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Radiation and Health: Exploring Unmet Educational Needs of Health Care Professionals- an Indian Experience

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Abstract

Introduction: *Today radiation has value added the increased longevity of human being and quality of life. Limited knowledge of the doctors about medical uses of radiation is a concern. In absence of published evidence about awareness of impact of radiation of human as well as environmental health, this article explores the same from health care professionals from India.*

Methods and Material: *Workshops on 'Radiation and Health' were organized at the medical colleges in Maharashtra, India in collaboration with Nuclear Power Corporation of India Limited. Pretested self-administered questionnaire was given to all the 207 participants registered for these workshops. Of them 141(68.7%) returned back the questionnaires. Data was analyzed by using SPSS version 19.0 software program (SPSS Inc., Chicago, Illinois, USA).*

Results: *Response rate for the pretested schedules was 68.71% (n=141).Majority of the participants 131 (92.9%) were medical teachers and postgraduate students. Limit of occupational radiation exposure and ALARA principal was correctly answered by 83 (58.87%) and 72 (51.06%) respondents. Sixty eight (48.23%) overestimated radiation exposure through CT scan. Though 83(58.87%) said that nuclear power plants do not emit radiation, only 35 (24.82%) could answer correctly actual radiation induced human mortality after Fukushima Daiichi nuclear facility accident in Japan.*

Conclusions: *Radiation protection training with well-placed mechanism of monitoring to the health care professionals is crucial. Their awareness about impact of nuclear energy on environmental health will be instrumental to alleviate anxiety about the same in the general public.*

Key-words: *Radiation, human and environmental health, health care professionals, India*

Introduction

The era of rapidly expanding scope of diagnostic radiology, nuclear medicine andradiotherapy has undoubtedly value added the increased longevity of human being and quality of life. Like any boon of technology is not devoid of disadvantages, various negative side effects of radiation have been also noted including mortality.[1-5] Published evidence mainly from developed countries has already validated concern about limited knowledge of medical doctors regarding radiation doses.[6-19] Health care professionals are at key position to decide the quantum of medical exposure of radiation to the patients and consequently its harmful effects which many a times may not be inevitable. This ultimately sets radiation protection awareness among them a topmost priority for rendering quality assured medical care to the patients! It is more imperative for India, one of the most preferred destinations for medical tourism where no such published evidence is available.

Radiation has made its significant contributions not only in the medicine but also in the agriculture, academics, industry, electricity generation and many more diverse fields. Nuclear power has been zeroed as a clean, green, affordable source of energy to fulfil pressing energy demands. It is well known fact that public awareness and acceptance of nuclear power as a source of energy is more important than mere availability of technical and financial resources.Worldwideproactive efforts are made mainly in the developed countries to raise public support towards nuclear source of energy. However there is limited published evidence assessing awareness of the health care professionals about impact of radiation on environmental health. [20] Today India in the midst of palpable anxiety and scare is considering nuclear power as source of electricity. Attempts are being made to raise awareness about nuclear power safety both in general and medical community in this country, however no baseline data is available due to lack of systematic research on this aspect. Present article explores knowledge of health care professionals from Mumbai towards radiation and both human as well as environmental health.

Subjects and Methods

A series of sensitization workshop on 'radiation and health' were conducted at medical colleges in Maharashtra, India in collaboration with Nuclear Power Corporation of India Limited which is a Government of India Enterprise under Depart-ment of Atomic Energy. Participants included medical teachers from different departments and technicians from Radiology department. Appropriate ethical approval was obtained and the delegates were explained about the study. Prior to commencement of scientific sessions in the workshop informed consent was taken and the required responses were obtained by administering well-structured pretested question-aire in multiple choice formats It included information about the present designation, years of service, field of specialty and twenty two questions assessing their knowledge regarding impact of radiation on human and environmental health. Pretested self-administered questionnaire was given to all the 207 participants registered for these workshops. Of them 141(68.7%) returned back the questionnaires. Data was analysed by using SPSS version 19.0 software program (SPSS Inc., Chicago, Illinois, USA).

Results

Questionnaires were distributed to 205 participants attending the workshop, of which 68.71% was the response rate (n= 141). Majority of the respondents had medical background 131 (92.9%). Nine (6.38 %) were from nonmedical background and information about qualification of a delegate was not available (0.70%). Only ten (7.63%) of the doctors were from radiology department while rest were non radiologists. Speciality was not available from 7 (4.96%) participants and two respondents were medical undergraduates.

Out of 131 doctors, information about post MBBS experience was available from 111 (84.73%) participants. Of them, 66 (59.45%) had more than 10 years and 45 (40.54%) had less than 10 years of post MBBS experience.

Table one show results of knowledge of the participants about medical uses of radiation and human health. Only 28.37% of the participant could answer correctly dose of radiation received by adult patient from CT scan as compared to conventional X ray chest. More than forty eight percentage of the respondents overrated the dose while 23.41% did not know the answer. Merely 75 (53.19%) delegates affirmed that they inform the patients about the risks and benefits of the diagnostic or therapeutic procedures which involve radiation. Fifty four (38.3%) denied the same while eight (5.67%) said that patient education for this is not applicable to them. Four of the participants did not respond to this question.

Table 1: Knowledge of the participants about medical uses of radiation and human health

Sr. No.	Question	Correct answer n (%)	Incorrect answer n (%)	Do not know n (%)
1	Charge possessed by proton	132 (93.62)	5 (3.55)	4 (2.84)
2	Equivalent of Becquerel transformation	39 (27.66)	32 (22.7)	70(49.65)
3	Recommended dose limit for occupational radiation exposure	83(58.87)	22(15.6)	36(25.53)
4	Explanation of ALARA principal	72(51.06)	46(32.62)	23(16.31)
5	Appearance of stochastic effects of radiation	99(70.21)	13 (9.22)	29(20.57)
6	The most crucial period for harmful effects of radiation exposure in pregnancy	118 (83.69)	18 (12.77)	5 (3.55)
7	Comparison of radiation exposure dose of CT scan and X-Ray in adult	40 (28.37)	68 (48.23)	33 (23.41)
8	Most radiosensitive human body organ	82 (58.16)	51 (36.17)	8(5.67)
9	Technique for measuring internal radiation dose monitoring	33 (23.40)	82(58.16)	26 (18.44)
10	Utilization of non-ionising radiation in ultrasound	114 (80.85)	18 (12.77)	9(6.38)
11	Utilization of non-ionising radiation in Magnetic Resonance Imaging	79 (56.03)	53 (37.59)	9(6.38)
12	Safe dose of radiation	83 (58.87)	51(36.17)	13 (9.22)

Following table indicates awareness of the participants towards radiation and environmental health

Table 2: Awareness of the participants towards radiation and environmental healt

Sr. No.	Question	Correct answer n (%)	Incorrect answer n(%)	Do not know n(%)
1	Average radiation exposure through natural sources per annum	30 (21.2)	76 (53.9)	35(24.82)
2	Indian state with the highest natural radiation exposure	91(64.54)	26 (18.44)	24(17.01)
3	Highest radiation exposure through beverages	71(50.35)	28 (19.86)	42(29.79)
4	Dangerous levels of radiation emission through nuclear power plants	83 (58.87)	45(31.91)	13 (9.22)
5	Higher waste generation from nuclear as compared to coal based power plants	77 (54.61)	49 (34. 75)	15 (10.64)
6	Nuclear power plants are safe	102 (72.34)	25(17.73)	14(9.93)
7	Nuclear power plants consume large amount of water	48(34.04)	75(53.19)	18 (12.77)
8	Risk involvement of transport of radioactive material	69 (48.94)	56 (39.72)	16 (11.35)
9	No radiation induced death due to recent accident in Fukushima Daiichi nuclear power plant, Japan	35 (24.82)	105(74.46)	1(0.71)

Only 21.2% of the respondents could correctly tell about average radiation exposure through natural sources per annum. Majority 58.87% thought that dangerous levels of radiation were emitted through nuclear power plants. Though 72.34% of the participants thought that nuclear power plants are safe, 54.61% assumed that they emit higher amount of waste as compared to thermal power based plants. Majority of the participants (74.46%) overestimated radiation induced deaths due to Fukushima Daiichi nuclear power plant accident in Japan while only 24.82% could answer this question correctly.

Keen interest was shown by all the participants to know more about radiation and visit to the nuclear power plant facility.

Discussion

A response rate of 68.78%, meant loss of valuable opinions of the significant number of the participants. This reflects importance given by the participants who are the key determinants for rendering quality assured medical care to the patients both directly and indirectly through training of future manpower in health care services.

Reviewing the relevant literature, points to the fact that the knowledge of medical professionals is deficient as in the present study.[6-19, 21-23] The results of this study show poor knowledge of the participants regarding the units of measurement of radiation exposure as seen elsewhere.[24] Awareness about the basic fundamental concepts related to use of non-ionizing radiation in ultrasonography and Magnetic Radiation Imaging in the present study was higher as compared to other studies

worldwide.[7,8,10,12-14,16-19,23-25] In our study 58.16% correctly identified gonads as the most radiosensitive organ while awareness about the same was variable as from published evidence. [6, 15] ALARA, which is the core principle for radiation protection was correctly described by 51.06% of the respondents in this study while awareness about the same ranged from 6.1% to 48%.[15, 6] Findings of unsatisfactory responses to the dose of radiation involved in the adult CT scan in this study was no different than the published evidence elsewhere. [6-8,10, 13-15, 16, 18, 22, 23] Unacceptable level of risk and benefit communication by the medical professionals with the patients before undergoing radiological procedures is similar with the published evidence elsewhere. [6-8, 10, 12-15]

Awareness about impact of radiation and environmental health among health care professionals could not be compared in view of scarcity of similar published studies.

Deficient knowledge of the teaching fraternity on this aspect may not be limited to themselves, as medical colleges have significant contribution building trained human resources practising elsewhere in India. Results of this study indicate radiation protection training is the need of the hour not only for health care professionals from radiology department who perform the procedures but also for general physicians and specialists who recommend the same. Induction training about radiation protection for doctors and paramedics should be imparted during the course of medical teaching in medical school for undergraduate and postgraduate studies. However just offering radiation protection courses may not suffice.[6-8] Therefore an in built review mechanism should be developed to assess whether this training is actually reflected into safe and effective rationalised practice of radiation based diagnostic and therapeutic procedures. Standards for proficiency for those doctors and paramedical workers where occupational radiation exposure is involved should be developed in consultation with the relevant stakeholders.Regular review and update in these standards keeping in pace with rapidly expanding technology will be of help to control health risks and maximize benefits of medical uses of radiation.

Sensitization of the health care professionals about radiation protection will make them accountable for patient education facilitating quality assured patient care. Provision for written information about doses, associated risk and benefits pertaining to any procedure involving radiological exposure on the requisition will not only act as a reinforcement of the training received by the health care professionals but also will be of help for better patient communication. This in turn will help doctors to rely more on clinical acumen and to order as well as perform more and more number of procedures involving non ionizing radiation where ever indicated.

Awareness of the health care professionals about impact of nuclear energy on both human and environmental health is essential who in turn will be instrumental to alleviate anxiety about the same in the general public. More elaborative ongoing research on this aspect in the general and medical community should be area of focus of social and behavioural scientists and health service providers!

Conclusions

Radiation protection training with well-placed mechanism of monitoring to the health care professionals is crucial. Their awareness about impact of nuclear energy on environmental health will be instrumental to alleviate anxiety about the same in the general public.

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