



2022 follow-up: impact of the COVID-19 pandemic on nuclear medicine departments in Europe

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Published online: 23 June 2022

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Introduction

The COVID-19 pandemic not only affected our daily lives, but also changed the work environment. Significant adjustments had to be taken in our nuclear medicine departments. To report this impact, one year ago, the results of a first survey conducted by the EANM were published, describing the reduction of conventional diagnostic and therapeutic procedures for

benign diseases, while the number of diagnostic PET/CT scans and therapeutic procedures for malignancy remained stable [1]. Following on from this 2021 survey, a subsequent survey was undertaken which closed in February 2022, also now with special attention for research and education. This web-based survey included closed-ended questions and free comments on clinical activity, organisation of departments, research and publications, and education (including virtual offerings) (Table 1).

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This article is part of the Topical Collection on Editorial.

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Table 1 EANM COVID-19 survey 2022 questions

 EANM COVID-19 survey 2022 on impact of the COVID-19 pandemic on nuclear medicine departments in Europe

Clinical Activities: September 2020—August 2021

In what way has the COVID pandemic affected the amount of conventional diagnostic nuclear medicine procedures (excluding PET and PET/CT) in your country?

By how much did the conventional diagnostic nuclear medicine procedures decrease?

By how much did the conventional diagnostic nuclear medicine procedures increase?

Which of the conventional diagnostic nuclear medicine procedures have been affected the most?

How has the COVID pandemic affected the number of PET or PET/CT procedures in your country?

By how much did the PET or PET/CT procedures decrease?

By how much did the PET or PET/CT procedures increase?

Which of the PET or PET/CT procedures have been affected the most?

How has the COVID pandemic affected the number of benign disease therapeutic procedures in your country?

By how much did benign disease therapeutic procedures decrease?

By how much did benign disease therapeutic procedures increase?

Which of the benign disease therapeutic procedures have been affected the most? Positive or negative impact?

How has the COVID pandemic affected the number of malignant disease therapeutic procedures in your country?

By how much did malignant disease therapeutic procedures decrease?

By how much did malignant disease therapeutic procedures increase?

Which of the malignant disease therapeutic procedures have been affected the most? Positive or negative impact?

Did the organization/management of the workflows in the nuclear medicine departments change in your country due to the COVID pandemic (e.g. reduced accessibility, limited number of procedures, exclusion of COVID-positive patients unless emergencies,...)?

Between September 2020 and August 2021, has the COVID pandemic influenced the number of employees/workers in the departments of Nuclear Medicine in your country?

Between September 2020 and August 2021, has the COVID pandemic influenced the number of employees/workers PRESENT in the departments of Nuclear Medicine in your country (increased absenteeism due to illness or precaution confinement)?

Did you observe any (persistent) problems within the supply of radiopharmaceuticals (cold kits, generators, ready to use, pharmaceutical ingredients...)?

Research Activities: September 2020—August 2021

Has there been any research to be put on-hold due to the health care situation?

Chemistry-radiopharmacy development

Laboratory activities (cell culture, in vitro models, setup of PK studies (e.g. metabolites)...)

Preclinical activity (animal models, small animal imaging, pathology (biopsies or post-mortem)

Clinical research (academic):

Diagnostic

Ongoing research

New protocols with existing tracers

Novel tracers

Therapeutic

Ongoing research

New protocols with existing tracers

Novel tracers

Clinical research (sponsored): September 2020—August 2021

Protocols on hold

Delayed or cancelled new protocols

Publications: was there any effect on scientific production in your country?

Global effect on research, including publications and participation to exchange of information: has there be any effect? If so, by what percentage reduced (less production ± less communication

Was there any restriction for applying for / getting research grants from official or private institutions due to the healthcare situation?

If yes, please elaborate using the free text (without mentioning specific institutions, unless necessary

Table 1 (continued)

 EANM COVID-19 survey 2022 on impact of the COVID-19 pandemic on nuclear medicine departments in Europe

Educational Activities: September 2020—August 2021

Has there been any effect during the academic year 2020–21 (ca. September to September), on educational activities?

If yes

Local education (undergraduates and postgraduates): in universities

Local education (undergraduates and postgraduates): in academic hospitals

Local education (undergraduates and postgraduates): in non-academic hospitals

Regional education (postgraduates)

National education programs (postgraduates)

Continuing education for specialists:

Physicians

Physicists

Radiopharmacists

Technologists

In the field of Nuclear Medicine, do you feel that the virtual offer was sufficient and accessible (including registration fees)?

National level

European level (EANM)

European level (with exception of EANM)

Other international level

Feeling about the future, beyond September 2021

From January 1, 2022, do you foresee any remaining or new impact on

Clinical activities

Research activities

Educational activities

Globally, is your country enthusiastic about the future of Nuclear Medicine during this phase of the pandemic and thereafter?

A core group of National Delegates volunteered to steer the initiative, together with the EANM Board and Executive Office.

In total, 29 questions were raised. All 39 EANM National Delegates were invited to reply and fill in the survey on behalf of the general situation in their country, with eventually 32 completing the survey. As the EANM performed a survey on the impact of COVID-19 on nuclear medicine departments and procedures in 2021 [1], comparisons can be made to some of the previous results and trends determined. However, considering the limited sample of responses and the lack of reproducibility between them, statistical analysis is not appropriate. The period covered in the current survey was September 2020 to August 2021.

European landscape of COVID-19 repercussions in European nuclear medicine departments

Impact on diagnostic procedures

Most countries saw conventional nuclear medicine remains stable (18/32; 56%) compared with the decrease seen last year in most countries (26/32; 81%) [1]. It decreased by less than 25% in 12/32 (38%), by 25–50% in 1/32 (3%), and by 50–75% in 1/32 (3%).

In PET/CT, the situation was different with 21/32 (66%) countries remaining stable which was essentially the picture seen last year with 22/32 (69%) remaining stable [1]. PET/CT decreased by less than 25% in 2/32 (6%) but *increased* by < 25% in 6/32 (19%) and by 25–50% in 3/32 (9%). Last



Fig. 1 Representation of countries that declared clinical and/or pre-clinical research was somewhat put on hold due and during the Covid-19 period 09/2020-09/2021. Most but not all countries gave an input.

year, only 2/32 countries (6%) saw PET-CT increase at all and this was by less than 25% [1]. In both two countries (Estonia and UK), further increase in PET/CT was observed in 2021 while conventional nuclear medicine slightly decreased.

Impact on therapeutic procedures

One country provided no appropriate data. Benign disease therapy was stable in 18/31 countries (58%) whereas last year it decreased in most countries (21/31; 66%) [1]. It decreased by less than 25% in 8/31 (26%), by 25–50% in 5/31 (16%), and no data was provided for 1 country. Therapy for malignant disease was stable in most countries (24/31; 77%), which was an improvement on last year, where 20/31 countries were stable (62.5%) [1]. There was a decrease of less than 25% in 6/31 (19%), from 25 to 50% in 5/31 (16%).

Organisational changes, radiopharmaceuticals supply, and time-peaks

Most countries saw a change in workflow (18/32; 56%). This was a little less than last year (21/32; 66%) [1]. The most frequently reported changes were (i) exclusion of

SARS-CoV-2-positive patients for elective procedures or reorganizing the planning for positive patients, (ii) patients and staff testing for SARS-CoV-2, leading to adaptations in the work schedules, and (iii) organizing patients' flow in different ways. The number of employees was stable in the vast majority of countries (29/32; 91%) with a decrease of less than 50% in 3/32 (9%). The number of employees present at work, however, was a problem with 16/32 (50%) countries reporting a decrease. Only a minority of countries had radiotracer supply problems related to the pandemic (7/32; 22%). Most of these problems were related to international transport issues. This was similar to last year where 8/32 (25%) had supply problems [1]. Five countries have been affected in the same way during both periods.

Research

In 12/32 countries (38%), some research was on hold. This comprised 39% of aggregated diagnostic research, 28% of aggregated therapeutic research, and 38% of sponsored trials. This mainly occurred in countries in the Northern part of Europe and some countries in Eastern Europe (Fig. 1). Publications were said to be delayed by 42% of respondents and access to grants by 25%. Preclinical research was reported as delayed by 66% of countries.

Education

Overall, the pandemic has impacted nuclear medicine education in most countries (27/32; 84%). This is broken down into affecting different employment groups as follows: technologists—78%, radiopharmacists—59%, physicists—67%, physicians—74%. Across countries, the impact on education was different between target groups. The majority of virtual education delivered at national and international levels has been sufficient and accessible: national—66%, EANM delivered—88%, European level (excluding EANM)—71%, and other international level—71%. From this, it seems that EANM has provided a good service to their members.

The future

Almost all countries were optimistic about the future with regard to nuclear medicine overall (30/31; 97%). Specifically, countries remained worried about further impact due to COVID-19 on education 16/31 (52%), research 10/31 (32%), and clinical activity 12/31 (39%). One country did not provide an opinion.

Discussion

The COVID-19 pandemic has continued to influence the nuclear medicine services across Europe (summarized as graphs in the Appendix Fig. 2). In standard scintigraphic imaging, the situation has improved compared to last year, but there is still a decrease in imaging activity by less than 25% in 38% of countries. The position in PET/CT and PET/MR has been less affected with activity growing in nine countries compared with 2 last year. This is mainly due to increased cancer diagnostics with [¹⁸F]FDG and [¹⁸F]F-PSMA or [⁶⁸Ga]Ga-PSMA PET/CT. In some countries, brain [¹⁸F]FDG PET was scaled down to make way for cancer PET/CT imaging. On average, the trend that PET/CT continues to grow while conventional Nuclear Medicine slightly declines reflects the evolution of the specialty, regardless of the COVID-19 pandemic.

Therapy for benign disease was stable in just over half of countries whereas last year it was decreasing. Regarding therapy for malignant diseases, there was an improvement, which is not surprising as it is likely that priority was given over benign disease due to clinical urgency. Therapy for malignant diseases was stable in 77% of countries which had improved from 62.5% last year, which is good news.

Operationally, it has been hard to deliver nuclear medicine services due to staff absences. Although the number of nuclear medicine employees has remained stable in 91% of countries, in about 50% the number present at work has decreased due to positive SARS-CoV-2 testing and quarantine. Less than a quarter of countries had problems with radiotracer supply, which was a small improvement on last year, but remains concerning. Five countries seem to have experienced similar difficulties over the last two years and should remain under scrutiny, with mitigation solutions proposed, if possible.

Research is a major problem with 38% of countries reporting delays in projects, in some countries already before 2021. Preclinical research was more adversely affected than clinical research, about 65% vs 40% of countries, respectively. Some of this impact is due to the prioritisation of clinical services, but it is clear that this will have an impact on clinical care, ultimately due to the reduction in new techniques and tracers entering into the clinical activity. It is a priority for patient care in the future

that this situation is reversed. However, in most countries, there has not been a delay in clinical research. During the past year, part of the decrease in the clinical research was probably due to the increase in cases and PET research in COVID-19 [2].

In 84% of countries, nuclear medicine education has been negatively affected with all craft groups affected to varying degrees. However, the virtual offerings from all national and international organizations have generally been sufficient and accessible with the EANM delivered education being rated the highest—positive by 88% of countries. COVID-19 imposed modifications on the previously structured way of teaching and learning for nuclear medicine trainees [3, 4]. Moreover, the successful adaptation of nuclear medicine education into online platforms stimulated educators and European Nuclear Medicine board members to implement online solutions for fellowship exams or assessing knowledge after residency training [5]. This is likely the goal that has been achieved by ESMIT, within the EANM core business. Indeed, efforts have been made to achieve the training objectives and various innovative teaching and learning methods along with available online educational resources, covering also online possibilities for examinations, are now inevitable during the global pandemic [3–5]. That said, anecdotally, staff are keen to get back to face-to-face meetings as virtual education does not deliver all that is required. It misses the social benefits of getting people together and the corridor conversations that lead to projects and developments.

All countries but one were optimistic about the future of nuclear medicine, which was great to see, but the impact of the pandemic is clearly not over. The position across Europe has improved from last year and hopefully will continue to improve as we now move forward with COVID-19 becoming endemic. It is likely that the role of nuclear medicine will remain limited to specific studies in the ongoing epidemic, and we should hope that the specialty returns to its roots and look ahead to theragnostic, novel developments in cardiology and neurosciences, or artificial intelligence which seem to be the greatest future opportunities for our discipline. Although indications showed differences between regions in Europe, the setting of the survey did not allow the identification of clear trends. This may be studied going forward, using an additional questionnaire, if needed.

Appendix 1

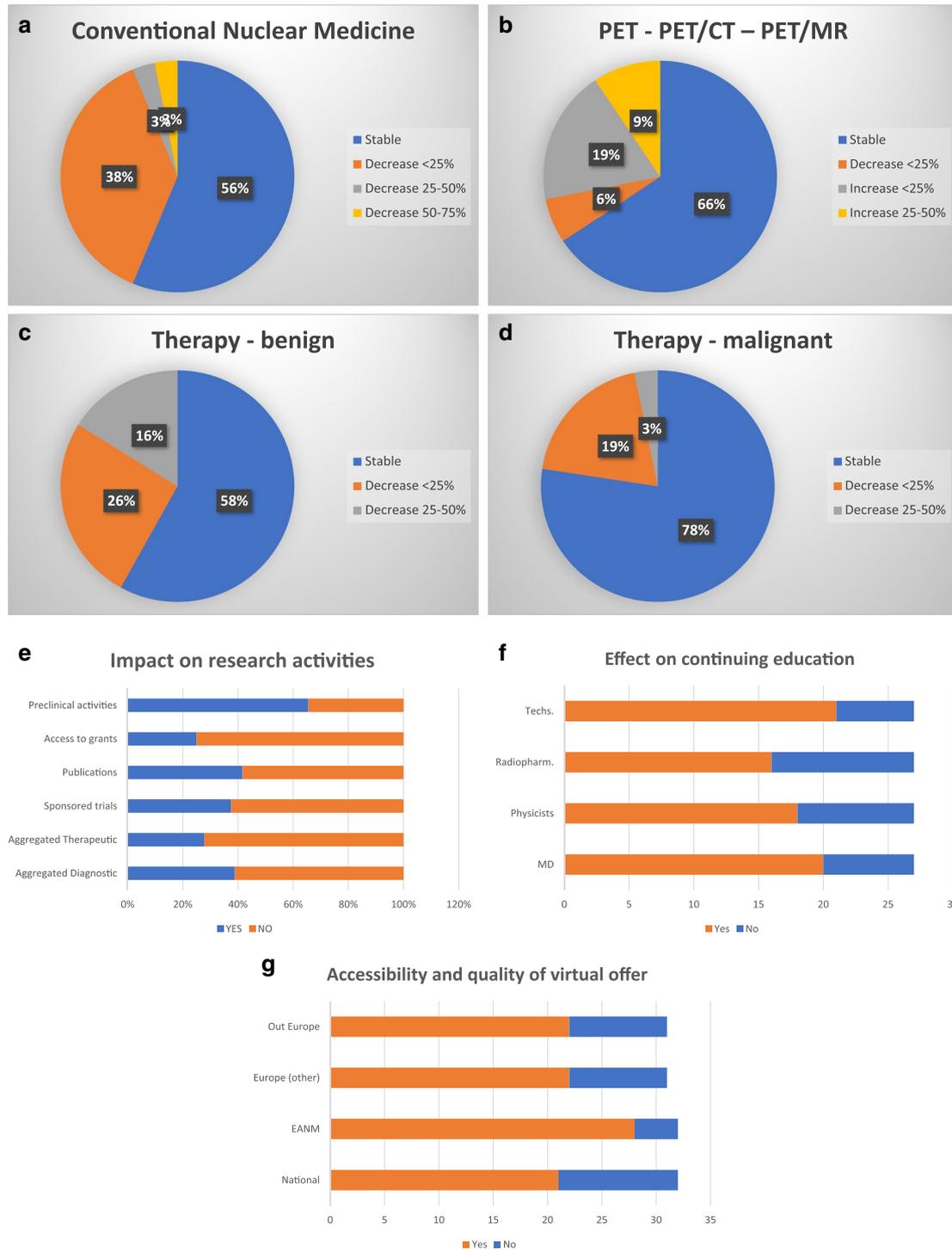


Fig. 2 Representative graphs of the situation in Europe during the second and subsequent waves of the COVID-19 pandemic. Figures represent the impact of the COVID-19 pandemic on conventional nuclear medicine activities (Fig. 2a), on PET activity (Fig. 2b), on

therapy for benign diseases (Fig. 2c), on therapy for malignant diseases (Fig. 2d), on research activities (Fig. 2e), on continuous education (Fig. 2f), and on channels of virtual information (Fig. 2g)

Acknowledgements The authors are grateful to all national delegates of the EANM for providing comprehensive data that made this analysis possible. A special thank is due to the Executive office of EANM (Vienna) and in particular to Silvia Marchetti, for coordinating the survey, analysis, and contacts that made the publication possible. Thanks finally to the members of the Board of EANM who provided continuous and enthusiastic support to this survey.

Declarations

Ethical statement This editorial falls outside of the scope of ethical concerns regarding experimentation with humans or animals. Data were provided on a voluntary basis by the National Delegates, representing their national board.

Conflict of interest Jolanta Kunikowska reports an unrestricted grant from Janssen and consulting fees from Telix and Novartis outside of the scope of this work. Richard Graham reports honoraria from GE for lectures and consultant work from Spectrum Dynamics outside the scope of this work. All other authors report no conflict of interest related to this work.

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