The Professional Radiation Workforce: A Systematic Study of Six Radiation Professions

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18 April 2023, NAS-NRSB

Acknowledgements

I would like to thank my co-authors and collaborators, including

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Jeanne LaBerge
Hubert Young Pan
Seth A. Rosenthal
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I have no conflict of interest.

Introduction

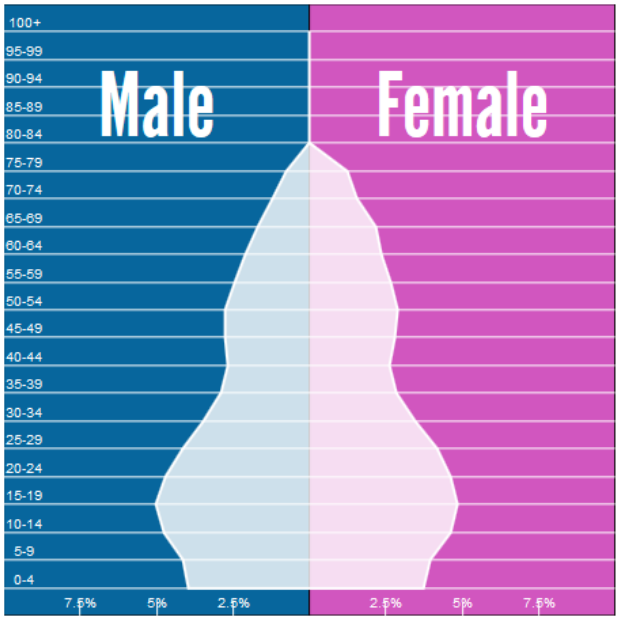
- A radiation workforce of sufficient size and capacity is needed to meet our nation's current and future needs for health care, electrical power generation, national security, defense, space exploration, etc.

- The US has created a community of professionals dedicated to the safe and beneficial use of radiation.

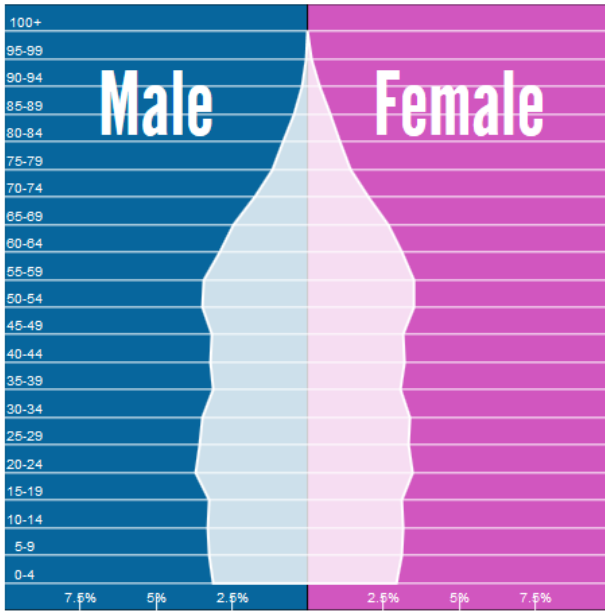
- However, their ranks have shrunk alarmingly, as documented by AAAS (2014), GAO (2014), HPS (2013), NAS/NRC (2012), and NCRP (2015).

US Demographics Population Pyramids

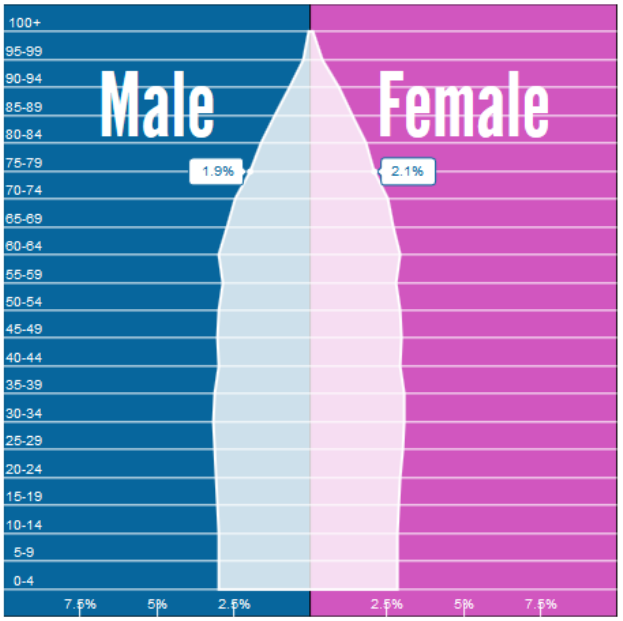
1976



2016



2056



http://populationpyramid.net

Introduction: NCRP's 2013 Workshop

- Adequate supplies of *some* professionals for next 5-10 y.
- Only 2 professions with adequate personnel *in short term*:
  - Medical physics
  - Nuclear power
- 10-20 years: projections reveal insufficient numbers of replacements for retirees.

NCRP Statement 12, 2015

Introduction: NCRP's Dire Warning

- US is on the "verge of a severe shortfall of radiation professionals such that urgent national needs will not be met."

- Projected shortfalls will adversely affect the public health, radiation occupations, emergency preparedness, and the environment.

NCRP Statement 12, 2015

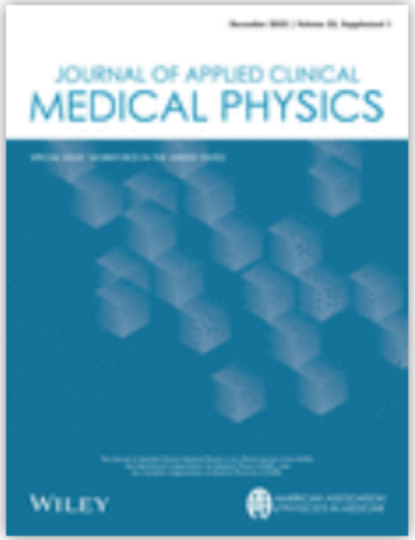
Methods of This Study

- ~60 experts volunteered.
- Utilize published literature, unpublished data, expert opinion, and speculation.
- Electronic meetings only, no budget or staff.
- Topics: current status, future outlook, and recommend actions.

Methods and Timeline

- Formulate research roadmap: ~ 1 y.
- Research, consensus, writing: ~ 4 y.
- Prepare submissions, revisions: ~ 2 y.
- Publication of study: ~ 1 y.

Results



Volume 23, Issue S1

Special Issue: WORKFORCE IN THE UNITED STATES

December 2022

- 60 pages
- Open access
  https://aapm.onlinelibrary.wiley.com/toc/15269914/2022/23/S1

Results: Study Components

1. Introduction
2. Health Physics
3. Medical Physics
4. Medicine
5. Nuclear Engineering
6. Radiobiology
7. Radiochemistry
8. Synthesis & Recommendations

Selected Key Findings

- "… almost without exception, it was apparent that there are significant limitations in precisely determining the current status and temporal trends of the professions considered."

- "… the current status and future outlook of the professions involved in radiation protection varied considerably dependent on specialty, subspecialty, and other factors."

Newhauser, W.D., Williams, et al. J Appl Clin Med Phys., 23: e13846. https://doi.org/10.1002/acm2.13846

Summary of Findings

TABLE 1 Select characteristics of the professional radiation workforce in the United States by discipline, as determined in 2018

Aspect	Health physics	Medical physics	Medicine	Nuclear engineering	Radiation biology	Radiation and nuclear chemistry
Size (number of workers)	3200–7000	8000	37 600 (34 000 radiologists; 3600 radiation oncologists)	18 000	~500	Estimate not available
Trends in workforce size	Shrinking	Growing; shortages in some subspecialties	Changing practices in radiology and radiation oncology affecting workforces	Slight growth; aging workforce lacking in diversity	Shrinking; shortages due to aging workforce, failure to replace	Shrinking; shortages due to aging workforce
Factors driving future trends	Closure of power plants	Increasing demand due to population growth/aging	Aging/ retirements, employment choices (full vs. part-time), use of AI	Increase in nonpower applications (e.g., nuclear security)	Aging/ retirements, reduced funding	Aging/ retirements, reduced funding
State of educa-tion/training	Small capacity; risk of program closure	Limited residency positions may affect the future pipeline	Adequate capacity	Adequate capacity	Complete loss of training programs	Risk of future inability to maintain the workforce
Future outlook	Poor	Good	Good	Good	Poor	Poor?

Newhauser, W.D., Williams, J.P., Noska, M.A., Borrás, C., Holahan, E.V., Dewji, S.A., Johnson, T.E., Hiatt, J.W., Poston, J.W., Hertel, N., Gress, D.A., Mills, M.D., Jordan, D.W., Sutlief, S.G., Martin, M.C., Jackson, E., Bluth, E.I., Frush, D.P., Oates, M.E., LaBerge, J., Pan, H.Y., Rosenthal, S.A., Townsend, L.W., Brady, L., Lindegard, J., Hall, H.L., McAndrew-Benavides, E., Abelquist, E., Anscher, M.S., Vazquez, M., Kronenberg, A., Willey, J.S., Lawrence, T., Woloschak, G.E., Marples, B., Wong, R., Story, M., Howell, R.W., Hei, T.K., Tolmachev, S.Y., Auxier, J.D., Rucker, T.L., Nilsson, M., Sudowe, R., Powell, B.A. and Jensen, M.P. (2022), Summary and conclusions, and abbreviations and acronyms. J Appl Clin Med Phys., 23: e13846. https://doi.org/10.1002/acm2.13846

Selected Recommended Actions

1) Initiating or enhancing annual **surveillance** of radiation professionals.

2) **Fostering cooperation**, coordination, and harmonization among the professions on workforce surveillance and related activities.

3) **Advocacy** for sustained funding for higher education and research.

4) Developing outreach activities to **attract future workers**.

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Thank You