's disease, they help reactivate dopamine production; in Alzheimer's, they support neuron regeneration and memory improvement; in cerebral palsy, they assist in brain repair; and in multiple sclerosis, stem cells help alleviate symptoms and slow disease progression [22–26].

Nursing professionals must gain a solid understanding of stem cell sources to engage in informed discussions on the topic. By equipping themselves with accurate information and adhering to the ethical standards set by the National Council of Nursing, they can make informed decisions regarding stem cell research and become key resources for educating others on the potential and implications of this scientific breakthrough [27–31].

## **OBJECTIVES OF THE STUDY**

- To evaluate nursing officers' understanding of stem cell therapy in neurological disorders.
- To determine the impact of a structured teaching program on nursing officers' knowledge of stem cell therapy in neurological disorders.
- To examine the relationship between the knowledge scores of nursing officers and selected sociodemographic factors.

## **HYPOTHESIS**

- $H_1$ : There may be significant improvement in mean posttest knowledge scores of nursing officers regarding stem cell therapy in neurological disorders.
- $H_2$ : There may be significant association between the knowledge with selected socio-demographic variables.

## **METHOD**

- *Study design*: Quasi-experimental study.
- *Setting*: Kempegowda Institute of Medical Sciences, Hospital and Research Centre, Bangalore.
- *Participants*: Female nursing officer's working in medical, surgical; and orthopedic ward with who are willing to participate and volunteer with written consent

## **METHODOLOGY**

For this research, the conceptual framework was based on J.W. Kenny's model, which emphasizes the interaction between the system and its environment, highlighting how the system receives input and how various factors affect the adaptation, modification, and integration of the environment. A quasi-experimental design was used in the study. Sixty nursing officers who met the inclusion criteria

were chosen using purposive sampling. The researcher introduced herself, provided an explanation of the study to the participants, obtained their consent, and then began the data collection process. The instrument used in this study is divided into two sections: demographic data and a structured knowledge questionnaire.

- *Section I:* This section gathers demographic information, including age, religion, marital status, educational background, work experience, years of clinical practice, and sources of information.
- *Section II:* This section contains a structured knowledge questionnaire with 40 questions designed to assess the participants' understanding of the subject matter.

The pilot study was conducted to find the feasibility of the study 02-05-2022 to 9-05-2022 among 10 nursing officers at ProMed Hospital Bangalore. The main study was conducted from 2-06-2022 to 30-06-2022 among 60 nursing officers at selected hospital Bengaluru, the subject was selected by purposive sampling and data was collected by structured knowledge questionnaire.

### Interventions

The participants will be given Structured Teaching Programme by using Powerpoint. The topic will include the introduction of stem cell and neurological disorders, treatment of neurological disorder, stem cells, function of stem cells, types of stem cells, stem cell therapy, types, routes, procedures, side effects of stem cells therapy, stem cells therapy on neurological disorders and benefits, nursing managements [32–34].

### DATA SOURCE/MEASUREMENT

#### Content Validity

The content validity of the instrument was ensured by seeking feedback from a panel of experts. Out of 10 experts, 7 were specialists in Medical-Surgical Nursing, 1 was a statistician, 1 was an English language expert, and 1 was a neurologist. Based on their suggestions, the tool was revised. The final version of the tool comprised seven questions related to sociodemographic data and 40 questions focused on assessing knowledge about stem cell therapy in neurological disorders.

#### Reliability of Tool

The reliability of an instrument refers to the extent to which it consistently measures the attribute it is intended to assess. To evaluate the reliability of the tool, data was collected from 10 nursing officers at ProMed Hospital in Banashankari, Bangalore. The Split-Half method, combined with Spearman's Brown Prophecy formula, was employed to test the tool's reliability.

#### Sample Size

Formula: (Yamane formula)

$$N = N/1 + (e)^2$$

where n = sample size

N = Population size,

E = Acceptable sampling error.

The population size was considered as seventy-fifth investigator/researcher assumed 5% expected error, i.e.,  $e = 0.05$  at 95% confidence level

$$\begin{aligned} n &= N/1 + N(e)^2 \\ &= 63/1 + 63(0.05)^2 \\ &= 63/1 + 63(0.0025) \\ &= 63/1 + 0.1575 \\ &= 63/1.1575 \end{aligned}$$

= 54.42

Based on the calculation, the recommended sample size estimation was  $N = 54.42$ , hence the study was conducted among an arbitrary 60 samples after discussion with the expert.

### **Outcomes**

The Structured Teaching Programme by using Powerpoint regarding introduction of stem cell and neurological disorders, treatment of neurological disorder, stem cells, function of stem cells, types of stem cells, stem cell therapy, types, routes, procedures, side effects of stem cells therapy, stem cells therapy on neurological disorders and benefits, nursing management. The pre-test will help the nursing officer's better understanding [35].

### **Demographic Variables**

The study will include demographic variables age, gender, marital status, socioeconomic status, type of family, place of living, educational status, and year of clinical experience.

### **Structured Questionnaire**

The Questions are Categorized by the Following:

- *General Information on neurological disorders:* 6 Questions for 6 marks
- *Stem Cells:* 15 Questions for 15 marks
- *Stem Cell Therapy:* 14 Questions for 14 marks
- *Stem Cell Therapy on Neurological Disorders:* 5 Questions for 5 marks (Each question carry 40 marks in a total of 40 questions).

## **STATISTICAL ANALYSIS PLAN**

### **Descriptive Statistics**

The researcher will utilize suitable statistical methods, such as mean, median, standard deviation, along with frequency and percentage distribution, to analyze the demographic variables.

### **Inferential Statistics**

- Paired t-test will be used for statistical analysis of the difference between pretest and posttest scores on knowledge regarding stem cell therapy on neurological disorders.
- The Chi-square test or F-test will be applied to assess the relationship between pre-test knowledge of stem cell therapy for neurological disorders and the selected demographic variables.

### **Dissemination**

Articles will be published in indexed journal.

### **Study Status**

Not yet started.

## **DISCUSSION**

In the current study, the frequency and percentage distribution of the demographic characteristics of nursing officers were described. It was found that 53.3% of the nursing officers were aged between 29 and 32 years, followed by 33.3% who were between 33 and 36 years old, and the remaining 13.3% were aged between 25 and 28 years. 55.0% of the nursing officers were Hindu in religion, 18.3% were Christian, 13.3% each of the study participants belong to other religion. Nearly 83.3% of the nursing officers were married, 10.0% were unmarried, 3.3% each of the study participants were divorced and widow respectively. About 88.3% of the nursing officers were completed GNM Nursing, 6.7% were PB.B. Sc nursing graduates and remaining 5.0% were B.Sc. nursing graduates. Around 56.7% of the nursing officers working in intensive care ward, 31.7% were working in medical ward, 6.7% were working in other and remaining 5.0% were working in other areas. Nearly 48.3% of the nursing

officers had 6–11 years of working experience, 3.3% had 11–16 years of working experience, 13.3% had 1–5 years of experience and remaining 5.0% had more than 16 years of experience. The majority 30.0% of the nursing officers had knowledge about stem cell therapy related to neurological disorder through health professional, 25.0% through workshops, 23.3% through print media, and only 21.7% through electric media [36].

In this study the nursing officers meeting the inclusion criteria were given a 40 items structured knowledge questionnaire to assess the level of knowledge. Pretest 63.3% of nursing officers had inadequate knowledge regarding stem cell therapy in neurological disorders, 23.3% had moderately knowledge and 13.3% had adequate knowledge. *Posttest*: The finding shows that 96.7% nursing officers had adequate knowledge, 3.3% had moderate knowledge and non-of nursing officers had inadequate knowledge. The study shows that the mean paired difference mean is 20.7, with SD 6.45. The calculated t-value = 24.9 with p-value is less than > 0.0001 level of significance among nursing officers at KIMS hospital, Bangalore. The study revealed that nursing officers had inadequate knowledge regarding stem cell therapy in neurological disorders. So, it was estimated STP was needed to increase their knowledge [37].

### TESTING OF THE HYPOTHESIS

- $H_1$ : There may be a significant improvement in mean posttest knowledge compared to mean pretest pain score of nursing officers.

The hypothesis H1 proposed in the study is supported, as there was a notable improvement in the mean pretest knowledge score, which was 23.0, compared to the mean posttest knowledge score of 28.5. The difference in scores was significant, with a p-value of less than 0.0001. Mean pretest adequate knowledge score was 18.6 were mean posttest adequate knowledge score 39.4 and difference score was highly significant with p-values < 0.0001

- $H_2$ : There may be a significant relationship between knowledge scores and certain sociodemographic factors. The investigator accepted the hypothesis  $H_2$  since there was no association between the knowledge among the nursing officers on stem cell therapy in selected demographic variables, such as age, religion, marital status, year of experiences, and source of knowledge but it was highly associated with year of experience and qualification with p-value less than 0.05 [38, 39].

### Competing Interests

The authors declare no competing interest.

### Authors' Contributions

The final paper has been reviewed and approved by all writers.

### Ethical Considerations

Ethical approval was obtained from Institutional Ethical Committee.

Approval reference No. KCN/262/22-23.

### Data Availability

No data is associated with this article as this is a study protocol.

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