SCIENCE COUNCIL ASSOCIATES MENTORSHIP PROGRAM (SCAMP)

Domain Classification and Analysis of National Institutes of Health Funded Medical Physics Research

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INTRODUCTION

The AAPM previously developed a database of AAPM member grants awarded by the National Institutes of Health (NIH), to evaluate whether members continue to perform nationally competitive research. Reports were previously published on this database, including a description of the algorithm that matched AAPM members to corresponding NIH grants.[1,2] A major conclusion was that NIH funding to AAPM members was $116M in 2015, which was slightly lower than the historic mean of $120M (in 2015 US dollars). In this study we further explore trends in AAPM member research funding, including funding of specific medical physics subdisciplines.

AIM

As part of the AAPM's Science Council Associates Mentorship Program (SCAMP) activity we extend previous efforts[1,2] by developing an algorithm that enables classification of NIH grants into various medical physics subdisciplines and scientific domains. **The aim is to provide a broad assessment of the research conducted by AAPM members, including evidence showing how medical physicists are significantly contributing to the development of innovative technologies and treatments.** This study ensures that AAPM member research continues to align with the priorities of the AAPM and NIH. It can provide direction for future initiatives relating to the medical physics research.

METHODS AND DATASETS

Datasets

1. NIH grants from 2002 to 2019, where an AAPM member was listed as a principle investigator were extracted from NIH's REPORTER (AAPM member grants).
2. NIH grants from 2002 to 2019, where an AAPM member was not listed as a principle investigator were extracted from NIH's REPORTER (non-AAPM member grants).

Methods

- An algorithm was developed to classify extracted NIH grants into various medical physics sub-disciplines e.g. imaging, therapy, or image-guided therapy.
- Grant titles, keywords, abstracts, and activity codes were searched for relevant words to classify grants into categories.
- The resulting output of the classification algorithm was manually checked to ensure accuracy for each classification task.

RESULTS

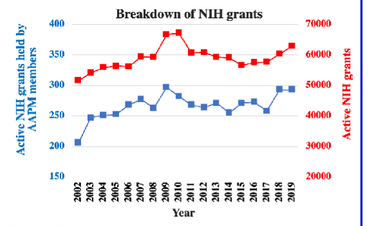

Figure 1: Yearly number of awarded NIH grants to any investigator (red) and yearly number of NIH grants awarded to AAPM members (blue). The transient increase starting in 2009 is due to the American Recovery and Reinvestment Act.

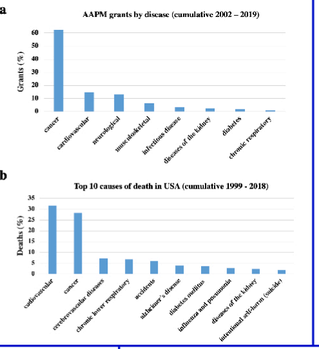

Figure 2: a) AAPM member NIH grants classified based on the disease studied. AAPM member cancer grants in 2019 most frequently referenced: 1) breast, 2) lung, 3) brain, 4) prostate, and 5) head and neck cancers. **b)** For comparison, the top 10 causes of death in the USA.[3]

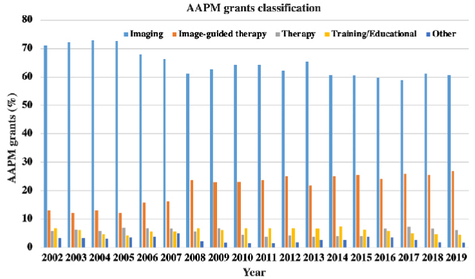

Figure 3: Classification of AAPM NIH grants into imaging, therapy, image-guided therapy, training, or other categories. There has been an increasing trend in grants focused on image-guided therapy studies.

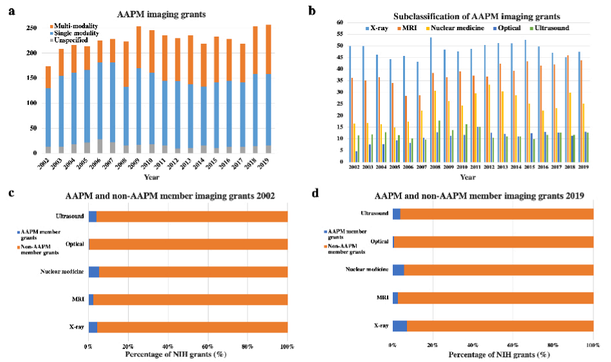

Figure 4: Breakdown of AAPM imaging grants. **a)** Single modality vs. multi-modality imaging grants. **b)** Breakdown of imaging grants by modality (note grants can be counted in more than one category). Also note the majority of nuclear medicine grants focused on positron emission tomography (97% of nuclear medicine grants in 2019) **c)** Comparison of AAPM and non-AAPM member imaging grants in 2002. **d)** Comparison of AAPM and non-AAPM member imaging grants in 2019.

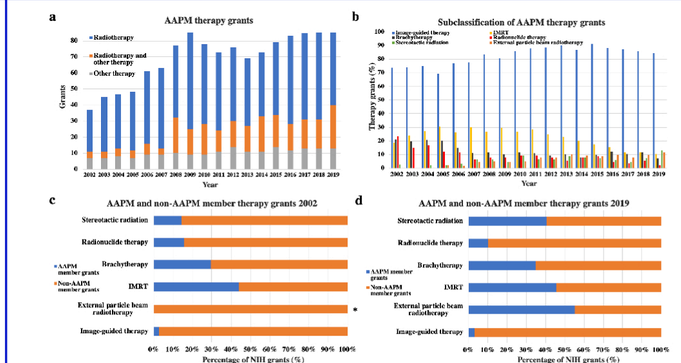

Figure 5: Breakdown of AAPM therapy grants. **a)** AAPM therapy grants comparing radiation therapy and non-radiation therapy. **b)** Breakdown of therapy grants into specific therapy categories. **c)** AAPM and non-AAPM member therapy grants in 2002. *There was only 1 NIH grant awarded for particle therapy research projects in 2002 and it was not held by an AAPM member. **d)** AAPM and non-AAPM member therapy grants in 2019.

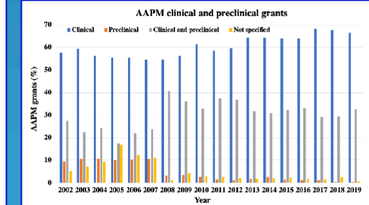

Figure 6: AAPM grants subclassified based on whether or not they included words associated with preclinical or clinical research.

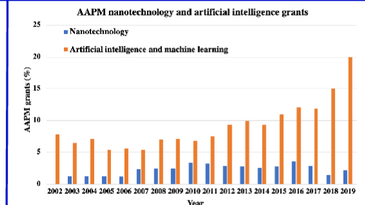

Figure 7: AAPM grants that included words associated with nanotechnology or AI (note grants can be counted in both categories).

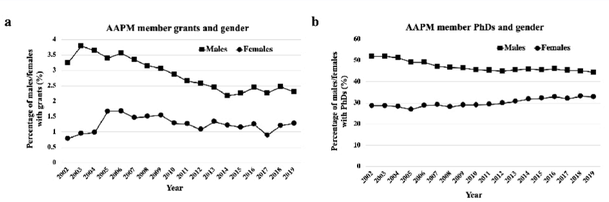

Figure 8: **a)** Yearly percentage of male and female AAPM members who are the primary contact PI on at least one NIH grant. **b)** Yearly percentage of male and female AAPM members with doctoral degrees for comparison.

CONCLUSIONS

- The percentage of AAPM member grants that have referenced image-guided therapy has increased from 13% in 2002 to 27% in 2019, suggesting opportunities for continued innovation of imaging technologies.
- When comparing AAPM member with non-AAPM member grants it was found that in 2019 AAPM members held a substantial fraction of all NIH grants that referenced stereotactic radiation therapies (41%), radionuclide therapies (10%), brachytherapies (35%), intensity-modulated radiation therapies (45%), and external beam particle therapies (55%).
- From 2002 to 2019, AAPM member grants referenced cancer more than all other diseases combined.
- Most grants awarded to AAPM members focus on clinical research, which underlies the translational aspect of medical physics and suggests medical physicists are uniquely positioned to help translate new technologies such as artificial intelligence into the clinic.
- The percentage of AAPM member grants referencing artificial intelligence words/phrases increased from 8% in 2002 to 20% in 2019.
- Overall, the percentage of AAPM membership holding NIH grants decreased from 2.9% in 2002 to 2.1% in 2019. However, this trend differed across gender, with the percentage of AAPM membership holding NIH grants decreasing for males (3.2% down to 2.3%) and increasing for females (0.8% up to 1.3%).

ACKNOWLEDGEMENTS

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