Original Article

Knowledge and Attitude about Stem Cells and Their Application in Medicine among Nursing Students in Universiti Sains Malaysia, Malaysia

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Abstract

Background: Stem cell research has been extensively explored worldwide to enhance human health in medical setting. Nevertheless, there is currently no full understanding of the stem cell knowledge and attitude levels among student nurses in Malaysia. This study aimed to assess the level of stem cell knowledge, attitude toward stem cell application in medicine, and its association with years of education, among Universiti Sains Malaysia (USM) undergraduate nursing students.

Methods: A cross-sectional study (n = 88) was conducted using self-administered questionnaire consisted of demographic information, stem cells knowledge and attitude statements. Data was analysed using Statistical Package Social Software 20.0.

Results: The majority of participants (92%) had moderate knowledge score about stem cells. Many students (33%) worried that stem cell application might cause a harm to humanity yet had a positive (76.1%) attitude towards its therapeutic potential (45.5%). Poor correlation between knowledge and attitude (r = 0.08) indicated that acceptance towards stem cell is not solely based on the knowledge level but also on other factors including religion and culture.

Conclusion: Therefore, this study suggests that various educational programs on stem cell should be implemented considering the religion, cultural, social, and behavioural determinants in the population to improve stem cell knowledge and encourage a more positive attitude towards stem cells in medicine among these nursing students.

Keywords: stem cells, knowledge, attitude, nursing student, Malaysia

Introduction

Recent developments in stem cell biology have explained a significant differentiation plasticity of many stem cell types in human tissue (1). Scientists are excited about the knowledge that could come from studying human stem cells. Most of them believe that these cells offer a precious opportunity to learn more about cytopathology, including how diseases develop and how they might be prevented or treated on the cellular level.

Stem cells are repair units of the body that serve a central function in the maintenance and regeneration of organs and tissues throughout an organism's lifetime. Their main function is to replenish dying cells and regenerate damaged tissues (2). Based on the extensive stem cell research findings, many scientists have claimed that the cells could potentially generate cures and treatment for various diseases including cancers,

cardiovascular disease, and igniting hopes of achieving stem cell-based replacement therapy in a medical setting (3).

Embryonic stem cells (ESCs) are undifferentiated cells (4); they are not programmed to be specific to any matured cell types found in the human body. Therefore, ESCs are fundamental in developing a diverse supply of tissues in the treatment of various diseases such as Parkinson's, Alzheimer's, spinal cord injuries and cardiovascular disease. Nonetheless, ESC research has been an issue of ethical, legal, and social controversy because it involves destroying embryos to obtain the cells (5,6). This has led to the demand of alternative sources of stem cells which do not involve killing of embryo, namely umbilical cord blood stem cells (UCBSCs) and adult stem cells (ASCs). UCBSCs are very much preferred because of the high proliferative potential,

increased ability for self-renewal, decreased ability for antigen presentation, and most importantly, the safety and ethical free characteristics (7). On the other hand, ASCs, which are found in almost all organs of the postnatal human body, provide an option of endogenous cell source for autologous transplantation, reducing the risk of graft rejection and allogenicity problems. ASCs such as cardiac stem cells have been successfully used to repair the damage caused by heart attacks (8). Because of the bright potential of stem cell-based treatment, it is vital for health care providers to keep abreast of current advances in stem cell science, particularly when there is an enormous potential of revolutionising therapy in the form of cell replacement therapy.

In Malaysia, stem cell research is relatively new. The second edition of the National Guidelines for Stem Cell Research and Therapy, Malaysian Medical Council Guideline No. 002/2009 published by the Medical Development Division of the Ministry of Health in 2009 (9), stated that most of Malaysia's stem cell laboratory research or clinical works to date only involved haemopoietic stem cells originated from bone marrow, peripheral blood, and cord blood. These cells are being used in the setting of stem cell transplantation in Malaysia because the ethical concerns associated with these cells are minimal as compared with ESCs. To date, the use of sources of cells other than the UCBSC and ASCs such as fertilised embryos is still a major concern in Malaysia (10). The national regulation of human ESC strictly governs the research involving stem cells. Because of this ethical issue, local researchers mainly conduct research using ASCs and cultured cell lines.

Although many controversies exist regarding stem cell research, the Ministry of Health recognises the importance of it. Government holds the policy that it is crucial for local scientists and clinicians to get involved in stem cell research provided that these researches conform to ethical guidelines. In fact, there have been more than 500 stem cell transplants performed in Malaysia to date based on the database published by Malaysian Stem Cell Registry (MSCR) that was established since December 2000 (11). MSCR collects the registry of Malaysians who are willing to donate their stem cells to any patient in need. Currently, there are 18000 registered potential donors. The purpose of computerising potential donor database is to ease the search for compatible stem cells for transplantation. In Malaysia, stem cell transplant is commonly carried out for patients suffering from hematological diseases including leukemia, thalassaemia, lymphomas, immunodeficiencies, and aplastic anemia (11).

Besides government bodies and agencies, there are also influxes of private companies dealing with stem cell-based therapies in Malaysia. Some of the commercial stem cells therapies are unproven or still in research and experimentation stages. Unfortunately, Malaysian public knowledge on stem cell is pathetically poor (12). Public are often ignorant of the complexities of scientific research, they are also often assumed to be unaware of the science product commercialisation process (13). Thus, professional healthcare providers, including nurses and nursing students (who are future nurses), must play their role in educating their patients to avoid the unethical use of stem cell-based therapy. Nurses are professional health care workers and are also the frontline people who will spend more time with the patients. In addition, nurses are patient's advocates in terms of medical knowledge (14,15). Information given from nurses to patient must be balanced and accurate, so that decision can be made considering the facts and unbiased answers. Therefore, nurses' knowledge on stem cells and their attitude towards stem cell application in medical setting are very important as these could affect the decision on providing appropriate stem cell-based treatments for many diseases including cancer and cardiovascular diseases. In present study, we aimed to measure the level of stem cell knowledge and attitude of stem cell application in medical setting among undergraduate nursing students from Health Campus, Universiti Sains Malaysia (USM). In addition, we aimed to correlate knowledge score and attitude score among these nursing students.

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. In Malaysia, there is yet no complete understanding of the knowledge and attitude of stem cells among nurses. During the literature review, no current papers from Malaysia were found for inclusion in the review, suggesting a need for more local research to determine the stem cell knowledge and attitude of Malaysian nurses. Thus, the present study was conducted to contribute to the body of knowledge on this issue and help to address the gap in Malaysian research. The outcome of this study can potentially help to address the issue of advocating nurses as well as future nurses in providing the necessary information about stem cell in medical settings. In addition, the result of this study also might serve as a basis to facilitate continuous nursing education regarding stem cells and improve nursing practice as a whole in Malaysia.

Materials and Methods

Design

This study is a cross-sectional study focused on investigating the knowledge and attitude level of undergraduate nursing students in USM towards stem cell application in medical setting.

Sampling and participants

This study used random sampling method to draw a representative sample from a study population using a random number generator via the Microsoft Excel 2007 software (Microsoft Corporation, USA). In this study, a total of 88 respondents were randomly chosen from the population for analysis.

Instrument development

The self-administered instrumentation tool used in this research study was a self-developed questionnaire formulated by the researcher based on the literature reviewed regarding stem cells and its application in the medical setting among health care professionals that particularly focus and/or reflected on the knowledge and attitudes.

Validity and reliability of instrument

To validate the accuracy and reliability of the instrument developed by the researcher in this study, the instrument content was reviewed and validated by an expert panel followed by a pilot study conducted within a selected group of 30 registered nurses in Hospital USM (HUSM). Thirty respondents were chosen because a general rule of thumb is to take 30 or greater as a estimation parameter (16). Results from the pilot study showed the Cronbach alpha of 0.67 for section B and 0.86 for section C. By doing so, it was able to demonstrate the validity and reliability scores of the instrument, and at the same time, providing a valuable insight for the researcher and act as an internal check of the questionnaire (17). Therefore, problems can be greatly minimised during the data collection phase.

Ethical consideration

The approval to conduct this study was obtained from the Dean of School of Health Sciences USM, Research Ethics (Human) Committee USM, and the Director of HUSM. The guidelines stated in the Ethics Research Board of USM were completely followed before conducting this study. Prior to taking part in the study, all respondents were asked to sign on a written consent form confirming their willingness to participate. They were also explained about the purpose and objective of the study by the researcher. This research provided autonomy, allowing respondents the freedom to decide whether to participate and give information. All respondents of the study were assured that confidentiality would be maintained.

Data collection

Once the ethical approval was granted from the academic and ethical department, data collection resumed as the next stage of study using structured questionnaires with the undergraduate nursing students in USM. Each respondent was given one envelope containing a questionnaire, respondent information, and research information, which was to explain the purpose of the study, its voluntary nature, and the anonymity of the responses. The researcher explained the study and obtained the consent of the participant to complete the survey. Researcher had passed the questionnaire, information sheet, and consent form to the respondents, and they were given approximately 15–20 minutes to complete the questionnaire. Upon completion, the researcher collected the questionnaire. The questionnaire consists of 3 sections: Section A was the demographic data which consists of sex, occupation, education years, and the highest level of education. Section B was the knowledge of stem cells including 20 dichotomous questions, which consist of either true or false. Lastly, Section C was the attitude level towards stem cells for their application in the medical field. Each question was scored on a five-point Likert scale. Each respondent was asked to select their view either to strongly disagree, disagree, unsure, agree, or strongly agree to the statements given to them.

Data analysis and scoring measurements

Data were entered and analysed using the Statistical Package Social Sciences (SPSS) software program version 20.0. Demographic data were analysed and reported with descriptive statistics using number and percentage. The numbers of correct answers for each question were quantified in percentages. To evaluate the

knowledge score in this study, dichotomous questions with "True" and "False" were used. Two score was given if the respondent answers correctly and one score was given if the respondent answers wrongly. Because there were a total of 20 questions, the range of score was 20–40, making 40 as the highest score, if the respondent answers all the questions correctly and 20 as the lowest score, if the respondent answers all the questions wrongly. Thus, the knowledge score obtained was categorized into 3 levels: High (35–40), Moderate (27–34) and Low (20–26) (18). Therefore, the higher the knowledge score, the higher the level of knowledge among the respondents. On the other hand, attitude level was measured using Likert 5-point scale. Respondent was given statements that represent a range of view on a subject relating to stem cells. Thus, each respondent was asked to select their view such as strongly disagree, disagree, unsure, agree, or strongly agree. Scores ranges from 1 point, which is "strongly disagre'" to 5 point, which is "strongly agree". Since there were 10 statements, the range of score is from 10–50 points. Thus, the higher the score, the higher the support and encouragement towards stem cells in medical setting among respondents. Pearson correlation was used to determine the association between knowledge and attitude. All tests were two-tailed and the significance level was set at $p < 0.05$.

Results

Demographic data

A total of 88 completed questionnaires were received from undergraduate nursing students in School of Health Sciences, USM. Table 1 shows the demographic characteristics of undergraduate nursing students. Majority of the nurses were female (93.2%) with most of them from matriculation (81.8%), followed by Sijil Tinggi Persekolahan Malaysia (STPM) or Malaysian Higher School Certificate (15.9%) and Diploma (2.3%). Eighty six respondents (97.7%) were Islam, only 2 respondents (2.3%) embraced other religion.

Stem cell knowledge score

Among the 88 nursing students, 81 (92%) students fall in the category of moderate for knowledge score, whereas 7 (8%) students scored high in terms of their knowledge for stem cells (Table 2). Particularly, there were 2 questions in which almost all students answered correctly, Q2: Stem cells are capable of dividing and can self-renew for long periods (94.3%) and Q7: Having more number of stem cells stored can improve the medical outcome such as faster recovery and fewer complications (93.2%). On the other hand, there were also 2 questions that had a poor response: Q5: Embryonic stem cells are capable of forming any cell type in the body including placenta (19.3%) and Q16: Bone marrow stem cells are taken from the spine (18.2%) (Table 3).

Table 1: Demographic characteristics of undergraduate nursing students in School of Health Sciences, USM (n = 88)

Variables (n = 88)		Frequency (%)
Sex	Male	6 (6.8)
	Female	82 (93.2)
Years of study (USM Nursing Undergraduate Degree Program)	2	29 (33.0)
	3	30 (34.0)
	4	29 (33.0)
Highest level of education	Diploma	2 (2.3)
	Matriculation	72 (81.8)
	STPM	14 (15.9)
	Degree	0 (0.0)
Religion	Islam	86 (97.7)
	Other	2 (2.3)

Table 2: Category of knowledge among nursing students

	Variables (n = 88)	Frequency (%)
Knowledge of nursing students	Low	0 (0.0)
	Moderate	81 (92.0)
	High	7 (8.0)

Table 3: Percentage of undergraduate nursing students (n = 88) with correct responses on each question

Knowledge question	Frequency (%) of correct answer
1 Stem cells are unspecialised.	48.3
2 Stem cells are capable of dividing and can self-renew for long periods.	94.3
3 Sperm and eggs are a source for adult stem cells.	52.3
4 Adult stem cells are also known as somatic stem cells.	83.0
5 Embryonic stem cells are capable of forming any cell type in the body including placenta.	19.3
6 Stem cells are unspecialised.	48.3
7 Stem cells are capable of dividing and can self-renew for long periods.	94.3
8 Sperm and eggs are a source for adult stem cells.	52.3
9 Adult stem cells are also known as somatic stem cells.	83.0
10 Embryonic stem cells are capable of forming any cell type in the body including placenta.	19.3
11 Umbilical cord blood stem cells are embryonic stem cells.	22.7
12 Harvesting umbilical cord blood stem cells can cause pain and involve harmful risks to the newborn and mother.	63.6
13 Umbilical cord blood stem cell transplantation has a lower risk for graft versus host disease than other types of stem cells.	78.4
14 Autologous adult stem cell transplantation is controversial, primarily because of the immunogenic graft rejection.	34.1
15 Stem cells can be used to test new drugs and its effectiveness.	72.7
16 Bone marrow stem cells are taken from the spine.	18.2
17 Embryonic stem cell transplantation has a serious disadvantage as it could result in the formation of tumour.	47.7
18 Umbilical cord blood stem cell transplantation is less efficient compared with bone marrow stem cell transplantation.	68.2
19 Stem cells can be induced from normal skin cells by switching on genes controlling the pluripotent and differential of stem cells.	69.3
20 Stem cells are maintained by obligatory asymmetric replication.	75.0

Attitude score

Among the 10 questions that evaluate the attitude level, majority of the undergraduate nursing student (76.1%) showed a good attitude towards stem cell application in medical setting (Table 4). The attitude questions are subdivided into Ethical (Q1-2), Religion (Q3-4), Culture (Q5-6), Professional (Q7-8) and Community (Q9-10) (Table 5). Ethically, there were a fairly moderate number of students who worry that it might kill lives, particularly embryo for benefits of other as observed for responses to Q1 (33%). Religiously, students believed that anything that involves taking a life away is immoral and illegal, and therefore is unnecessary. Many of respondents were worried about stem cell being unethical and should be given the due respect as a living human adult, this has been clearly shown clearly shown responses to Q3 (44.3%) and Q4 (56.8%). In the aspect of culture, respondents had a very positive attitude to encourage stem cell application for the benefit of the future (Q5 and Q6, both at 47.7%). Professionally as a future nurse, the nursing students saw the importance of gaining more knowledge in this aspect (Q7, 60.2%) and lastly, in terms of the community, almost half of the students believed that there is a bright future for stem cells and more awareness program should be conducted for the benefit of the health care provider and the community (Q9, 58% and Q10, 45.5%) (Table 5).

Table 4: Category of attitude score among nursing students

	Variables (n = 88)	Frequency (%)
Attitude of nursing students	Poor	1 (1.1)
	Moderate	6 (6.8)
	Good	67 (76.1)
	Excellent	14 (15.9)

Table 5: Percentage of undergraduate nursing students (n = 88) that agreed with the statement (positive response)

Attitude question	Frequency (%) of positive response
1	I am worried that stem cell transplantation might potentially open doors to human being killed for the benefit of others.	33.0
2	The government should prohibit all researches regarding embryonic stem cells from embryo or aborted fetus.	28.4
3	Life begins at conception; thus, embryonic stem cell research which involves the destruction of embryo is immoral, illegal and unnecessary.	44.3
4	A blastocyst should be given the same respect and right to live as a living human adult.	56.8
5	Stem cell transplantation should be widely practiced.	47.7
6	I would advise pregnant mothers to store their umbilical cord blood stem cells for future purposes.	47.7
7	Competency in stem cell knowledge is important for me as a health care provider.	60.2
8	I am aware of the potential benefits, uses, and possible harms of stem cell research.	36.4
9	There should be more awareness program regarding stem cell.	58.0
10	The future of mankind is bright if stem cell research could be successfully conducted.	45.5

Association of knowledge with attitude

Mean knowledge score for year 2, 3, and 4 undergraduate nursing student was 31.55 ± 1.70, 31.97 ± 1.83 and 31.62 ± 1.80, respectively. Mean and standard deviation (SD) of knowledge score for each year is shown in Table 6. The correlation between the knowledge score and attitude score among nursing students was poor ($r = 0.08$), thus, showing that there was poor association between the knowledge and attitude score. Besides that, the p value > 0.05 indicated that the correlation between the education years and knowledge score was not significant. Results are shown in Table 7 and scatterplot Figure 1.

Discussion

Even though most of the nursing students were receptive towards more knowledge and information about stem cell research using human embryo, they also generally agreed that it is immoral and illegal to do so. Data showed that the respondents expressed concern towards the misuse of embryo for unethical research purpose. Similar concern has been raised worldwide (19), suggesting that embryo research might have caused the misleading use of research goals and even a commercial push that may lead to exploitation.

Nursing student (> 50%) agreed that a blastocyst should be given the same respect and right to live as a living human adult. This is possibly because of the religion background of majority respondents who followed Islam. Malaysia is populated by 70% of Malays whose religion is Islam. Being the main religion in Malaysia, Islamic belief has coloured this country into the uniqueness of religion perception that has shaped the Malaysian nurse students perception on stem cell research (20). According to the Islamic beliefs, in the first stage of the pregnancy, which is the first four months, which is also called pre-ensoulment, biological growth of the human biological growth occurs and it supposed to be respected. Abortion at this stage is only allowed for grave reasons (21). In the second stage, which is after the fourth month, the biological person becomes a moral person, making the fetus to achieve a moral and legal status of an adult (22), thus killing it during this stage is considered homicide. Due to the strong beliefs in religion, the religious concerns affect just as much the attitude of the respondents, which explained the lack of interest towards stem cell knowledge. Nevertheless, with the moderate knowledge possessed by the undergraduate nursing students,

Table 6: Average knowledge score for each education year

Year	Knowledge score (mean ± SD)
2	31.55 ± 1.70
3	31.97 ± 1.83
4	31.62 ± 1.80

Table 7: Correlation between knowledge score and attitude score

	Knowledge score	
	r	*p* value*
Attitude score	0.08	0.482

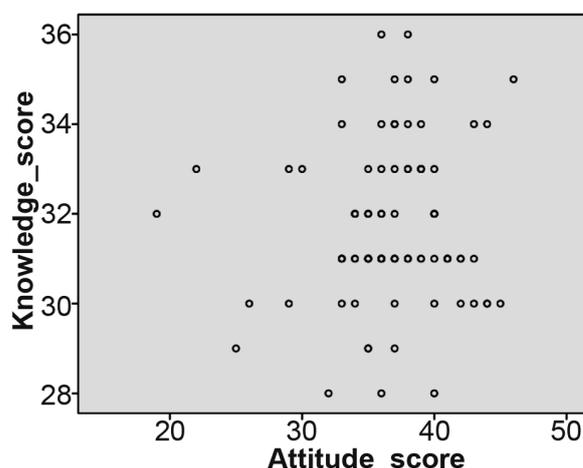* Pearson Correlation ($p > 0.05$ indicated correlation is not significant)

Figure 1: Correlation between knowledge score and attitude score

they can foresee the power and the future of stem cells in the medical application, thus, they possess a positive attitude for acquiring more information and exposure about the benefits of stem cells.

It was found that the association between the undergraduate nursing students knowledge and attitude score of stem cells was poor, which was indicated by the correlation coefficient, $r = 0.08$. This finding is consistent with the research done by Sorgo and Ambrozic-Dolinsek which shows that there is a weak relationship between knowledge and attitude (23). This explains that knowledge and attitude are not on a linear graph, indicating that acceptance towards stem cells is not solely based on scientific facts, but on other factors such as religion, culture, and exposure to stem cells.

Therefore, various educational programs on stem cell must be adapted for the religious, cultural, and social environment in the community. The stem cell awareness programs should be implemented after considering the religious, economic, social and behavioural determinants in the population. Ministry of Health should emphasise on the future of stem cell by frequently organising stem cell awareness talks frequently to encourage a more positive attitude towards stem cells in terms of research and treatment. University authorities should consider stem cells as a crucial topic and ensure that knowledge and positive attitude about stem cells should be imparted to the nursing students, being the future nurses, enabling them to educate, advocate, and improve nursing care as a whole.

Conclusion

Latest knowledge and findings of stem cells are deemed important in nursing care, particularly for undergraduate nursing students who are the future nurses and soon have the responsibility of an advocator and teacher, and as a healthcare provider. The results of this study warrant a need to promote stem cell knowledge and its application in medical field to create awareness and update information among undergraduate nursing students. Adequate knowledge will empower the future nurses to gain more knowledge, thus, creating an attitude to improve holistic nursing care that would directly make an impact in the quality of life of many patients. Therefore, further assessment and efforts should be undertaken for improving the USM undergraduate nursing curricula to impart knowledge and positive attitude in these nursing students about stem cells.

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Conflict of Interest

None.

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Authors' Contributions

Conception and design: JLL, LKS, SCT
Analysis and interpretation of the data: JLL
Drafting of the article: JLL, SCT
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Final approval of the article: JLL, LKS, WANWA, SCT
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References

1. Sadri S, Mazhari R, Sadri M, Konjedi N, Shah P. Cardiovascular applications of stem cell therapy. *J Stem Cell Res Ther*. 2011;**S1(003)**:1–7. doi: 10.4172/2157-7633.

2. Fujimaki S, Machida M, Hidaka R, Asashima M, Takemasa T, Kuwabara T. Intrinsic ability of adult stem cell in skeletal muscle: An effective and replenishable resource to the establishment of pluripotent stem cells. *Stem Cells Int*. 2013;**2013**:1–18. doi: 10.1155/2013/420164.

3. Dresser R. Stem cell research as innovation: Expanding the ethical and policy conversation. *J Law Med Ethics*. 2010;**38(2)**:332–341. doi: 10.1111/j.1748-720X.2010.00492.x

4. Bodnar MS, Meneses JJ, Rodriguez RT, Firpo MT. Propagation and maintenance of undifferentiated human embryonic stem cells. *Stem Cells Dev*. 2004;**13(3)**:243–253. doi: 10.1089/154732804323099172.

5. Nisbet MC. Public opinion about stem cell research and human cloning. *Public Opin Q*. 2004;**68(1)**:131–154. doi: 10.1093/Poq/Nfh009.

6. Robertson JA. Embryo stem cell research: Ten years of controversy. *J Law Med Ethics*. 2010;**38(2)**:191–203. doi: 10.1111/j.1748-720X.

7. Ikuta LM. Human umbilical bord blood transplantation: What nurses need to know. *AACN Adv Crit Care*. 2008;**19(3)**:264–267. doi: 10.1097/01.AACN.0000330376.11272.8b.

8. Carr CA, Stuckey DJ, Tan JJ, Tan SC, Gomes RS, Camelliti P, et al. Cardiosphere-derived cells improve function in the infarcted rat heart for at least 16 weeks: An MRI study. *PLoS One.* 2011;6(10):e25669. doi: 10.1371/journal.pone.0025669.

9. Ministry of Health Malaysia. *Guidelines for stem cell research and therapy* [Internet]. Kuala Lumpur (MY): Ministry of Health; 2009 [cited 2014 Jan 20]. Available from: http://www.nih.gov.my/mrec/MALAYSIAN STEM CELL RESEARCH GUIDELINES.htm.

10. Kuen PFC. The regulatory regime for human embryonic stem cell (HESC) research in Malaysia: A critique [Internet]. *Malaysian Journal of Law and Society.* 2012;**16** [cited 2014 Jan 20]. Available from: http://www.myjurnal.my/public/issue-view.php?id=4269&journal_id=310.

11. Malaysian Stem Cell Registry [Internet]. Kuala Lumpur (MY): Institute For Medical Research, Ministry of Health; 2013 [cited 2014 Jan 20]. Available from: http://www.imr.gov.my/en/highlights-featured-articles/1112-malaysian-stem-cell-registry-mscr.html.

12. Hart PD. *Voters' view on stem cell research* [Internet]. Newton (MA): The Civil Society Institute; 2004 [cited 2014 Jan 20]. Available from: www.civilsocietyinstitute.org/reports/stemcellresearchpaper.pdf.

13. Millstone E, Van Zwanenberg P. A crisis of trust: For science, scientists or for institutions? *Nat Med.* 2000;**6**:1307–1308. doi: 10.1038/82102.

14. Berman A, Synder SJ, Kozier B, Erb G. *Fundamentals of nursing: Concepts, process and practice.* 8th ed. New Jersey (NJ): Pearson; 2008.

15. Burns P, Jones SC, Iverson DC, Caputi P. Where do older Australians receive their health information? Health information sources and their perceived reliability. *J Nurs Educ Pract.* 2013;**3(12)**:60–69. doi: 10.5430/jnep.v3n12p60.

16. Browne RH. On the use of a pilot sample for sample size determination. *Stat Med.* 1995;**14**:1933–1940. doi: 10.1002/sim.4780141709.

17. Polit DF, Beck CT. *Nursing research: Principles and methods.* Philadelphia (PA): Lippincott Williams & Wilkins; 2004.

18. Kumar R, Mehta S, Kalra R. Knowledge of staff nurses regarding legal and ethical responsibilities in the field of psychiatric nursing. *Nursing and Midwifery Research.* 2011;**7(1)**:1–11. Available from: medind.nic.in/nad/t11/i1/nadt11i1p1.pdf.

19. Beeson D. Egg harvesting for stem cell research: Medical risks and ethical problems. *Reprod Biomed Online.* 2006;**13(4)**:573–579. doi: 10.1016/S1472-6483(10)60647-5.

20. Al-Hayani FA. Muslim perspectives on stem cell research and cloning. *Zygon.* 2008;**43(4)**:783–795. doi: 10.1111/j.1467-9744.

21. Larijani B, Zahedi F. Islamic perspective on human cloning and stem cell research. *Transplant Proceedings.* 2004;**36(10)**:3188–3189. doi: 10.1016/j.transproceed.2004.10.076.

22. Kaunitz AM, Benrubi GI, Barbieri RL, Darney PD, Edelman A, Speroff L, et al. Ethics and referral for abortion. *Am J Obstet Gynecol.* 2009;**200(6)**:e9. doi: 10.1016/j.ajog.2008.12.017.

23. Sorgo A, Ambrozic-Dolinsek J. The relationship among knowledge of, attitudes toward and acceptance of genetically modified organisms (GMOs) among Slovenian teachers. *Electron J Biotechnol.* 2009;**12(3)**:1–13. doi: 10.2225/vol12-issue4-fulltext-1.