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ASSOCIATION BETWEEN NURSES' KNOWLEDGE AND ATTITUDES TOWARD STEM CELL APPLICATION IN MEDICINE

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ABSTRACT

Nurses, as frontline health care professionals, need to understand stem cells and their application in medicine so they can enter the debate on this issue. This study aimed to determine the association between nurses' knowledge and attitudes toward the application of stem cellsin medicine in a tertiary teaching hospital in Kelantan, Malaysia. A cross-sectional study was employed on 97 nurses trained in midwifery and neonatology by random sampling method using a self-administered questionnaire. Majority of the nurses (n=84; 86.6%) surveyed had a moderate knowledge about stem cells in medicine. More than half (n=59; 60.8%) of the nurses exhibited a positive attitude towards the therapeutic potential of stem cells in medicine. There was a statistically significant difference in total knowledge scores and nurses' clinical working experiences (p=0.003).

The majority of nurses showed a positive attitude toward the use of stem cells in medicine. Implementation of an in-service educational programme should be promoted to enhance the impact of knowledge and attitudes on stem cell application to fit contemporary health care needs.

Keywords : Stem cells, medicine, nurses' knowledge, nurses' attitude

INTRODUCTION

Stem cell research has great promise. However, heated debate regarding the ethical boundaries of scientific research (Brock, 2006) threaten to limit its possible benefits. Recent developments in stem cell biology have explained a significant differentiation between the plasticity of embryonic stem cells (ESCs) and adult stem cells (ASCs) in human tissue (Sadri *et al.*, 2010). Based on extensive stem cell research findings, many scientists have claimed that the cells could potentially generate cures and treatments for various diseases, including cancers and cardiovascular disease. This has ignited hopes of achieving stem cell-based replacement therapy in medical settings (Dresser, 2010; Sadri *et al.*, 2010).

ASCs' main function is to replenish dying cells and regenerate damaged tissues specific to the organ where they are found (Fujimaki *et al.*, 2013). Continuous development in cell biology has opened doors not only to ASC research but also to other human stem cell research. ESCs, while different from ASCs, they are undifferentiated in the human body. Therefore, many scientists consider ESCs to be fundamental to developing a diverse supply of tissues to treat variety of diseases such as acquired immunodeficiency syndrome (AIDS), diabetes, Parkinson's, Alzheimer's, spinal cord injuries and cardiovascular disease. The hallmark of stem cell research has been a significant scientific breakthrough leading to improvement in the quality and length of life (Pillai, 2012).

ESC research has been plagued by ethical, legal and social controversy. However, opposition to ESC research has decreased in accordance with an increase in understanding of ESC research. But there remains general caution about ESC in human research leading to the demand for alternative sources of stem cells that does not involve death of embryos. These sources include umbilical cord blood stem cells (UCBSC), which unlike ESCs, are desirable due to their high

proliferative potential, increased ability for self-renewal, decreased ability for antigen presentation and most importantly, their safety and ethical value. The absence of antigens in UCBSCs, which immune response resulting in their rejection, makes it more advantageous (Ikuta, 2008).

Stem cell replacement therapy has enormous potential to revolutionize medicine (Ministry of Health Malaysia, 2013). Being aware of this potential, the Ministry of Health in Malaysia supports stem cell research. Therefore, it is important for health care providers to keep abreast of current advances in stem cell science.

Literature has shown that nurses have a recognized role in providing patient education. They are perceived as a credible source of health information (Burns *et al.*, 2013). Since nurses and midwives are maternal and child health care professionals, they must be knowledgeable and aware of recent trends in diagnosis and treatment, competent and able to apply their knowledge of nursing and midwifery practice (Varghese, 2013). Mohammed and Sayed's (2015) intervention study of nurses at two university hospitals in Eygpt revealed that the majority of nurses (88.7%) had poor knowledge of stem cell use. They concluded that educational intervention provides the means by which nurses can improve their knowledge. In the context of rapidly developing stem cell research and use in medicine, nurses need to increase their knowledge about this controversial topic. Thus, they face the challenge of learning about, understanding and assimilating their knowledge of stem cells and their use into their daily nursing practice.

AIM

This study aimed to determinethe association between knowledge and attitudes toward stem cell application in medicine among nurses in a tertiary teaching hospital.

METHODOLOGY

Study design and setting

A cross-sectional study was conducted in the Labour Unit and Neonatology Unit at the Hospital Universiti Sains Malaysia (Hospital USM), a referral and tertiary teaching hospital located on the north east coast of peninsular Malaysia.

Population and sampling method

Random sampling was used to recruit nurses to the study. Using the Raosoft sample size determination, the minimal sample was calculated and a 10% drop out rate was added to anticipate non response and incomplete questionnaires, giving a total of 95.One hundred and forty-three nurses working in the Labour Unit and Neonatology Unit were invited to participate in the study. They were selected because they had completed all aspects of their theoretical and practical training as a requirement of the nursing, midwifery and neonatology programme; and had more than a year of working experience in clinical settings. Information about the study was sent to nurses by the researchers. Written informed consent was obtained from those nurses who agreed to participate in the study.A total of 97 of the nurses completed the questionnaires.

Ethical Approval

The research project was granted ethical approval by the Human Research Ethics Committee, Universiti Sains Malaysia (USM) and the Hospital Director, USM in 2012. All procedures were performed in compliance with the USM Ethical Guidelines.

Questionnaire design

The questionnaire used in this study was developed by the researchers after reviewing related literature, with a specific focus on the knowledge and attitudes of nurses and midwives about stem cells.The questionnaire was written in both English and Malay. It encompassed three parts:

- Part 1 Socio-demographic data (age, ethnicity, highest level of nursing education, years of clinical working experience, and religion).
- Part 2 Knowledge pertaining to stem cells and their application in medicine. This was evaluated through a true-false questionnaire consisting of 20 statements. The knowledge section was graded in the range of one (1) to forty (40), with 35 – 40 being high knowledge, 25-34 being moderate knowledge and 20-26 being low knowledge (Kumar, Mehta & Kalra, 2011). Therefore, the higher the knowledge score, the higher the level of knowledge among the nurses about stem cells and their application in medicine.
- Part 3 Attitude towards stem cell application in medical settings. This was assessed through a 5-point Likert scale (Strongly Agree, Agree, Unsure, Disagree and Strongly Disagree). Ten statements were provided. Scores ranged from 1 point which was 'strongly disagree' to 5 points, which was

'strongly agree'. The attitude section was graded in the range of ten (10) to fifty (50) points. The higher the score, the higher the support and encouragement among nurses. Thus this indicated an overall positive attitude to stem cell use in medicine.

Validity and Reliability

To ensure reliability and validity of this study of nurses, drafts of the questionnaire were reviewed by four stem cell and molecular biology experts. The questionnaires were pre-tested among 30 nurses from the medical and surgical wards, with a Cronbach's alpha of 0.86 for knowledge and attitude. This indicated that the questionnaire had a good reliability level. Pilot testing was carried out to test the clarity and applicability of the study tools as well as estimation of the time required to fill the survey questionnaire. Minor modifications were done in the form of making the statement clear, concise and precise for better understanding.

Data Collection

The questionnaires were distributed and collected from nurses by the study researchers. The nurses were given twenty minutes to complete the questionnaire. The research team wanted to determine nurses' spontaneous responses to the questions. It was expected that nurses would complete the questionnaire without access to textbooks or other information sources.

Data Analysis

The collected data were entered into the Statistical Package for Social Sciences (SPSS) software (v.20.0) for data analysis. Descriptive statistics were used to summarize socio-demographic characteristics, and the knowledge and attitudes of the nurses. For comparing nurses' knowledge and attitude scores among differenct clinical experience year groups, a one way ANOVA was performed. A p-value of equal to, or less than 0.05 was considered significant.

RESULTS

A total of 97 nurses completed the survey questionnaire. Table 1 showed the demographic characteristics of nurses. All were female (100%) and 97.7% (n=95) were Muslim. The majority of the nurses had 2-12 years of clinical experience in nursing (n=45; 46.4%). The second highest percentage was for the 13-23 years of experience group (n=28; 28.9%), while those with more than 23 years of experience were the least represented (n=24; 24.7%). The majority of nurses had a Diploma of Nursing (n=94; 96.9%). The remainder had a Degree in Nursing (n=3; 3.1%).

Table 1: Socio-Demographic Characteristics of Respondents (n=97)

Variables	Frequency (%)
Gender	
Female	97 (100)
Years of Clinical Experience	
2-12	45 (46.4)
13-23	28 (28.9)
>23	24 (24.7)
Highest Level of Nursing Education	
Diploma	94 (96.9)
Degree	3 (3.1)
Religion	
Muslim	95 (97.9)
Others	2 (2.1)

Stem Cell Knowledge Score

Among the 97 nurses, 84 (86.6%) fell in the category of moderate knowledge, while 13 (13.4%) scored high in terms of their knowledge about stem cells (Table 2). Specifically, there were 5 questions which almost all participants answered correctly. These were Q2: "Stem cells are capable of dividing and self-renewing for long periods" (92.8%); Q4: "Adult stem cells are also known as somatic stem cells" (39.8%); Q6: "Stem cells play an essential role in organogenesis" (91.8%); Q7: "Having more stem cells stored can improve the medical outcome such as faster recovery and fewer complications" (96.9%); and Q10: "Umbilical cord blood stem cells are used in life threatening diseases" (92.8%). However, there were 3 questions which were poorly answered. These were Q5: "Embryonic stem cells are capable of making any cell type in the body, including placenta" (11.3%); Q9: "Umbilical cord blood stem cells can be stored indefinitely in a tissue bank" (16.5%); and Q17: "Embryonic stem cell transplantation has a serious disadvantage as it could cause the formation of tumours" (14.4%).

Table 2: Stem Cells and Their Application in Medicine. Questions with Correct Response Rate(n= 97)

Question	Knowledge on stem cell and their application in medicine	Correct Response, %
1	Stem cells are unspecialized.	82.5
2	Stem cells are capable of dividing and self-renewing for long periods.	92.8
3	Sperm and eggs are a source for adult stem cells.	34.0
4	Adult stem cells are also known as somatic stem cells.	93.8
5	Embryonic stem cells are capable of making any cell type in the body including placenta.	11.3
6	Stem cells play an essential role in organogenesis.	91.8
7	Having more stem cells stored can improve the medical outcome such as faster recovery and fewer complications.	96.9
8	Embryonic stem cells are multipotent stem cells.	29.9
9	Umbilical cord blood stem cells can be stored indefinitely in a tissue bank.	16.5
10	Umbilical cord blood stem cells are used in life threatening diseases.	92.8
11	Umbilical cord blood stem cells are embryonic stem cells.	21.6
12	Harvesting umbilical cord blood stem cell can cause pain and harmful risks to the newborn and mother.	86.6
13	Umbilical cord blood stem cell transplantation has a lower risk for graft versus host disease compared to other types of stem cell.	82.5
14	Autologous adult stem cell transplantation is controversial, primarily due to the immunogenic graft rejection.	41.2
15	Stem cells can be used to test new drugs and their effectiveness.	87.6
16	Bone marrow stem cells are taken from the spine.	48.5
17	Embryonic stem cell transplantation has a serious disadvantage as it could cause the formation of tumours.	14.4
18	Umbilical cord blood stem cell transplantation is less efficient compared to bone marrow stem cell transplantation.	83.5
19	Stem cells can be induced from normal skin cells by switching on genes controlling the pluripotent and differential of stem cells.	61.9
20	Stem cells are maintained by obligatory asymmetric replication.	85.6

Attitude Scores

Among the 10 questions measuring nurses' attitudes towards stem cell application in a medical setting, the majority of nurses (n=84; 86.6%) showed a good attitude. The 10 questions were divided into the following categories. Ethical (Q1 & Q2); Religion (Q3 & Q4); Culture (Q5 & Q6); Professional (Q7 & Q8); and Community (Q9 & Q10) (see Table 3).

It is interesting to note that less than 20% of the nurses were concerned about the ethics of stem cell use and the possibility that humans would be killed in the process. Similarly, less than 20% believed that embryonic stem cell research should be banned. However, in relation to religion, just over one third (37.1%) of the nurses believed that embryonic stem cell research should be illegal, and an equal percentage believed embryos should command the same level of respect and right to life as adults.

In the aspect of culture, the nurses showed a very positive attitude to encouraging stem cell application for the benefit of future generations (Question 5, 53.6% and Question 6, 51.5%). Professionally, the nurses saw the importance of gaining more knowledge about stem cell use (Question 7, 45.4%) and indicated their awareness of its benefits and harms (Q8, 50.5%). In regard to community, half of the nurses believed that there is a bright future regarding stem cell development for medical purposes and that more awareness programmes should be conducted for the benefit of the health care providers and the community (Question 9, 45.4% and Question 10, 51.5%) (Table 3).

Table 3:Percentage of Nurses' Attitudes that Agreed with the Statement (Positive Response) (n=97)

S/N.	Attitude Question	Frequency (%) of Positive Response
1	I'm worried that stem cell transplantation might potentially open doors to human being killed for the benefit of others.	18.6
2	The government should prohibit all research regarding embryonic stem cell harvesting from embryos or aborted fetuses.	17.5
3	Life begins at conception thus embryonic stem cell research which involve destruction of embryo is immoral, illegal and unnecessary.	37.1
4	A blastocyst should be given the same respect and right to life as a living human adult.	37.1
5	Stem cell transplantation should be widely practiced.	53.6
6	I would advise pregnant mothers to store their umbilical cord blood stem cell for future purposes.	51.5

7	Competency in stem cell knowledge is important for me as a health care provider.	39.2
8	I am aware of the potential benefits, uses and possible harms of stem cell research.	50.5
9	There should be more awareness programs regarding stem cell use.	45.4
10	The future of mankind is bright if stem cell research is successful.	51.5

Association between Stem Cell Knowledge and Years of Clinical Working Experience

Table 4 showed that the output of the ANOVA analysis and whether there was a statistically significant difference between different clinical experience groups' knowledge score means. A significant difference was found only in the 1-5 years of clinical experience group (p=0.003).

Table 4: Knowledge Score for Years of Clinical Working Experience

Years of Experience	Knowledge Score (mean ± SD)	F	*P-value*
1-5	31.43± 1.65	4.865	0.003 *
6-10	32.67± 1.75		
11-15	32.50 ± 1.62		
More than 16	33.11 ± 1.76		

Association between Attitude to Stem Cell Useand Years of Clinical Working Experience

Table 5 showed the output of the ANOVA analysis and whether there was a statistically significant difference between different clinical experience groups' attitude score means. The significance level was 0.849 (p =0.849), which was more than 0.05 and therefore showed no statistically significant difference.

Table 5: Attitude Score for Years of Clinical Working Experience

Years of Experience	Attitude Score (Mean ± SD)	F	*P-value*
1-5	36.61± 4.19	0.267	0.849
6-10	36.61± 4.65		
11-15	37.25 ± 8.29		
More than 16	37.72 ± 6.04		

** One-way ANOVA (p >0.05 indicated the difference of attitude mean score is insignificant)*

DISCUSSION

Ethical issues surrounding stem cell research continue to be debated. This study was carried out to determine nurses' knowledge and attitudes regarding stem cell use in medicine. Participants' views may have been influenced by the fact that all were female and almost all were Muslim. Most had 13 years or more of clinical working experience (n=52), while 45 had between 2-12 years of experience.

On assessing knowledge regarding stem cells, the findings revealed that the nurses had a moderate level of knowledge. Their moderate knowledge scores may be attributed to the fact that stem cells are a new advanced trend. Moreover, nursing and midwifery curricula remain deficient in this issue. In addition, the scores may be due to the nurses' lack of reading and updating their professional knowledge. Having said this, a moderate level of knowledge was expected because Diploma nurses constituted the majority of the study sample. This finding is in contrast to Mohammed and Sayed (2014), who reported that nurses in their study demonstrated poor knowledge about stem cells and their use.

Even though most of the nurses were receptive towards gaining more knowledge and information about stem cells and their application in medicine, over 30% believed stem cell research and use to be immoral and felt it should be prohibited. This finding may be due to the nurses' religious beliefs. It has similarities with Farley (2013), Aksoy (2005) and Al-Hayani (2004), who mentioned that Islamic beliefs shape the views of Muslims toward stem cell research. Data also showed that the nurses expressed apprehension towards misuse of embryos for unethical research purposes. Similar concerns have been raised worldwide, with suggestions that embryonic research is an excuse for a commercial push that may lead to exploitation (Beeson, 2006). There have even been suggestions that researchers have misled the public about their research goals (Beeson, 2006).

Almost paradoxically, though the religion of the majority of the nurses (more than 50%) supported stem cell research and use in medical settings. This indicated that factors other than purely religion had influenced the nurses' responses. This may be due to the way in which the questions were phrased or may be due to the

current ethical debate versus the scientific debate. The results demonstrated the nurses were looking to the future, weighing up the perceived benefits versus risks. The nurses' positive attitude in wanting more information about the benefits of stem cell use is an encouraging finding because it indicated that they will actively seek out more knowledge to upgrade their practice in this area. This finding is in contrast to Mohammed and Sayed (2014), who reported a high negative attitude in their study and a need to implement educational intervention to foster knowledge with the goal of nurses' acceptance of stem cell use in medical settings. Chen and Lou (2013) also emphasized that such educational strategies would be beneficial. If such strategies were implemented at the tertiary teaching hospital in Kelantan where the current study was undertaken, then there will be more awareness. The nurses' attitudes as revealed from the data indicated that they would welcome the inclusion of a topic on stem cells in their curriculum.

On assessing the knowledge of the studied sample's regarding stem cells, the finding of a statistically significant difference between the 1-5 years of experience group and all the other groups ($p = 0.003$) were noted. The lack of knowledge regarding stem cells is may be due to late exposure to stem cell technology in the clinical environment as it was a later development. Moreover the nurses lack the efficiency of updating knowledge after being settled in the clinical environment for a longer time. Also, for the nurses who are in the clinical setting with longer years of experience lack the knowledge due to lapse of longer period of time since they have undertaken their Diploma or Degree.

The ANOVA for the association between attitude to stem cell use and years of clinical working experience showed no statistically significant difference in attitude across years of experience compared to the association between stem cell knowledge and years of clinical working experience. This implies that for nurses with 1-5 years of clinical working experience, there is no significant link between years of clinical working experience, and nurses' knowledge and attitudes regarding stem cell research and use in medicine.

STRENGTHS AND LIMITATIONS

The questionnaire survey had a reliability level of 0.86 for knowledge and attitude, which can be recognized as good. In the survey, only specific questions were asked, which limited the type and scope of information collected from participants (Polit & Beck, 2010). As a result, the survey questionnaire was considered the most appropriate and convenient method of data collection.

A number of limitations in this study prevent generalizability to a wider population of nurses. The study involved only a small group of nurses, all female and very few with Degrees in Nursing, who worked in the Maternity Unit and Neonatal Unit in one tertiary teaching hospital. The small sample size and single study setting were necessary limitations in a given time and access restraints.

CONCLUSION

It can be concluded that nurses' knowledge toward stem cells is moderate but they have a positive attitude in wanting more information about,and exposure to, the benefits of stem cell research and use. The study recommends the need for in-service educational programs related to stem cells to develop nurses' knowledge, attitudesand practice in order to fit this contemporary trend in health care.

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