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INVITED EDITORIAL

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After the Fukushima nuclear reactor accident, medical doctors and health professionals were asked to provide medical support to members of the Japanese public who may have been exposed to radiation releases or may have inhaled or ingested radioactive substances. This mainly consisted of providing appropriate information regarding the level of risk and the potential health effects, as well as in some cases, conducting or supervising radiation or biological tests in order to decide if special medical care was necessary.

In April 2011, the Main Commission of the International Commission on Radiological Protection (ICRP) held a session in Seoul (Korea) on the Fukushima accident, in order to learn from the ongoing Japanese experience and to offer advice in the follow-up process. What happened during the weeks following the Fukushima accident vividly demonstrated the need for better training in radiation protection (RP) and the need for a better understanding of ionising radiation on the part of medical and paramedical personnel, especially for those working in the local hospitals. The well-timed ICRP publication on education and training in RP for medical professionals and students [1], available April 2011, contains such advice for health authorities, universities, medical societies and professionals.

Members of the Radiation Protection Board of the Japan Radiological Society were involved in medical support for the Fukushima population and their direct experiences are described here. Several lessons can be learnt from their observations to improve the RP understanding of medical and paramedical personnel.

During the weeks following the Fukushima accident, instances were reported of medical professionals refusing to attend to the population, as they feared potential contamination and irradiation. This behaviour resulted from a lack of knowledge and a misunderstanding of both the risk of radiation incurred by the health professionals and the appropriate medical care required by the patients.

The effects of ionising radiation and radioactive contamination are topics included in the basic training of RP in the recent ICRP document [1].

The depth of misunderstanding also extended to news media coverage, especially reports on the emergency workers in Fukushima who were called in to stabilise the overheating reactor cores. Sensational news reports on the possible severe health effects for those working in the nuclear power plant and receiving an effective dose greater than 100 mSv, caused these workers and their families great anxiety. Such basic concepts as radiation quantities (absorbed dose and effective dose), units (mGy and mSv) and the fact that thousands of mGy are needed to cause acute radiation sickness (and possible death) are part of the training recommended by ICRP [1] for medical doctors and nurses. Furthermore, it is noted that lower doses, on the order of several hundred mSv would be needed to increase the lifetime risk of developing cancer by one or two per cent above the natural occurrence of about 50 per cent for the general Japanese population.

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Some people went to health centres asking for the administration of intravenous radiological contrast medium, as they knew that this contains iodine, and consequently thought that it could protect them from thyroid cancer. Others gargled and drank significant amounts of iodine compounds that are only to be used to treat minor mouth infections, and these misadministrations resulted in illness. In the event that radioactive iodines are released during an accident, the medical authorities might recommend taking potassium iodide (KI) pills or syrup (for children) to block the uptake of radioactive iodine. However, if the exposure potential to radioactive iodine is low the adverse effects from taking even these relatively benign agents might outweigh the potential benefit. Further, KI is not recommended for persons over the age of 40 years since such adults are less susceptible to radiation-induced thyroid cancer than very young children [2].

The risk of thyroid cancer after potential internal contamination with radioactive iodine following the release into the atmosphere and sea during the Fukushima accident was one of the main concerns in the population. Measurements of potential contamination with I-131 in the thyroid carried out on more than 1000 children showed that only minimal intake had occurred [2].

Pregnant women were worried about the potential effects on their foetus and some feared a high percentage would develop cancer or be born with malformations—given the small and relatively short-term potential exposure to radiation doses around Fukushima, these outcomes seem highly improbable. Large-scale monitoring for birth defects in Belarus after the Chernobyl accident, for example, has failed to demonstrate an association with the much higher levels of environmental exposure experienced in 1986 [3]. Such unjustified anxiety could easily have been avoided had medical personnel been properly informed regarding radiation risks during pregnancy.

Following a minor potential contamination or irradiation, some patients went to their doctors asking for the type of cancer they would develop and how many months they would have to wait until the 'cancer occurred'. Unfortunately, many doctors were not able to give the correct answer because they lacked information and understanding regarding the effects of low-level radiation and the stochastic nature of cancer induction.

Health and regulatory authorities, medical, scientific and professional societies, and universities and other groups with responsibilities in training programs need to emphasise how this terrible Japanese disaster has highlighted serious gaps in knowledge regarding radiation effects and radiological protection in the medical community, and how critically important it is to improve this situation.

In any emergency or accident, medical doctors and other health professionals are the first 'reference' for advice and they should be able to answer questions calmly and from a position of knowledge, no matter how serious the situation is. In such cases, members of the public and workers likely to be either real patients or simply worried persons are ready to follow their advice.

ICRP Publication 113 [1] contains recommendations concerning radiation protection training for medical professionals (including nurses and technicians) and medical students. If these are followed, this should help to remedy weaknesses in subject knowledge, contribute to a better use of radiation in medicine and enable better management of radiation risks in case of radiation accidents or emergencies (such as at Fukushima). With a proper education and training in the basic aspects of radiation terminology, radiation effects and radiation protection, the management of the population near Fukushima would have been much more effective. Appropriate answers would have provided the required public assurance and minimised unnecessary anxiety. Clearly the terrible tragedy of loss of loved ones, loss of livelihood and evacuation from your home provided sufficient long-lasting mental stress without adding

an exaggerated radiation concern.

Psychological reasons and a lack of proper information have sometimes led to persons rejecting vegetables, avoiding water or milk without any grounds, and engendered economic and social consequences of significant importance.

The population near Fukushima, workers in the nuclear power plants, pregnant women and any person likely to be at risk should be properly informed without alarmism or exaggeration. The health system and professionals should be in a position to provide proper advice and proper medical care without feeling inadequate due to a lack of knowledge. They therefore need to know about radiation and its biological effects, and to learn how to communicate the risks it engenders without causing undue alarm.

Many people may run to hospitals, making triage difficult and blocking hospital resources for more urgent medical care. The catastrophe in Japan has proved that it is of the highest importance that all medical doctors and health professionals become acquainted with the basic concepts of RP. These basic concepts [1] include:

- properties of ionising radiation (x-rays, alpha particles, beta particles and electrons);
- how to quantify the amount of radiation, and radiological quantities and units;
- radiation mechanisms of interaction with biological materials;
- classification of radiation effects: deterministic and stochastic;
- magnitude of the risk of cancer and hereditary effects;
- use of radiation in diagnostic and interventional radiology, nuclear medicine, PET/CT and radiotherapy;
- recommendations and legal requirements applying to medical, occupational, and public exposure;
- principles and methods of protection of patients and staff in diagnostic and interventional radiology;
- principles of justification of radiological procedures, optimization and dose limitation;
- typical doses from diagnostic procedures;
- appropriate role of effective dose in medicine;
- deciding when children and pregnant women require special consideration in diagnostic and interventional procedures;
- risks to pregnant women (as patients or staff) and to foetuses involved in nuclear medicine, radiotherapy, and diagnostic and interventional radiology;
- knowledge and skills required to provide appropriate patient counselling on radiation risks before and after medical exposures;
- commonly asked questions and suggested answers.

References

[1] ICRP (International Commission on Radiological Protection) 2009 *Education and Training in Radiological Protection for Diagnostic and Interventional Procedures. ICRP Publication 113; Ann. ICRP* **39** 1–68
[2] Wakeford R 2011 And now, Fukushima *J. Radiol. Prot.* **31** 167–76
[3] Wakeford R 2011 The silver anniversary of the Chernobyl accident. Where are we now? *J. Radiol. Prot.* **31** 1–7

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