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Critical Review

The Radiation Oncology Job Market: The Economics and Policy of Workforce Regulation

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Examinations of the US radiation oncology workforce offer inconsistent conclusions, but recent data raise significant concerns about an oversupply of physicians. Despite these concerns, residency slots continue to expand at an unprecedented pace. Employed radiation oncologists and professional corporations with weak contracts or loose ties to hospital administrators would be expected to suffer the greatest harm from an oversupply. The reduced cost of labor, however, would be expected to increase profitability for equipment owners, technology vendors, and entrenched professional groups. Policymakers must recognize that the number of practicing radiation oncologists is a poor surrogate for clinical capacity. There is likely to be significant opportunity to augment capacity without increasing the number of radiation oncologists by improving clinic efficiency and offering targeted incentives for geographic redistribution. Payment policy changes significantly threaten radiation oncologists' income, which may encourage physicians to care for greater patient loads, thereby obviating more personnel. Furthermore, the implementation of alternative payment models such as Medicare's Oncology Care Model threatens to decrease both the utilization and price of radiation therapy by turning referring providers into cost-conscious consumers. Medicare funds the vast majority of graduate medical education, but the extent to which the expansion in radiation oncology residency slots has been externally funded is unclear. Excess physician capacity carries a significant risk of harm to society by suboptimally allocating intellectual resources and creating comparative shortages in other, more needed disciplines. There are practical concerns associated with a market-based solution in which medical students self-regulate according to job availability, but antitrust law would likely forbid collaborative self-regulation that purports to restrict supply. Because Congress is unlikely to create one central body to govern residency controls for all specialties, we recommend better reporting of program-specific employment metrics and careful, intellectually honest re-evaluation of existing Accreditation Council for Graduate Medical Education accreditation standards.

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The health policy literature is replete with articles on the projected shortage of primary care physicians in the United States (1-3). Comparable analysis of the US radiation oncology workforce, however, has been much more sparse and offers less consistent conclusions about projected supply and demand. Using Surveillance, Epidemiology, and End Results (SEER) data, Smith et al (4) projected in 2010 that demand for radiation therapy would grow 10 times faster than supply over the next decade. Two years later, Shah (5) published an editorial that described a rapid increase in the number of radiation oncology trainees and expressed concern about an oversupply of radiation oncologists leading to a tight labor market. This prompted several responses from prominent academic radiation oncologists, arguing that residency expansion appeared justified (6-9).

In this issue of the journal, Smith and coauthors (Pan et al) (10) update their 2010 SEER analysis and adjust their projections, concluding that growth in the supply of radiation oncologists over 2015 to 2025 is likely to outpace the growth in demand. The adjustments are primarily based on an increase in the projected supply associated with the recent expansion in residency positions but also demonstrate a small decrease in expected utilization, principally from prostate cancer. In this report, we seek to place these updated results in context and present a critical analysis of the economics and social policy associated with regulation of the radiation oncology labor market.

Available Survey Data Raise Concerns About Physician Oversupply

Other than the analyses performed by Smith et al (4, 10), the data pertaining to the radiation oncology labor market are largely limited to surveys. In 2012 the American Society for Radiation Oncology (ASTRO) Workforce Committee conducted an online survey to better understand the specialty's concerns with workforce issues such as work-life balance, reimbursement, and employment opportunities. Thirty-three percent of responding radiation oncologists believed that the supply of radiation oncologists exceeded demand, whereas only 16% percent believed the opposite to be true (11). Thirty-five percent of surveyed radiation oncologists had looked for a new position in the past 3 years, with 47% of them indicating that they had difficulty obtaining a satisfactory position (12). However, over one-third of the responding academic radiation oncologists indicated that there was a vacancy in their department, and over 80% of the job seekers indicated that their difficulty arose from a lack of positions in a desired geographic area. Furthermore, on a scale of 1 to 10, radiation oncologists reported an average career satisfaction score of 8.2. Hence, it is plausible that the perceived difficulty in securing alternative employment was secondary to physicians' desire for specific practice types in a narrow range of locations that would generate extremely high levels of satisfaction.

Bland et al (13) conducted a survey of the 2014 US residency graduating class, with 71% of respondents indicating that the job market was worse than what they anticipated when entering residency. Six months after graduation, 93% of the residents who attempted to secure staff positions in radiation oncology were successful. Most of those who were unsuccessful in finding employment entered fellowship.

The job market for graduating residents in Canada has been poor for most of the past decade. Graduates are typically forced to obtain locum or fellowship positions for at least 2 years, and roughly 25% of graduates leave the country for positions abroad (14). As a response to the tightening job market, the Canadian Association of Radiation Oncology (in collaboration with the Human Resources & Standards and Radiation Oncology Program Directors Committee) reduced the number of entry-level residency positions by 16% and eliminated additional trainees by preventing transfers into radiation oncology.

Medical students may be taking note of residents' job market concerns as the ratio of applicants to positions has declined over the past 10 years (15). From 2004 to 2015, the number of radiation oncology residency positions grew by 56.3% (from 128 to 200), whereas the number of first- or only-choice applicants increased by only 22.6% (from 186 to 228). (Complete data on the number of radiation oncology residency positions since 1993 are presented in Fig. 1.) Nevertheless, entry into the specialty continues to be fiercely competitive in terms of required test scores, grades, and publications. It is plausible that admission standards will relax in the face of reduced medical student demand, which could reverse the declining ratio of applicants to positions by encouraging less qualified individuals and foreign medical graduates to apply.

Stakeholder Interests Vary Substantially

Changes to the supply of radiation oncologists would disparately affect various stakeholders (Fig. 2). An oversupply of physicians would adversely affect radiation oncologists planning to search for employment, as well as

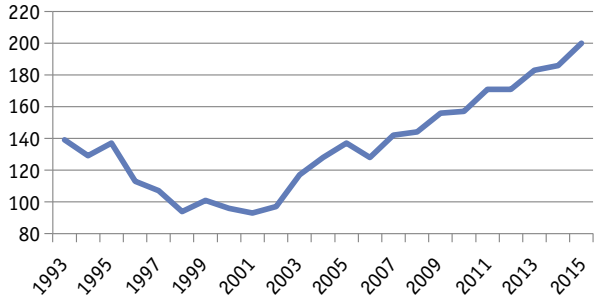

Fig. 1. Radiation oncology residency positions by year.

Winners	Losers
• Equipment owners (hospitals and shareholders of freestanding centers) • Entrenched professional groups • Technology vendors	• Employed radiation oncologists • Radiation oncology residents • Less entrenched professional groups, particularly in competitive markets

Fig. 2. Stakeholder winners and losers associated with an oversupply of radiation oncologists.

those who have contracts that can be renegotiated. Employers would be expected to reduce salaries, offer less robust fringe benefits, require higher productivity, and/or otherwise reduce the attractiveness of employment offers. Graduating residents without work experience may be harmed the most because they are not yet board certified, are most likely to require on-the-job training, and carry risk of failure in domains that are not taught in residency, such as business development.

Reducing the cost of labor for hospitals and freestanding centers via an oversupply of radiation oncologists would also be expected to adversely affect less entrenched physician groups that contract with externally owned enterprises to provide physician services. If the job market softens and compensation packages decline, hospitals and freestanding centers will find it increasingly economical to employ their own physicians. In cases in which the hospital still wishes to hire an independent practice to provide the professional services, it may seek to extract more favorable contractual terms. For instance, the hospital may seek shorter contract lengths, impose heightened administrative or reporting requirements, offer fewer or no quality bonuses, refuse to guarantee a floor for professional collections, or require increased contributions for office expenses.

An oversupply of radiation oncologists, however, would be favorable for some stakeholders. In general, equipment owners would be expected to benefit from the lower cost of labor. This is particularly true for owners that have secured strong covenants not to compete from their physicians and/or operate in states that require a certificate of need (government approval) prior to the establishment of a new radiation oncology center. Hospitals and freestanding centers in states without certificate-of-need requirements would have to tread more gingerly with their employment contracts for fear that physician employees will defect and establish a competing enterprise. Professional groups with extended contracts to provide professional services or those that have longstanding relationships with external referring physicians should also benefit from the lower cost of labor. Such professional practices may be able to offer lower starting salaries and longer partnership tracks as the strength and security of less entrenched physician-owned organizations dwindle.

Revenue for technology vendors should also improve in a system with more radiation oncologists. As the cost of labor decreases for hospitals and freestanding centers, facilities should be more willing to purchase new technology and upgrade older equipment. Moreover, there may be some degree of over-treatment generated by the excess clinical capacity. Significant research has shown an association between higher physician-to-population ratios and utilization of discretionary health care services such as physician visits, surgical procedures, and diagnostic imaging (16, 17). In radiation oncology, this may translate into more frequent recommendations for treatment, more protracted fractionation regimens, and an increased use of expensive modalities, all of which would increase demand for new technology.

The projected impact on insurers is less certain. Physician-induced demand might increase utilization and adversely affect all payers. However, if radiation oncologists open new centers to compete with incumbents, then the competition should reduce unit prices for commercial insurers. Even without new centers, the reduced cost of labor may encourage competition on price, particularly as radiation oncology becomes integrated into alternative payment models (as discussed later in the "Impact of Compensation and Payment Policy on Supply and Demand" section).

With such disparate stakeholder interests, it is important that policymakers considering workforce regulation take a societal perspective. Policymakers' first priority is to ensure high-quality care for patients by allowing for a sufficient capacity of well-trained physicians to meet clinically appropriate demand. A shortage of radiation oncologists would presumably lengthen wait times and adversely affect cancer outcomes, but an oversupply can adversely affect quality by discouraging promising medical students from entering the specialty. To determine whether reallocation of such talent to other specialties and nonmedical disciplines is socially optimal, policymakers must consider the impact to both clinical quality and research productivity. Along this vein, any efforts designed to regulate the radiation oncology workforce should seek to ensure appropriate utilization of societal resources, including taxpayer subsidies for PhDs and residency training. Graduating residents who have dedicated their early careers to research must have opportunities to use these skills. If such positions become difficult to fund or otherwise challenging to maintain, then one must question whether residency programs should select medical

students with a more clinical focus, reallocating research talent and interest elsewhere.

Policymakers should care about physician opportunities insofar as they affect society at large. Unemployment and underemployment among radiation oncologists would be problems if they led to bankruptcies, failure to repay student debt, or unethical behavior designed to recapture lost income. Subpar salaries and low levels of job satisfaction are also a concern if they might lead to burnout that is sufficient to negatively affect clinical quality. Lastly, and perhaps most importantly, an oversupply of physicians in one specialty may cause an undersupply in another specialty or medically related discipline where resources would be better allocated (eg, geriatrics).

Increasing Capacity Without Increasing Supply

In the accompanying SEER analysis, Pan et al (10) argue that the supply of radiation oncologists is an imperfect surrogate for clinical capacity and suggest that policymakers focus on the latter. There are two principal ways in which clinical capacity may be augmented without increasing the number of radiation oncologists: (*1*) optimize the geographic distribution of physicians; and (*2*) improve clinical efficiency.

Aneja et al (18) mapped the ratio of radiation oncologists to the population aged 65 years or older within different health service areas at 2 time points and showed a striking maldistribution of physicians. Radiation oncologists were disproportionately concentrated in highly populated metropolitan areas with higher socioeconomic characteristics, with the ratio of physicians to the population aged 65 years or over varying by at least a factor of 10. Many metropolitan statistical areas (MSAs) in the Northeast and Southern California exhibited >12 radiation oncologists per 100,000 persons aged 65 years or over, whereas MSAs throughout the Midwest showed 0 to 2 physicians per 100,000 persons aged 65 years or over. Radiation oncologists were less evenly distributed than both primary care physicians and all medical doctors in 1995 and 2007, the 2 time points examined by the authors.

Although some of the maldistribution may be secondary to a higher concentration of academic physicians with lower clinical responsibilities in more densely populated MSAs, these data strongly suggest excess capacity in some locations. Reallocating physicians to more rural environments could offset many of the capacity shortages that exist in rural environments without increasing the total supply of physicians. The available data suggest that policy initiatives to redistribute the primary care workforce and increase the availability of care in underserved areas have seen some success. For instance, the National Health Service Corps Scholarship Program, which awards full medical school tuition in exchange for a commitment to work in an underserved area after training, has been associated with an increase in the long-term supply of physicians in rural areas (19, 20). Such scholarship programs may have a positive impact on the ability to attract other physicians to rural areas who do not have similar contractual obligations (21).

There also may be significant opportunity to improve clinical capacity without increasing the supply of radiation oncologists by optimizing workflows and increasing physicians' efficiency. Administrative and clerical work has become a large component of the radiation oncologist's workday, with the average physician spending several hours per week on insurance matters alone (22). According to one estimate, at least half of a physician's time is spent on clerical work that is of limited value to the patient (23). Many clerical and administrative tasks, such as requesting prior authorization, calling in prescription refills, and filling out documentation to support billing, could be performed by other staff with minimal physician oversight. Significant capacity could be created by ensuring that all staff work to the top of their licenses. Increased use of nurse practitioners and physician assistants to collect clinical data, provide basic patient counseling, and document clinical encounters may further augment physicians' ability to treat more patients without sacrificing quality.

Some departments require physicians to staff multiple hospitals or satellite facilities. This can have benefits in terms of vacation coverage and occasionally allow for more disease-site specificity, but the impact on clinical capacity is substantial. Radiation oncologists who split their time among multiple sites may spend upward of 10 hours per week commuting and require more time to contour and review plans because they must do so remotely, with imperfect Internet connections that require an additional log-in after any period of inactivity. In larger departments, physicians will spend time walking to the dosimetry department to review a plan. Readjusting workflows to allow physicians to spend more time seeing patients and less time traveling, waiting, and remotely accessing technology could significantly improve clinical capacity without increasing the supply of physicians.

Over the past 5 years, there has been substantial consolidation of the provider landscape, with fewer community-based, physician-owned practices and more hospital satellites and larger private practices with centralized, corporate ownership (24, 25). These changes may naturally produce a more efficient radiation oncology workforce as organizations possess sufficient economies of scale to optimize a team-based approach with appropriate support from midlevel providers. Such practices are also more likely to adopt department-wide standardization of dosing, simulation instruction, normal tissue constraints, and image guidance protocols, which should reduce the time that physicians spend thinking about these issues. Consolidation may also allow for increased disease-site specialization, which can eliminate the need for physicians to repeatedly reference guidelines and primary literature, thereby improving efficiency.

The opportunity to improve efficiency in radiation oncology, and thus clinical capacity, is likely to be substantial and could compensate for as much as a 50% increase in physician supply. The University of Texas MD Anderson Cancer Center used principles of time-driven activity-based costing to redesign the workflow in its preoperative anesthesia assessment center, where patients were assessed prior to the day of surgery to avoid same-day cancellations. By allowing midlevel providers to assess lower-complexity cases, enhancing information technology, and standardizing the preoperative assessment process, the center was able to service 20% more patients per year while reducing the number of physician full-time equivalents by over 50% (26).

Impact of Compensation and Payment Policy on Supply and Demand

Instability in the payment for radiation oncology services has led to downward pressure on physician compensation that is likely to continue for much of the next decade. Medicare reimbursement to freestanding radiation oncology facilities has declined by over 20% from 2005 to 2015 (27), with additional cuts implemented at the start of 2016 (28). Although the Patient Access and Medicare Protection Act is expected to freeze Medicare reimbursement for freestanding radiation oncology treatments at 2016 levels for 2 years (29), the specialty remains a clear target for payment cuts by the Centers for Medicare & Medicaid Services (CMS) (30, 31). There is also significant risk that Medicare will decrease the reimbursement to hospital-based facilities to bring their payments in line with freestanding centers (32, 33).

The transition away from physician ownership is likely to continue as hospitals acquire satellite facilities to expand their regional footprints, gain negotiating clout with commercial payers and better position themselves for the accountable care era. Many radiation oncologists will thus continue to opt for an employment model, which typically offers lower compensation than partnership in a physician-owned practice. The payer mix across a broad range of locations is becoming increasingly unfavorable as baby boomers age and transition from commercial insurance to Medicare. Insurers have also been able to drive down the prices of radiation oncology services by promoting narrow networks on individual and small group exchanges, where consumers tend to be more cost conscious (34). Finally, an influx of direct utilization management tools, especially prior authorization, has started to affect fractionation patterns and the implementation of advanced technology (35).

All of these factors will work in concert to restrict radiation oncologists' income in the foreseeable future. As recent increases in radiation oncologists' median relative value unit productivity suggest, physicians are likely to see more patients to compensate for the lost earnings, thereby increasing clinical capacity (36). The effect may be akin to when the Medicare Prescription Drug, Improvement, and Modernization Act of 2003 reduced reimbursements for outpatient chemotherapy drugs, and medical oncologists responded by prescribing more chemotherapy (37). Radiation oncologists also might be tempted to increase their recommendations for radiation, hyper-fractionate, or otherwise use more advanced technology, but the adoption of alternative payment models that discourage resource-intensive treatment may limit the effect largely to patient volume.

There is little doubt that alternatives to the fee-for-service payment system will substantially affect radiation oncology going forward. In January 2015, Department of Health and Human Services Secretary Sylvia Burwell announced an initiative calling for 30% of Medicare payments to be tied to alternative payment models by 2016 and 50% of payments by 2018 (38). The Medicare Access and CHIP Reauthorization Act of 2015 encourages participation in alternative payment models by awarding providers who receive a substantial share of their revenue through such programs with a 5% yearly bonus from 2019 through 2024 (39). It also exempts participating providers from payment adjustment under the newly created Merit-Based Incentive Payment System, which modifies payments according to quality metrics, resource utilization, participation in clinical practice improvement activities, and meaningful use of an electronic health record. In December 2015, Congress passed legislation specifically addressing the implementation of bundled payments for radiation oncology. The Patient Access and Medicare Protection Act requires CMS to submit a report to Congress within 18 months of the bill's passage on the development of an episodic alternative payment model for radiation therapy delivered in freestanding centers (40).

The extent to which payment reform will affect clinical capacity and demand for radiation oncology services depends on the type of model that thrives. The Radiation Therapy Alliance (RTA), a nonprofit advocacy organization representing freestanding radiation oncology centers, has long advocated for radiation-specific episodic payments in the freestanding setting that aggregate the professional and technical billing for each cancer type into one lump sum but do not include payment for radiology, laboratory workup, hospital or emergency department visits, or complications. In 2012, 21st Century Oncology successfully launched a similar model with Humana that applies to 90% of all cancer patients treated with external beam radiation but excludes stereotactic treatments and brachytherapy (41). ASTRO originally rejected specialty-specific and modality-specific episodes that rely on past fee-for-service claims to set rates (42) but has since developed radiation-specific proposals for the treatment of bone metastases and breast cancer that closely resemble the RTA−21st Century Oncology model.

CMS has thus far been most interested in comprehensive oncology bundles that include surgery, drugs, radiation

therapy, and the cost of complications, rejecting RTA's proposal for radiation-specific episodic payments in the 2013 Medicare Physician Fee Schedule (43). The Center for Medicare & Medicaid Innovation (CMMI), an offshoot of CMS created by the Patient Protection and Affordable Care Act to test innovative payment and service delivery models, has expressed a similar philosophy (44). Before the close of 2016, CMMI is expected to roll out its Oncology Care Model, a bundled-payment pilot that puts medical oncologists at financial risk for global spending (all medical costs, regardless of whether they relate to the cancer diagnosis) that occurs within 6 months of administering chemotherapy or hormonal therapy (45). Under the Oncology Care Model, medical oncologists are given benchmarks for spending based on prior years' risk-adjusted fee-for-service claims. Depending on whether the providers enter a 2-sided or upside-only risk model, Medicare keeps the first 2.75% to 4% of the savings. If medical oncologists meet quality metrics, they are eligible to retain 100% of any additional savings, which should serve as a powerful incentive to reduce expenditures.

As of the writing of this article, CMMI has yet to release its methodology for risk adjustment or the details surrounding the Oncology Care Model's quality metrics. It is thus unclear whether the need for radiation in particular circumstances will alter the bundled-payment amount or whether some degree of savings will be conditioned on certain types of patients receiving radiation therapy. However, there is significant concern that the Oncology Care Model will affect the demand for radiation therapy by decreasing referrals to radiation oncologists in marginal circumstances such as painful bone metastases or prophylactic cranial irradiation for small cell lung cancer. In a bundled-payment pilot initiated by United Healthcare, in which medical oncologists had incentives to reduce global spending (albeit not full financial risk), savings were achieved primarily from a reduction in hospitalizations and the use of radiation therapy (46).

The Oncology Care Model may also increase clinical capacity, thereby reducing the need for more radiation oncologists. This is true for 3 principal reasons. First, medical oncologists are likely to encourage hypofractionation by preferentially referring to physicians who tend to treat with shorter courses, and fewer patients on treatment should allow for greater time to see new consultations. Second, the model creates an incentive for medical oncologists to refer to physicians who avoid expensive technology, for example, those who choose 3-dimensional conformal radiation therapy over intensity modulated radiation therapy and whole-brain radiation therapy over repeated courses of stereotactic radiosurgery with magnetic resonance imaging surveillance. The resulting decrease in earnings for radiation oncologists should generate an interest in treating more patients, as reviewed earlier. Finally, the Oncology Care Model is a multipayer model in which commercial insurers participate by piggybacking on the program's requirements. Medical oncologists at risk for global spending will be rewarded for selectively referring their commercially insured patients to radiation oncologists with the lowest prices. Similar to the exchange-based health plans discussed earlier, this will encourage competition on price among radiation oncologists, putting further downward pressure on income.

Any projection of the demand for radiation oncology services, or the expected clinical capacity, must take into consideration the likely evolution of the payment system. At this time, CMS seems most interested in comprehensive models that place centralized, referring physicians at financial risk for complications and downstream spending. These systems have the potential to disrupt treatment patterns and reduce radiation oncologists' income. Many medical oncology practices and commercial insurers are expected to balk at the Oncology Care Model's detailed practice structure and reporting requirements, limiting the impact of version 1.0, but subsequent iterations of the program and similar models from private payers significantly threaten radiation oncology revenue. Integrating radiation therapy into these models and sharing in both the upside and downside would help to mitigate the concerns, but under the Oncology Care Model, there is little incentive for medical oncologists to offer such gain sharing because they can test the waters with an attractive upside-only option in which spending above predefined benchmarks is paid in full by Medicare. Radiation therapy—centric models such as the ones advanced by RTA and ASTRO would also be preferable, although such programs have thus far gained little traction. The need for more physicians will be determined in large part by how ASTRO, RTA, and the field at large respond to the Patient Access and Medicare Protection Act's mandate to create an episodic payment model that incorporates radiation therapy.

Financing and Governance of Graduate Medical Education

Total federal funding for graduate medical education (GME) is approximately $16 billion annually. Medicare contributes the lion's share, providing almost $3 billion for direct medical education—resident salaries and benefits—and $6.5 billion for indirect medical education, to compensate academic medical centers for the decreased efficiency and increased costs associated with employing resident physicians (47). Payment for direct medical education is made directly to the academic institution in accordance with the number of Medicare-funded residency positions. The cost of indirect medical education is accounted for by higher Medicare payments for each inpatient admission.

Out of a concern for an oversupply of physicians and rising Medicare spending, the Balanced Budget Act of 1997 capped the number of Medicare-funded residency positions. Hospitals without training programs can secure Medicare-

funded positions if they develop newly accredited programs, but after 5 years, Medicare caps the hospitals' slots. In addition, rural hospitals that already receive GME funding can receive additional Medicare-funded positions for newly approved specialty programs. Outside of these exceptions, hospitals may increase the size of their training programs as desired, but they will not receive additional funding from Medicare. The extent to which Medicare funded the recent expansion in radiation oncology positions is unknown, although it is likely that a some percentage were not supported by external financing.

Academic medical centers face several perverse incentives to increase the number of training slots in radiation oncology, regardless of whether there is a societal need for more physicians. First, expansion brings prestige to the organization and the individuals in power, particularly the chair and program director. Second, because residents are often interested in practicing in the region where they train, an abundance of graduates may decrease the cost of hiring entry-level attendings. Finally, residents may serve as a source of relatively cheap labor compared with a midlevel provider, increasing departmental profits and attracting senior leaders through promises of resident coverage. The fact that past restrictions on GME funding (including the cap imposed by the Balanced Budget Act of 1997) failed to slow the growth in residency positions serves as strong evidence that residents are economically advantageous to hospitals, even without Medicare funding (48). Although radiation oncology residents are supervised to a greater extent than their internal medicine counterparts, the higher salaries for specialist attendings translate into greater economic benefit associated with resident support that allows for augmented patient loads.

Although several federal advisory groups such as the Council on Graduate Medical Education have influence on the matter, there is no single body that comprehensively governs the financing of GME. The Accreditation Council for Graduate Medical Education (ACGME) is responsible for the accreditation of radiation oncology programs and the authorization of new residency slots. Because all GME funding is contingent on accreditation, and there is no other organization controlling the purse strings, the ACGME also dictates funding in cases in which a program is eligible for Medicare-funded positions. Importantly, antitrust and fair-trade prohibitions prevent accrediting bodies from considering the makeup of the physician workforce or the geographic distribution of residency positions. The ACGME must accredit solely based on a residency program's capacity to train new physicians.

Conclusion and Recommendations

The inconsistent analyses of the US radiation oncology labor market demonstrate the extreme difficulty associated with projecting supply and demand many years into the future. Nevertheless, the study by Pan et al (10) raises significant concern about an oversupply of physicians that deserves deep consideration from our specialty, as well as broader policymakers. Indeed, the study by Pan et al may under-project the capacity of radiation oncologists and overestimate demand by failing to model improvements in efficiency or consider the impact of declining compensation and the implementation of alternative payment models that turn referring physicians into cost-conscious consumers of radiation therapy.

Excess physician capacity carries a significant risk of harm to society by suboptimally allocating intellectual resources and creating comparative shortages in other, more needed disciplines. Rural radiation oncology positions are currently underfilled, but simply increasing the number of radiation oncologists is unlikely to correct the geographic maldistribution and, at the very least, is a blunt and imperfect tool to solve the problem (49). Studies on the broader medical labor market show that increases in training positions have not proportionally augmented the number of physicians who practice in underserved areas (50, 51). Any undersupplies that arise may be best addressed through short-term reformations that increase clinical capacity without training more physicians, such as direct financial incentives to practice in underserved areas (eg, loan forgiveness) and augmented participation of midlevel providers.

The theoretically ideal solution is a market-based approach in which medical students are called on to self-regulate according to perceptions about job availability. Market reformations could be used that would decrease information asymmetries and otherwise allow medical students to make better long-term decisions. For instance, academic departments might commit to collecting and publishing detailed data on job availability, salaries, and career trajectory, broken out by training program. Training programs might also offer shorter tracks for clinically focused trainees to decrease the lag time from residency application to graduation. Broadening the skill set taught in radiation oncology to include limited diagnostic interpretation, comprehensive radionuclide handling, and additional interventional procedures would help to make graduates more marketable and expand what would otherwise be a stagnant field. However, there are significant concerns associated with a market-driven solution, not the least of which is the practicality associated with drastic changes to the length or scope of radiation oncologists' training.

Moreover, for a marketplace solution to work optimally, there would need to be an abundance of residency positions in all specialties, with graduating medical students allocating themselves to the disciplines with the most promising career outlooks. If some specialties restrict training slots to a greater degree than others, the market will be distorted, producing an undersupply of some physicians and an oversupply of others. Training residents may be more expensive for some disciplines and produce lower "returns" for the department than other disciplines, thereby

forcing specialties to be disparately reliant on GME funding for residency expansion. Moreover, the incentive structures may differ for the academic leaders of different specialties. In radiation oncology, resident coverage may further recruitment of top faculty, whereas other specialties may value resident services less or tacitly agree to limit training slots to protect earnings despite a societal need for physicians. Graduating medical students may reasonably opt to fill whatever slots are available, rather than leave the medical field altogether, even if the latter would be societally optimal because of an oversupply in the specialties with residency openings. Foreign medical graduates may be particularly likely to accept open positions because of comparatively poor earning potential abroad.

Even if all specialties committed to an abundance of training positions, we question the wisdom of a pure market-based solution. In our view, residency training is too long, and the decision about choice of specialty training is too complex and emotionally laden to expect graduating medical students to accurately titrate applications to expected clinical demand. Even in the legal field, in which the length of training is much shorter and choice of subspecialization is much more fluid, there has been significant overtraining of attorneys, resulting in defaults on student loans and misallocated talent (52, 53). The experience in diagnostic radiology in the United States and radiation oncology in Canada, where many graduating residents struggle to obtain jobs and are forced into multiple fellowships, also supports the notion that some top-down control of the resident spigot is necessary.

Experts are unlikely to be able to reliably titrate physician capacity to future demand. However, we believe that committees with expertise in labor economics and social policy would be better equipped than individual medical students to make decisions that best allocate resources for society. Market-based reformations can also take place alongside top-down regulation, eventually reducing the scope and influence of the latter. Ideally, one central body would govern GME funding and residency controls for all disciplines because self-regulation by individual specialties is inherently laden with conflicts of interest. However, such ultra-centralized regulation would require congressional action, and thus specialty-specific self-control is often touted as the most realistic solution.

Unfortunately for advocates of such a solution, antitrust law would likely forbid collaborative self-regulation that purports to restrict the supply of physicians, even if the restriction is based on sound empirical evidence of a surplus. Any agreement to restrict residency positions would likely be condemned as a "per se illegal" horizontal cartel, with courts refusing to entertain the collaboration's procompetitive arguments, regardless of their merit. At the very least, ASTRO, the ACGME, the Association of Residents in Radiation Oncology, the Association for Directors of Radiation Oncology Programs (ADROP), and the Society of Chairs of Academic Radiation Oncology Programs (SCAROP) could face significant legal challenges if they were to conspire to restrict residency expansion, even temporarily.

Short of direct congressional action, there are limited solutions to the projected oversupply. As a start, we suggest that SCAROP and ADROP ask all member programs that expanded over the past 10 years to release information about the number of slots that generated additional Medicare funding. If a substantial percentage of the expansion positions received governmental support, then GME funding restrictions may be a sufficient solution to titrate and redistribute residency positions.

Our specialty must also do a better job of collecting and reporting meaningful employment metrics. Data should be available for each training program so that medical students can make well-informed decisions about where to train and whether an alternative career path is in their best interests. Organizations that expand beyond their ability to secure employment for their graduates should be faced with a market penalty (ie, decreased medical student interest and prestige), which is difficult without full transparency. Currently, it is challenging for residents to transfer programs without a compelling personal rationale. This ensures at least a 5-year lag between the release of employment data and any market penalty. SCAROP and ADROP could further improve the efficiency of the market by committing to assist residents who want to transfer out of training programs that fail to secure favorable employment for graduates.

Lastly, the projected oversupply of radiation oncologists and recent rise in fellowship positions raise concern that ACGME's accreditation standards are too liberal. It is plausible that the existing requirements are insufficient to produce radiation oncologists who are competent to independently treat all disease sites. We suggest that the Radiation Oncology Review Committee of ACGME, in conjunction with ADROP and SCAROP, take a close look at current requirements for program accreditation. Importantly, the re-evaluation of accreditation standards must be undertaken in an intellectually honest fashion without an eye toward restricting supply. Any attempt to use the accreditation system as an end run around antitrust law would be inappropriate and illegal (54).

The projected oversupply of radiation oncologists presents a challenging problem, which has the potential to enrich equipment owners at the expense of both young physicians and society through the misallocation of scarce talent. Training programs will continue to possess a perverse incentive to expand and antitrust law limits our specialty's ability to work collaboratively, but the situation is not hopeless. SCAROP, ADROP, the ACGME, ASTRO, and the Association of Residents in Radiation Oncology can all play a role in perfecting the marketplace for resident talent and ensuring that accreditation standards are appropriate for a rapidly changing specialty with increased reliance on advanced technology. Regardless of who leads the charge and whether change is driven by governmental fiat or improvements in the marketplace, matching supply and

demand and rectifying geographic maldistribution represent smart public policy.

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