

daily exposure to radiation should not be underestimated as its cumulative effects could take decades to be evaluated. Because of the poly-aetiological nature of some pathologies (e.g. neoplasms), it may be impossible to link final health effects of radiation on medical personnel to exposure sustained by those personnel many years previously.

During a procedure, there are three to six individuals in the room. Any radiation dose received is dependent on an individual's distance from the radiation source, but continuous work in high volume centres results in accumulated exposure. Some of these professionals might be of reproductive age. Is it ethically acceptable to irradiate a number of young individuals daily and repeatedly for treatment of patients who are usually older and burdened with significant comorbidities?

This is a question that will raise the eyebrows of colleagues ready to cite the Hippocratic Oath. Yet, the situation described is not similar to putting a medical professional's health in jeopardy under extraordinary circumstances, e.g. intensive care unit specialists fighting COVID-19 or trauma surgeons operating in a war zone. The systematic exposure of young professionals to a silent hazard like radiation is the daily working environment of thousands. What happens when these individuals get sick or give birth to children with catastrophic genetic disorders? What are the social and long term financial burdens? Further research is required to find answers to these questions.

If we wish to discuss the details of the "Elephant in the Operating Room", we must also discuss the ethics of working with "Elephants".

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**Nikolaos Patelis**

3<sup>rd</sup> Department of Vascular Surgery, Athens Medical Center, Athens, Greece  
Email-address: [patelisn@gmail.com](mailto:patelisn@gmail.com)

Available online 9 October 2020

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<https://doi.org/10.1016/j.ejvs.2020.09.008>

DOI of original article: <https://doi.org/10.1016/j.ejvs.2020.09.007>

## Response to "Re The Elephant in the Operating Room"

We thank Dr Patelis for his thought provoking letter. The risk of working with radiation is evident but still largely

uncertain. There is no "radiation free" option for most specialists, certainly not for residents who are young and require great exposure in a short period of time, but also for nurses and anaesthetists. In short, we are compelled to put ourselves in harm's way to do our job. With the endovascular revolution, our practice now takes place in a dangerous environment, a fact that must be acknowledged.

This is one big mammoth we can hardly control, let alone ignore.

One cannot rely solely on ethics for radiation safety, we should strive for stricter regulation to protect professionals. This entails substantial investment in safety and monitoring equipment, improved risk assessment, enforcement of risk reduction measures, and obligatory (re)certification in radiation management. Administrators and physicians who do not comply need to be liable. Scientific societies and other professional associations, political stakeholders, and scientific publications like that of Massiot *et al.*<sup>1</sup> all play a role.

This elephant is not leaving the room. We must learn to tame it.

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**Frederico Bastos Gonçalves\***

Serviço de Angiologia e Cirurgia Vascular, Centro Hospitalar Universitário de Lisboa Central/NOVA Medical School, Rua de Santa Marta 50, Lisbon, 1150-299, Portugal

**Nabil Chakfé**

Department of Vascular Surgery and Kidney Transplantation and GEPROVAS, University Hospital of Strasbourg, France

\*Corresponding author.

Email-address: [f.bastosgoncalves@nms.unl.pt](mailto:f.bastosgoncalves@nms.unl.pt) (Frederico Bastos Gonçalves)

Available online 13 October 2020

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<https://doi.org/10.1016/j.ejvs.2020.09.007>

DOI of original article: <https://doi.org/10.1016/j.ejvs.2020.09.008>

## Ethics in Occupational Exposure Needs a Green New Deal

We would like to thank Dr Patelis for his relevant comments regarding the worrying issue of long term occupational exposure.<sup>1</sup> We definitely agree that it is the real question lying behind all the recent literature regarding radiation. By law in France, staff are supposed to be trained, monitored, and adequately equipped against radiation. This is the institution's responsibility. On an individual basis, every operator has the moral responsibility of justification and optimisation.

Justification questions the indication. Optimisation requires awareness, experience, and caring for the team. It seems paramount that the operator should be in charge of the radioprotection approach, as the ethics acceptance of staff radiation exposure requires the daily application of all these rules.

As we are trying to answer the question of “ethics in occupational exposure”, it seems mandatory to define dose reference levels to discriminate the reasonable from the non-reasonable. Large and multicentre registries are needed to define such levels. One could imagine that in the near future, radiation dose would be a criterion of quality of care as part of a textbook outcome.

Meanwhile, there is a tremendous gap between theory and real life. This gap is even larger in non-elective procedures, where junior surgeons are the most exposed. It raises the question of the right balance between risk and training. Obviously, simulation in endovascular procedures is still not sufficiently integrated into vascular training programmes.

However, the youngest generation of vascular surgeons has been raised with the “shields up” spirit. In many teams, the youngest are the most aware of the danger of radiation and therefore more respectful for the rules. In a way, the young community has taken the lead on this issue involving their own future, as they did for climate change. The reduction of occupational exposure will come with their innovative ideas and technologies.

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**Iannis Ben Abdallah**<sup>\*‡</sup>

*Université de Paris, Inserm UMR-S 1140, Paris, France  
Department of Vascular Surgery, Assistance Publique-Hôpitaux de Paris,  
Hôpital Européen Georges Pompidou, Paris, France*

**Nicolas Massiot**<sup>‡</sup>

*Department of Vascular Surgery, CHU de Reims, France*

**Salma El Batti**

*Université de Paris, Inserm UMR-S 1140, Paris, France  
Department of Vascular Surgery, Assistance Publique-Hôpitaux de Paris,  
Hôpital Européen Georges Pompidou, Paris, France*

\*Corresponding author. Université de Paris, Inserm UMR-S 1140, 75015 Paris France; Department of Vascular Surgery, Assistance Publique-Hôpitaux de Paris, Hôpital Européen Georges Pompidou, 75015 Paris, France.

*Email-address: [ian.benabdallah@gmail.com](mailto:ian.benabdallah@gmail.com) (Iannis Ben Abdallah)*

‡Iannis Ben Abdallah and Nicolas Massiot are joint first authors.

Available online 9 December 2020

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<https://doi.org/10.1016/j.ejvs.2020.10.029>

DOI of original articles: <https://doi.org/10.1016/j.ejvs.2020.09.007>

<https://doi.org/10.1016/j.ejvs.2020.09.008>