



Impact of the COVID-19 pandemic on nuclear medicine departments in Europe

Ana Paula Moreira^{1,2} · François Jamar³ · Zehra Ozcan⁴ · Doina Piciu^{5,6} · Claudine Als⁷ · Maja Franceschi⁸ · Elin Trägårdh⁹ · Ivana Zagar¹⁰ · Anna Sowa-Staszczak¹¹ · Florent Cachin^{12,13} · Roel Bennink¹⁴ · Flavio Forrer¹⁵ · Tom Christian Adamsen^{16,17} · Andreas Fotopolous¹⁸ · Marika Kalnina¹⁹ · Lars Thorbjørn Jensen²⁰ · Hanna Mussalo²¹ · Milan Simanek²² · Lina Garcia-Cañamaque²³ · Sergei Nazarenko²⁴ · Jasna Mihailovic^{25,26} · Zvi Bar-Sever²⁷ · Martin O'Connell²⁸ · Daniela Miladinova²⁹ · Richard Graham³⁰ · Raffaele Giubbini³¹ · Lucia Kaliská³² · Damir Rozić³³ · Bernd J. Krause³⁴ · Hans-Jürgen Gallowitsch³⁵ · Tamás Györke³⁶ · Severina Sediene³⁷ · Pavel Romyantsev³⁸ · Wolfgang Wadsak³⁹ · Jolanta Kunikowska⁴⁰

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Introduction

Since the beginning of the year 2020, the coronavirus-19 disease (COVID-19) pandemic has undoubtedly posed significant challenges to healthcare systems worldwide [1]. It has also affected, in a way previously unimaginable, our lifestyle and the way we relate to each other, not only at work, but also in the community and in the family setting. Healthcare

systems worldwide have been forced to make huge alterations to be able to handle the different stages of the pandemic.

Specifically in nuclear medicine departments, several adjustments have had to be made to face this unprecedented worldwide cross-sectional disease. Reflecting the need for swift and continuous adaptation, the number of publications on this phenomenon, which continues to impact upon our routines, has increased considerably in recent months/the past year [2–10].

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✉ Ana Paula Moreira
anapaulamorao@gmail.com

¹ Nuclear Medicine Department, Centro Hospitalar e Universitário de Coimbra, Coimbra, Portugal

² Institute for Nuclear Sciences Applied To Health, University of Coimbra, Coimbra, Portugal

³ Nuclear Medicine Department, Cliniques Universitaires St-Luc, Brussels, Belgium

⁴ Department of Nuclear Medicine, Ege University School of Medicine, Izmir, Turkey

⁵ University of Medicine and Pharmacy Iuliu Hațieganu Cluj-Napoca, Cluj-Napoca, Romania

⁶ Nuclear Medicine Department, Institute of Oncology I. Chiricuta Cluj-Napoca, Cluj-Napoca, Romania

⁷ Department of Nuclear Medicine, Hôpitaux Robert Schuman Zithaklinik, Luxembourg, Luxembourg

⁸ Department of Oncology and Nuclear Medicine, Sestre Milosrdnice UHC, Zagreb, Croatia

⁹ Clinical Physiology and Nuclear Medicine, Skåne University Hospital and Lund University, Malmö, Sweden

¹⁰ Department of Nuclear Medicine, Institute of Oncology Ljubljana, Ljubljana, Slovenia

¹¹ Medical College, Endocrinology Department, Nuclear Medicine Unit, Jagiellonian University, Kraków, Poland

¹² Nuclear Medicine, Jean Perrin Cancer Center, Clermont-Ferrand, France

¹³ Medical Biophysics Department, Clermont Auvergne University, Clermont-Ferrand, France

¹⁴ Radiology and Nuclear Medicine, Amsterdam University Medical Center, Amsterdam, The Netherlands

¹⁵ Cantonal Hospital St. Gallen, St. Gallen, Switzerland

¹⁶ Centre for Nuclear Medicine, Department of Radiology, Haukeland University Hospital, Bergen, Norway

¹⁷ Department of Chemistry, University of Bergen, Bergen, Norway

¹⁸ Nuclear Medicine Department, University Hospital of Ioannina, Ioannina, Greece

¹⁹ Pauls Stradins Clinical University Hospital, Riga, Latvia

²⁰ Department of Nuclear Medicine, Herlev Hospital, Herlev, Denmark

The aim of this editorial is to report on the impact of COVID-19 on nuclear medicine departments. The data was obtained via a compact online survey that was conducted by the EANM and sent to its National Member Societies (Table 1, Appendix). All 39 EANM National Delegates were invited to reply on behalf of their country in January 2021, with 32/39 National Delegates having completed the survey. The Delegates surveyed their own countries' national societies or individual nuclear medicine departments to obtain an understanding of the impact of COVID-19 at national level. In general, the results were then discussed internally to identify possible common trends or inequalities, thus translating them to the European level. The survey questions focused on the following categories: impact on diagnostic (scintigraphy and positron emission tomography) and therapeutic nuclear medicine procedures, supply of radionuclides or radiopharmaceuticals, operational aspects of nuclear medicine departments, and time-peak of major impact. In total, 20 (partly connected) questions were asked, and after collecting the data, the respondents required an average of < 10 min to fill in the online form.

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

Impact on diagnostic procedures

In most countries (26/32; 81%) there has been a decrease in diagnostic scintigraphy procedures, with 15/26 (58%) having a decrease of less than 25% and 11/26 (42%) having a decrease

of between 25 and 50%. Diagnostic scintigraphy procedures were most severely affected in the benign disease setting, with myocardial perfusion scintigraphy, ventilation lung scintigraphy, thyroid scintigraphy and bone scintigraphy suffering the greatest impact. Conventional diagnostic nuclear medicine studies remained stable in the 6 remaining countries.

The number of positron emission tomography (PET) procedures remained stable in the majority of countries (22/32; 69%), though there was a decrease, mostly by less than 25%, in some of them (8/32; 25%). PET using [^{18}F]FDG for oncology was the most severely affected procedure. Interestingly, 2/32 countries (6%) showed a slight increase of less than 25% in PET scans (*Estonia; UK*). Here we note that, with regard to the questions on PET in the survey, it is implied that they refer to all PET modalities (e.g. PET, PET/CT or PET/MR).

Impact on therapeutic procedures

Benign disease therapy decreased in most countries 21/32 (66%), by less than 25% (9/21) and 25–50% (10/21), respectively. Therapies of benign diseases remained stable in 10/32 countries (31%), and increased by less than 25% in 1/32 country (*Luxembourg*). The most severely affected procedures have been radioiodine treatments and radiosynoviothetesis.

Malignant disease therapy remained mostly stable (20/32; 62.5%). Although these therapies are indisputably important to fight malignant disease, a decrease was observed in more than a third of countries (12/32; 37.5%), though in the majority of those (9/12) by less than 25%. The most severely impacted malignant disease therapeutic procedures have been ^{131}I -treatments for thyroid cancer, and

²¹ Department of Clinical Physiology and Nuclear Medicine, Kuopio University Hospital, Kuopio, Finland

²² Department of Nuclear Medicine, Hospital Pelhřimov, Pelhřimov, Czech Republic

²³ Nuclear Medicine Department, Grupo HM Hospitales Madrid, Madrid, Spain

²⁴ Department of Health Technologies, Tallinn University of Technology, Tallinn, Estonia

²⁵ Department of Radiology, Faculty of Medicine, University of Novi Sad, Novi Sad, Serbia

²⁶ Centre of Nuclear Medicine, Oncology Institute of Vojvodina, Sremska, Kamenica, Serbia

²⁷ Department of Nuclear Medicine, Schneider Children's Medical Center, Petah Tikva, Israel

²⁸ Mater University Hospital, University College Dublin, Dublin, Ireland

²⁹ Institute of Pathophysiology and Nuclear Medicine, Faculty of Medicine, University Ss. Cyril and Methodius, Skopje, North Macedonia

³⁰ School of Radiology, Royal United Hospitals, Bath NHS Foundation Trust, Bath, UK

³¹ Chair of Nuclear Medicine, University of Brescia and Spedali Civili Hospital, Brescia, Italy

³² Institute of Nuclear and Molecular Medicine, Banská Bystrica, Slovak Republic

³³ Department of Nuclear Medicine, University Hospital Mostar, Mostar, Bosnia and Herzegovina

³⁴ Department of Nuclear Medicine, Rostock University Medical Centre, Rostock, Germany

³⁵ Department of Nuclear Medicine and Endocrinology, Klinikum Klagenfurt Am Wörthersee, Klagenfurt, Austria

³⁶ Department of Nuclear Medicine/Semmelweis University, Medical Imaging Centre, Budapest, Hungary

³⁷ Lithuanian University of Health Sciences, Kaunas, Lithuania

³⁸ SOGAZ International Medical Center, Saint-Petersburg, Russian Federation

³⁹ Division of Nuclear Medicine, Department of Biomedical Imaging and Image-Guided Therapy, Medical University of Vienna, Vienna, Austria

⁴⁰ Nuclear Medicine Department, Medical University of Warsaw, Warsaw, Poland

palliative or therapeutic administration of radiopharmaceuticals for bone metastases and for prostate cancer. This may have resulted in a significant loss of quality of life for some cancer patients, although this impact was not evaluated in the survey.

Organisational changes, radiopharmaceuticals supply and time-peaks

Organisation/management workflows underwent changes in most European nuclear medicine departments (21/32; 66%). The most frequently observed organisational changes were modification of scheduling practices, such as rotating cohort teams of personnel to avoid potential widespread quarantine in case of infected staff. Other organisational adaptations consisted of increasing time intervals between patient scheduling, stricter disinfection procedures, risk stratification for SARS-CoV2 infection, reducing the number of accompanying persons allowed (i.e. mainly dependent patients and children), and implementation of routine SARS-CoV2 tests in selected situations.

Most of the countries had no issues regarding the supply of radiopharmaceuticals (24/32; 75%). In countries with significant shortages, insufficient supplies were mainly reported for ^{131}I .

The most severely affected months during the COVID-19 pandemic were March, April and May, 2020.

Discussion

Nuclear medicine departments were no exception with regard to the general influence of the COVID-19 pandemic on healthcare systems worldwide. Several factors contributed to the significant impact observed.

Overall, scheduled conventional diagnostic and therapeutic procedures for benign diseases were affected and quantitatively reduced, by less than 25% for most of the diagnostic procedures and by 25–50% for the majority of benign therapies. Diagnostic PET/CT scans and malignant therapeutic procedures remained stable in the majority of participating European countries, with rates of 69% and 66%, respectively. Fortunately, the problem of stable and secure radiopharmaceutical supply was only a minor factor.

Considering that diagnostic scintigraphy studies in the participating European countries were more severely impacted (mostly with a decline in thyroid, cardiac, bone, and lung scans) than PET scans (mostly remained stable), and that benign therapy was more severely affected overall than malignant therapy, we deduce that, despite all the difficulties, there has been an effort to prioritise the assessment of cancer patients. Another reason for the less severely affected PET/CT scans could be the fact that local cyclotron centres can produce PET radionuclides and tracers, whereas some countries rely on regular international flights for their weekly supply of generators (e.g. $^{99}\text{Mo}/^{99\text{m}}\text{Tc}$) and some radionuclides (^{131}I). In fact, there was even an increase in PET/

CT procedures in two countries. One explanation for this might be the overbooked CT capacities, which resulted in PET/CT becoming a one-stop staging tool without prior CT.

The most severely affected months were those coincident with the first wave of the pandemic in Europe, i.e. March–April–May 2020. The effect was probably most prominent in this period due to the sudden outbreak of the disease and the unexpected need for departmental reorganisation. Some countries reported a lower number of examinations during spring 2020, but a subsequent increase during autumn 2020, resulting in a stable situation when considering the whole year. It must be kept in mind that the survey was launched and filled in before the “third wave” was apparent. This may have changed the situation, but no data are available yet at European level.

It is worth noting that there was most likely some ambiguity in the answers to the initial question (*‘In what way has the COVID pandemic affected the amount of diagnostic scintigraphy procedures in your country?’*) since, due to lockdowns of all sorts, the global workflow of most medical specialties and hospitals in general was reduced for non-COVID-19 patients, and, of course, the workflow of nuclear medicine departments was affected proportionally. In fact, the workflow depended on the official and legally imposed lockdown periods, mainly implemented not only to reduce the circulation of the virus, but also to provide manpower for the most urgent tasks (e.g. shift of nursing staff and physicians to Covid units). The absolute numbers of nuclear medicine examinations were reduced compared to previous years, in great part probably due to external legal restrictions. Consequently, the reduced contact with physicians in outpatient consultations in the initial period of the pandemic resulted in a decreased number of patients being referred to nuclear medicine for diagnosis and treatment, this effect being less prominent for oncological patients. Another reason for this general decrease was certainly patient no-show due to the fear of being infected at the hospital or using public transport to reach the medical centres, but this was not quantified at the level of the EANM member countries.

Finally, while the scope of this survey was mainly focused on changes in healthcare in nuclear medicine units, the EANM, its national member societies and individual institutions are also the ones providing speciality training and academic research in nuclear medicine. We can thus infer that the pandemic probably not only affected healthcare service but also the training and education of our residents and young fellows, the future generation of nuclear medicine physicians. As the total number of diagnostic or therapeutic applications was reduced, our residents were able to attend a smaller number of studies/courses than in previous years. Some of them were even assigned to rotations for COVID-19 services for several months, hence academic productivity and research projects in the field of nuclear medicine might also have been affected.

To provide a follow-up perspective on the situation, the EANM National Delegates express the need for a repeat survey during 2022, hopefully after the pandemic has stabilised.

Appendix

Table 1 EANM COVID-19 survey questions

EANM COVID-19 survey
In what way has the COVID pandemic affected the amount of diagnostic scintigraphy procedures in your country?
By how much did the diagnostic scintigraphy procedures decrease?
By how much did the diagnostic scintigraphy procedures increase?
Which of the diagnostic scintigraphy procedures have been affected the most?
How has the COVID pandemic affected the amount of PET procedures in your country?
By how much did the PET procedures decrease?
By how much did the PET procedures increase?
Which of the PET procedures have been affected the most?
How has the COVID pandemic affected the amount 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?
How has the COVID pandemic affected the amount 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?
Did the organization/management of the workflows in the nuclear medicine departments change in your country due to the COVID pandemic? If yes, please specify
Have you observed any problems within the supply of radiopharmaceuticals? If yes, please specify
Which months of the year were affected the most? (multiple answers possible)
Additional comments on the diagnostic and therapeutic parts

Declarations

Ethics approval and consent to participate Institutional Review Board approval was not required because the paper is an Editorial.

Conflict of interest Without relevance to this work, Wolfgang Wadsak declares himself to be a co-founder of MINUTE medical Ltd, Vienna—Austria, and a part-time employee of CBmed Ltd (Center for Biomarker Research in Medicine, Graz—Austria). Without relevance to this work, Richard Graham declares that he has been paid by GE in the past for giving talks on DatScan. The other authors have no conflicts of interest to disclose.

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