

# MEDICAL PHYSICS IN NORWAY – HISTORY, EDUCATION, CERTIFICATION AND NORDIC COLLABORATION

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**Abstract—** The Norwegian Association of Medical Physics (NFMF) was established in 1976 and celebrates its 45<sup>th</sup> anniversary in 2021. The main aim for NFMF is to support the medical physics community. The mandate of NFMF is also to initiate, encourage and facilitate the exchange of knowledge and cooperation across professions and country borders. An important focus is to continuously evaluate and develop the educational programme in order to improve and standardize the professional level of medical physicists in Norway.

**Keywords—** Medical Physics, Education, Certification and Collaboration.

## I. INTRODUCTION

Medical physicists in Norway are primarily employed in hospitals within the fields of diagnostic radiology (X-rays, MRI), nuclear medicine and radiation therapy. In addition, active research groups in physics departments at Norwegian universities work in close collaboration with the hospitals, especially within radiation therapy and radiobiology.

In this paper we will focus on the history of medical physics in Norway; how physicists initially worked with radiation therapy and over the years evolved into being medical physicists actively involved in interdisciplinary teams in charge of the preparation, delivery and evaluation of the diagnostic imaging and treatment of patients. Medical physicists are today the spearhead in the development and implementation of new technology in order to improve the patient outcome.

## II. A BRIEF HISTORY OF MEDICAL PHYSICS IN NORWAY

The first medical physicist in Norway was Nelius H. Moxnes who was hired during the initial phase of the building process of the Norwegian Radium Hospital in Oslo in 1929. As a part of this work, Moxnes established a physics laboratory to ensure that the dosimetry and treatment methods would be ready for the opening of the hospital in 1932. Moxnes was later asked to build a governmental laboratory in 1939. This laboratory is today the Norwegian Radiation and Nuclear Safety Authority (DSA) [1]

Since 1972, radiation therapy departments have been established outside the capital of Oslo in order to be geographically close to the patients. The establishment of radiation therapy departments across the country led to a demand for medical physicists within radiation therapy.

There are currently 10 radiation therapy departments in Norway: Tromsø, Bodø, Trondheim, Ålesund, Bergen, Stavanger, Kristiansand, Ullevål (Oslo), Radiumhospitalet (Oslo) and Gjøvik.

In the 1970s computer assisted medical technology was introduced, primary as a result of worldwide advancement within medical physics. This demanded more advanced physics service at the hospitals. Norway has always been an early adopter of new and cutting-edge medical technology. The first computed tomography (CT) machine in Norway was installed at Ullevål University Hospital, Oslo, in 1975. CT based radiation therapy planning was established in Bergen in 1979 and the first magnetic resonance imaging (MRI) machine was installed in Stavanger in 1986. This led to a steady growth in the number of diagnostic physicists at the university hospitals across the country. The diagnostic physics group at the university hospitals acted as a physicist pool, serving the smaller peripheral radiology departments.

As a result of the diagnostic and radiation therapy advancements in the 1970s, the medical physics community established the Norwegian Association of Medical Physics (NFMF) in 1976. Today, NFMF has 223 members and the number is increasing each year. The NFMF holds an annual meeting for the Norwegian medical physics members with invited speakers, proffered papers, poster sessions and vendor exhibition. The annual meeting typically attracts 120 members and is one of the cornerstones in the Norwegian medical physics “family” where the social programme and mingling during the coffee breaks is just as popular as the scientific programme.

## III. LEGISLATION

The Norwegian radiation law was established in 1938, one of the first radiation legislations in the world. Today, the EU basic safety standards (2013/59/Euratom) are implemented in the Norwegian radiation protection regulation where appropriate and feasible. An update in the Norwegian radiation legislation stated that the number of scientists with an MSc degree should reflect the complexity and number of the modalities available in the hospital. In the notes of the current legislation it is stated that a scientist certified by the NFMF meets the necessary requirements to work in a Norwegian hospital. This implies that a certification as a medical physicist or medical physics expert is recommended, but not mandatory in order for a scientist to work in a hospital. A scientist working in a hospital is not defined as

“authorized health personnel” in the Norwegian health legislation, which restricts the scientist from working directly with patients.

#### IV. EDUCATION

In the medical physics community, a typical requirement in order to work as a physicist in a hospital in Norway is to hold an MSc degree within either nuclear physics, biophysics or medical technology. Four universities in Norway offers a complete Master’s programme or separate Master’s level courses within these topics: The Norwegian University of Science and Technology (Trondheim), the University of Oslo (Oslo), the University of Bergen (Bergen) and the Arctic University of Norway (Tromsø). The Master’s thesis can be conducted in collaboration with hospitals and with clinical physicists as supervisors.

Several universities and colleges in Norway work closely together with the hospitals and have active research groups and PhD programmes within medical physics.

#### V. CERTIFICATION AND SPECIALIZATION

In 2001 the DSA set down a work group to establish a Norwegian training programme for medical physicists working within radiation therapy, based on European guidelines. The Norwegian training programme was published in 2005. In 2009, the NFMF established a certification programme for medical physicist and a specialization programme within X-ray imaging, MRI, nuclear medicine and radiation therapy. The certification and specialization programmes are based on EFOMP and other international recommendations.

The certification as a medical physicist requires a minimum of 2 years of training after accomplishing an MSc degree in physics. The certification process is based on recommended literature, courses (hosted by e.g. ESTRO or Royal Marsden) and shorter internships or “sit-ins” to learn about typical tasks of other professions such as the technical staff, oncologists, radiologists and radiographers. A medical physics expert or a senior medical physicist acts as a supervisor who guides the process and approves the certification application that is later assessed by the NFMF. Today, 166 medical physicists are certified by the NFMF.

A certified medical physicist can apply to be become a medical physics specialist (equivalent to medical physics expert) within X-ray imaging, MRI, nuclear medicine or radiation therapy. The specialization to become a medical physics expert is based on CPD points (Continuous Professional Development) according to the EFOMP standards. Since 2009, 72 medical physicists have been accredited as a medical physics expert. The accreditation is valid for 5 years before it must be renewed.

It is a goal that the certification process is relevant and feasible in the everyday clinic at Norwegian hospitals. The

NFMF certification process is therefore under continuous evaluation and development. The educational resource bank established by the NFMF education council with recommended courses and literature is highly appreciated and works as a stamp of approval and quality for physicists in training. However, out of 72 accredited medical physics experts there are currently only 19 medical physics experts with valid accreditation in Norway, see Table 1 for details. The NFMF board are currently looking into why so few medical physics experts renew their accreditation.

Table 1 Number of NFMF members, certified medical physicists and medical physics experts with valid accreditation in Norway as of October 1<sup>st</sup> 2021

NFMF members		223
Certified Medical Physicists		116
Medical Physics Experts	Specialty	
	X-ray imaging	8
	Nuclear Medicine	3
	MRI	0
	Radiation therapy	8

#### VI. NORDIC COLLABORATION

The first Nordic medical physics meeting was held in 1962 in Örebro, Sweden. The Nordic Association of Clinical Physics (NACP) was formally founded in 1965, only a few years later than e.g. the Association of Physics in Medicine (AAPM). At the time, NACP established highly acclaimed workgroups and publications within topics such as dosimetry, radiation protection, treatment planning, education and simulation techniques [2].

The triannual NACP symposia was revitalized in 2008 in Aarhus, Denmark. The role as hosting nation rotates between the Nordic countries. The next NACP symposium will be held in 2023 in Reykjavik, Iceland, and will be organized in cooperation with the Danish society of medical physics (DSMF) and NFMF.

There are two specialty committees under the umbrella of the NACP: The Radiological Physics Committee (RPC) and the Nuclear Medicine Physics Committee (NMPC). The mandate of the specialty committees is to initiate Nordic networks and collaborations within their field of medical physics to meet the demands from the community. The committees organize courses that are relevant for their community. The committees consists of one member from each of the Nordic countries.

#### VII. INTERDISCIPLINARY COLLABORATION

The NFMF closely collaborates with the Norwegian Oncology Association, the Norwegian Radiology Association, The Norwegian Society of Radiographers and the DSA.

Within radiation therapy, a national quality assurance group (KVIST) was established in 2000 by the DSA in order to harmonize and strengthen the field of dosimetry and radiation therapy. KVIST consists of representatives from physics, oncology and therapists from each radiation therapy department in Norway. KVIST is continually working to improve the quality and communication between the radiation therapy clinics and across the different professions working within radiation therapy. Each year an interdisciplinary meeting within radiation therapy is held in collaboration between KVIST, NFMF, the Norwegian Oncology Association and The Norwegian Society of Radiographers.

### VIII. CONCLUSIONS

We have given an overview of how the fields within medical physics have developed since its infancy in 1929. Since 1976 the NFMF has been instrumental in the development of the medical physics community, especially the annual meeting for the members of NFMF and the establishment of the educational programme to improve and

standardize the professional level of medical physicists in Norway. In addition, supporting and facilitating communication and collaboration across professions and country borders continues to be one of the key activities for the NFMF in the years to come.

### REFERENCES

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