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Original paper

European survey on laser safety management in medical settings

Susie Clarke [a], Michelangelo Biondi [b], Ayyakkannu Manivannan [c], Efi Koutsouveli [d], Jonna Wilén [e], Caroline Banahan [f,*], Mihaela Ivanova [g], Ana I. Gómez-Varela [h], Rudolf Verdaasdonk [i], Jesús Tornero [j], Ronald Sroka [k], Nolan Vella [l], Andreas Springer [m]

[a] Imaging Physics and Radiation Safety, The Newcastle-upon-Tyne Hospitals NHS Foundation Trust, Newcastle-upon-Tyne, UK
[b] Medical Physics Unit, USL Toscana Sud Est, Italy
[c] Medical Physics, NHS Ayrshire and Arran, UK
[d] Medical Physics Department, Hygeia Hospital, Athens, Greece
[e] Dep of Diagnostics and Intervention, Umeå University, Sweden
[f] Medical Physics, St. Vincent's University Hospital, Dublin, Ireland
[g] Medical Physics, National Center of Public Health and Analyses, Sofia, Bulgaria
[h] Applied Physics Department, Institute of Materials, University of Santiago de Compostela, Spain
[i] MedTech Center, University of Twente, the Netherlands
[j] Center for Clinical Neuroscience, Hospital Los Madroños, Madrid, Spain
[k] Laser-Forschungs-Labor, LIFE-Center at Department of Urology, LMU-Hospital, Munich, & German Society of Biophotonic and Lasermedicine, Germany
[l] Medical Physics, Mater Dei Hospital, Malta
[m] Medical Physics, Ordensklinikum Linz, Austria

A B S T R A C T

Purpose: The European Federation of Organisations for Medical Physics (EFOMP) Working Group on Policy Statement 21 aims to highlight the role of the medical physics expert in management of medical laser sources. To inform this work, a survey on laser safety management was developed and distributed to all 37 EFOMP National Member Organisations (NMOs) across Europe. This aimed to understand, in broad terms, arrangements for medical laser safety in these countries, including the regulatory framework, practical safety arrangements for workers and patients, and safety training.

Methods: The 16 question survey was distributed to NMO presidents in November 2024. Questions required a mix of multiple choice answers and open-ended text answers. One laser safety representative from each NMO responded for each country.

Results: 25 NMO responses were received. Results showed some lack of awareness on regulatory issues – 10 respondents were not aware of a regulatory body for laser safety. There was variation in the level of expert and local supervision – 13 indicated laser protection officers for local supervision of laser work was not usual, and 13 indicated a laser safety expert was not normally appointed to an organisation. 23 reported either in-house or manufacturer laser training, however only 15 reported having laser safety documentation.

Conclusion: The survey results indicate that the standard of medical laser safety arrangements vary considerably between European countries. This indicates there is work to be done to ensure that a consistent approach is taken across Europe to minimise laser risks to workers and patients.

1. Introduction

The importance of exploring laser safety management across European countries cannot be overstated, particularly given the increasing reliance on laser technologies in medical settings [1]. As these technologies continue to advance, understanding the current arrangements for safety practices becomes crucial for protecting both healthcare professionals and patients.

The European Union "Directive 2006/25/EC – artifical optical radiation" sets out minimum health and safety requirements for exposure of workers to artificial optical radiation [2], including work with laser radiation. There is an obligation on EU member states to transpose this Directive and others into national law. Member states may adopt stricter rules for protection of workers when transposing, so legislative requirements may vary across EU countries [3]. The European Commission has also published non-binding guidance on implementing this directive which focuses on assessment of the risks from artificial optical radiation [4]. In some cases, individual countries have developed their own sector-specific guidance also, for example, in the United Kingdom the Medicines and Healthcare products Regulatory Agency (MHRA) has published "Lasers, intense light source systems and LEDs – guidance for safe use in medical, surgical, dental and aesthetic practices" [5].

* Corresponding author.
E-mail address: carolinebanahan@svhg.ie (C. Banahan).

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In July 2024, the European Federation of Organisations for Medical Physics (EFOMP) launched a Working Group (WG) to develop Policy Statement 21 on "The role of the Medical Physicist and Medical Physics Expert in the management of medical laser sources". This initiative aims to promote the safe, effective, and optimised use of laser-based medical devices across clinical settings, as well as to develop and define best practices, and support universal safety standards. As part of this initiative, a survey was conducted between December 2024 and March 2025 to establish, in broad terms, national regulatory frameworks, local organisational practices, and strategies for implementing laser safety measures, in various European countries. This collaborative effort seeks to identify common challenges and successes, fostering a culture of safety and accountability across the region. By highlighting variations in laser safety management, the survey not only helps raise awareness but also provides information that can drive improvements and standardisation of practices, ultimately enhancing patient safety and care quality as well as occupational safety throughout Europe.

This report summarises the findings from this survey relating to laser safety management practices across European countries. The results will contribute to the development of Policy Statement 21 to be published by EFOMP.

2. Materials and Methods

The Working Group designed a survey targeting all National Members Organisations (NMOs) within EFOMP to gather information on the current roles and responsibilities of Medical Physicists (MPs) in laser safety management across Europe. The questionnaire was distributed in November 2024 to all 37 current NMO members of EFOMP. Results of the questionnaire were collected between December 2024 and March 2025.

The questionnaire was addressed to the NMO presidents and EFOMP delegates, requesting that only one laser safety representative from each NMO complete it on behalf of their country. The anonymous responses to the questionnaire were collected via Google Forms, an open-source web application for surveys.

The survey included 16 questions, comprising of 10 quantitative (multiple choice) and 3 qualitative (text box provided for respondent to write their answer) queries. 3 initial questions established the professional background of the respondant (NMO represented, professional role and sector represented (healthcare or medical research)). The questions addressed topics regarding regulatory aspects, organisational practices, the involvement of MPs in managing laser sources, education and qualifications, quality assurance, and practical implementation of laser safety measures in healthcare settings across Europe. The survey was developed by the working group members to ensure a wide variety of topics were addressed.

3. Results

Responses were received from medical professionals involved in laser safety management, primarily medical physicists, representing 25 NMOs. Each NMO represents a separate European country.

The quantitative results are given within the figures in Appendix 1.

Regulatory framework

- **Awareness of Regulations**: 19 NMOs reported awareness of regulations governing the safe use of lasers or artificial optical radiation in their countries (Fig. 1).
- **Regulatory Authority**: 15 NMO respondents indicated that they were aware of an authority in their country who regulates laser safety within healthcare, while 6 reported they were not aware of any such regulatory authority, and 4 respondents were unsure (Fig. 2).
- **Formal Reporting Pathway**: 14 NMO respondents confirmed the existence of a formal pathway to report significant laser-related accidents, either via a national reporting route, or an internal organisational route. 11 respondents were not aware of any existing mechanism for reporting laser related accidents (Fig. 3).

Organisational practices

- **Laser Safety Experts**: 9 of respondents indicated that laser safety experts are usually appointed within relevant organisations in their country, while 13 reported no such appointments, and 3 were unsure (Fig. 4). Nobody reported that this was typically a full time role in organisations.
- **Local Laser Protection Officers**: 7 NMOs reported that organisations typically have laser protection officers at a local level, while 13 indicated this was not common practice, and 5 were unsure (Fig. 5).
- **Safety Committees**: Only 5 respondents confirmed that organisations usually have forums such as radiation safety committees to discuss laser safety arrangements, while the majority (17) reported typically having no such committees. 3 were unaware (Fig. 6).

Implementation and training

- **Safety Training**: Training approaches varied widely (Fig. 7):
  - 23 NMOs reported training provided in-house or by laser equipment manufacturers
  - 5 NMOs reported training by an external provider
  - 7 NMOs reported there was no formal laser safety training
- **Safety Documentation**: The majority of respondents had some form of laser safety documentation in place (Fig. 8):
  - 15 NMOs reported usually having laser safety documentation. This may be all or some of the following: safe operating procedures/ local rules, laser safety policies and risk assessments
  - 6 NMOs reported having access to national/international laser safety guidance documents
  - 9 NMOs reported having no safety documentation or unaware

Quality assurance

- **Equipment Testing** (Fig. 9):
  - 17 respondents indicated that laser equipment is usually tested either in-house or by laser manufacturer
  - 7 respondents either didn't know or were unsure of equipment getting tested
  - 1 respondent stated that their country's national law requires these tests to be performed periodically by accredited external bodies.

4. Discussion

The survey data indicate considerable variation in practices, responsibilities, and involvement of Medical Physicists in laser safety management across European countries. Specific challenges include:

1. **Lack of Standardisation**: Wide variation in regulatory approaches and implementation of laser safety measures.
2. **Training Deficiencies**: Significant gaps in formal training programs, with many countries relying solely on manufacturer-provided training.
3. **Documentation Gaps**: Many organisations lack comprehensive safety documentation.
4. **Expert Qualification**: No standardised qualification path for laser safety experts across Europe.
5. **Patient Safety Focus:** One respondent specifically noted the need for greater emphasis on patient safety rather than just staff safety.

Despite 19 respondents being aware of legislation governing laser safety and 15 respondents reporting that there was a regulator in their country, only 9 had laser safety experts appointed. A strong regulatory

approach to laser safety would boost the role of laser safety experts and encourage resources into development of expert training programmes.

The lack of regulatory enforcement may stem from poor incident reporting. 11 respondents had no knowledge of a reporting route for laser safety incidents. This lack of reporting may lead to a perceived opinion that the hazards associated with medical lasers is low.

Risk assessments are an inherent part of laser safety as they outline the particular hazards associated with individual lasers based on where they are used and on their clinical application(s). They describe measures to reduce these hazards to an acceptable risk. According to this survey, only 5 respondents reported typically having risk assessments in place, despite 9 having laser safety experts in place. This could point to a lack of resource, or potentially highlight a lack of expert qualification pathways.

It would be important to keep future guidelines practical and suitable for implementation in the existing workflow of the medical professionals.

Medical Physicists working within hospitals may be appointed as, or acting in the role of, the competent person for laser use, or "laser safety expert". Their role is typically to advise on the safe use of medical lasers. They contribute to maintaining a safe, effective and optimised use of laser-based devices for patients, staff and visitors. In particular, the role may include involvement in quality assurance, risk management (e.g. advice on designation of laser controlled areas and specification of safety controls, including protective equipment, signs, etc.), staff laser safety awareness training, user-specific training, and optimisation and safety of the practices.

The necessity of producing guidelines for this role was identified in the 'EFOMP Malaga Declaration 2023: An updated vision on Medical Physics in Europe' where it is stated that an 'A Medical Physics Expert (MPE) has the core knowledge, skills and competences commensurate with that of the Magnetic Resonance Safety Expert, Laser Safety Expert and MR Scientist and is required to deal with the risk assessments described in EU Directive 2013/35″ [6]. Similarly, Directive 2006/25/EC introduces requirements for exposure limits and the assessment of exposure risks and hazards for workers working with laser radiation, and training. It is clear that a laser medical physics expert is necessary for sucessful application of the 2006 Directive and any resulting legislation within the medical sector.

MPEs in many European countries are already established for ionising radiation issues, while the role of the medical physics expert in laser safety is less defined. A training programme on the role of the medical phyiscist in laser safety at national and European levels could address these gaps. For example, special editions of the European School of Medical Physics Expert (ESMPE) could be organised in collaboration with the NMOs in order to reach the medical physics community.

The authors acknowledge several limitations of the data obtained relating to how the survey was conducted. As only one person responded on behalf of each NMO, their answers may be limited to their experience and not capture a wider perspective for that country – laser safety management could be better or worse in other organisations or areas. Although respondents were required to give their professional role, as the survey was anonymous, the professional background of the respondent was not checked. Therefore it is possible some respondents had little knowledge of laser safety management and may not have been the right person to answer the questions.

The survey was sent out in English only, therefore there is the possibility of misinterpretation of certain questions for non-native English speakers. For example, the term "laser safety expert" and "officer" may have various interpretations.

12 countries did not respond to the survey request, despite follow up by the survey team. Therefore the data does not include some countries who may have a robust laser safety culture in place, potentially causing some misrepresentation within the data obtained.

The survey results are intended therefore to give a broad indication of the current state of laser safety management across Europe upon which to base further recommendations, rather than to derive conclusions about laser safety in any particular country.

5. Conclusion

This survey gathered information on the current roles and responsibilities of Medical Physicists in laser safety in European countries that are members of EFOMP. The results revealed the differing landscape of laser safety management across Europe, with considerable variations in regulatory frameworks, organisational practices, and practical implementation. This survey highlights a clear need for greater standardisation of laser safety management practices, particularly regarding expert qualification, training programs, and safety documentation.

The findings suggest potential opportunities for European-wide harmonisation of laser safety practice, training programs, common core curricula and qualification pathways for laser safety experts to ensure consistent protection of patients and healthcare workers across all European countries.

Declaration of competing interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

Appendix 1. – Figures of survey results

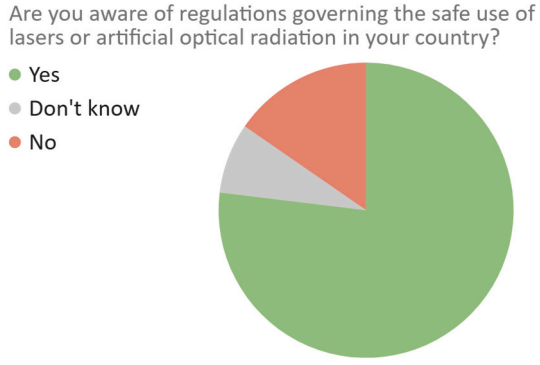

Fig. 1. Awareness of regulations governing safe use of lasers or artificial optical radiation. The graph gives an indication of the survey responses for each country. 19 survey respondents said they were aware of such regulations in their country (green), 4 respondents indicated they were not aware of such regulations

(red), and 2 respondents did not know (blue).

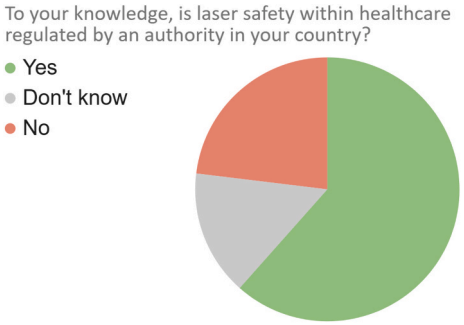

Fig. 2. Awareness of a regulatory authority for laser safety within healthcare. The graph gives an indication of the survey responses for each country. 15 survey respondents said there was such a regulatory authority in their country (green), 6 respondents reported that they were not aware of any such regulatory authority (red), and 4 respondents were unsure (blue).

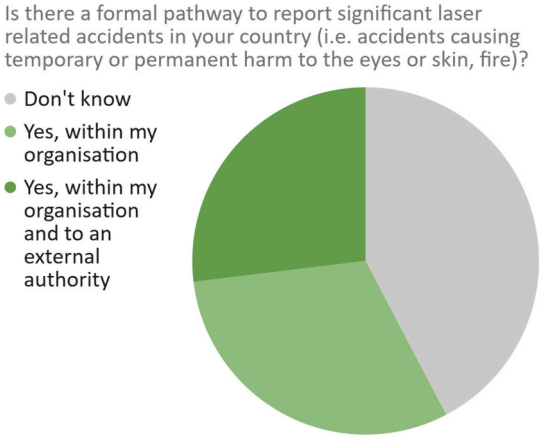

Fig. 3. Formal laser accident reporting pathways. The graph gives an indication of the survey responses for each country. 7 survey respondents said there was a formal reporting pathway within their organisation (light green), 7 respondents said there was a formal reporting pathway both in their organisation and to an external authority (dark green), and 11 respondents did not know (blue).

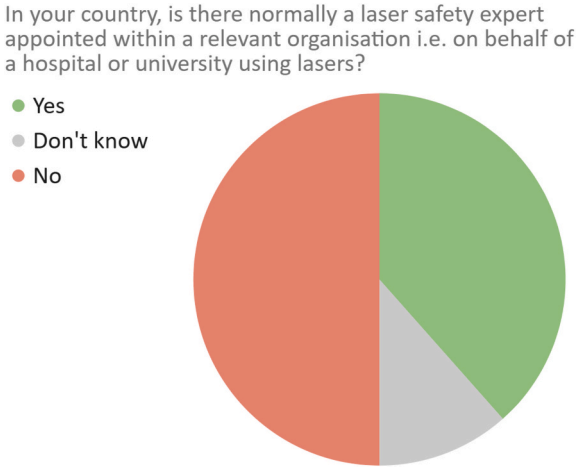

Fig. 4. Appointment of a laser safety expert within an organisation using medical lasers. The graph gives an indication of the survey responses for each country. 9 survey respondents said there was normally a laser safety experted appointed (green), 13 respondents said there was not usually such a person appointed (red) and 3 respondents did not know (blue).

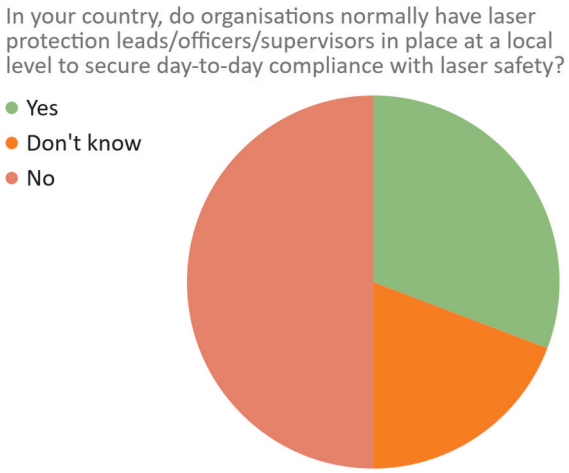

Fig. 5. Laser protection leads/officers/supervisors in place at a local level to secure day-to-day compliance with laser safety in organisations using medical lasers. The graph gives an indication of the survey responses. 7 survey respondents said there was normally such a role in place (green), 13 respondents said there was not normally such a role (red) and 5 respondents did not know (orange).

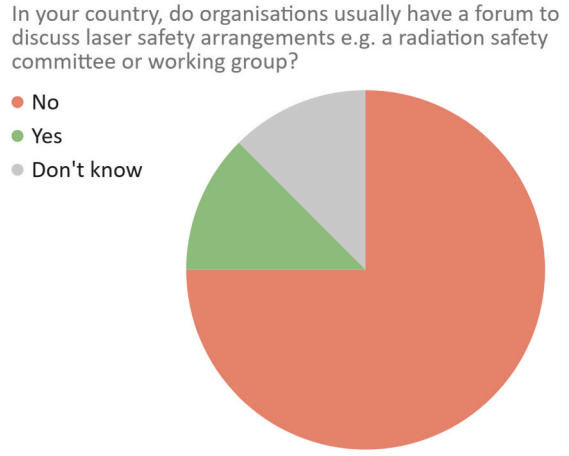

Fig. 6. Forums within organisations using medical lasers for discussing laser safety arrangements. Examples could be a radiation safety committee or working group. The graph gives an indication of the survey responses. 5 survey respondents said there was usually such a forum (green), 17 respondents said there was not usually such a forum (red) and 3 respondents did not know (blue).

Key:
1. In-house by organisation
2. By equipment manufacturer
3. By external provider
4. No formal laser safety training provided

Fig. 7. How laser safety training is usually provided. The graph gives an indication of the survey responses for each country. 10 countries reported in-house training within the organisation. 13 reported training from the laser equipment manufacturer. 5 reported training was provided by an external provider. 7

reported no formal laser safety training was provided. Note some countries incorporated multiple ways of providing training.

Key:

1. In-house by organisation
2. By equipment manufacturer
3. By external provider
4. No formal laser safety training provided

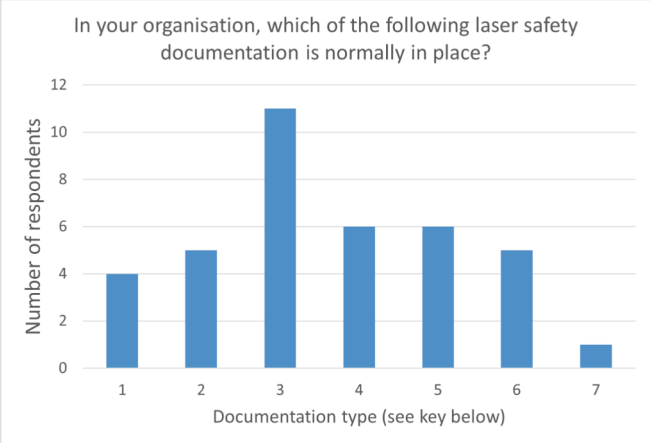

Fig. 8. Laser safety documentation. The graph gives an indication of the survey responses regarding what laser safety documentation organisations normally have in place for using medical lasers. 11 countries reported having safe operating procedures/local rules. 6 countries reported access to national/international guidance documents. 6 countries reported a laser safety policy was normally in place. 5 countries reported a laser risk assessment was normally in place. 1 reported availability of laser safety manual. 5 countries reported no documentation was normally in place. 4 respondents did not know.

1. Do not know
2. None
3. Safe operating procedure(s)/local rules
4. Access to national/international laser safety guidance documents
5. Laser safety policy
6. Laser risk assessment(s)
7. laser safety manual

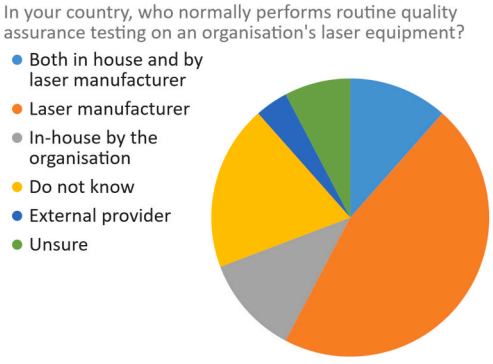

Fig. 9. Performance of quality assurance testing on laser equipment. The graph gives an indication of the survey responses regarding who normally performs this testing on an organisation's equipment. 3 respondents reported quality assurance testing was done both in house and by the laser manufacturer (light blue). 12 reported this was done only by the laser manufacturer (orange). 2 reported this was done in house by the organisation only (grey). 5 reported they did not know (yellow). 1 reported this was done by an external provider (dark blue). 2 respondents were unsure (green).

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