Current Landscape of Radiopharmaceutical Therapies: SNMMI Therapy Task Force Survey

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The field of nuclear medicine is undergoing a renaissance with the growth of new PET agents and applications, as well as several novel radiopharmaceutical therapies. Although radiopharmaceutical therapies are a foundational component of nuclear medicine practice and have been successfully applied for decades in the treatment of benign and malignant disorders, recent and pending approvals for new diagnostic and therapeutic radiopharmaceuticals are the source of clear excitement about the future. Many clinical trials are currently underway for treatment of prostate (*1*), *neuroendocrine, and other malignant tumors. Recent prospective data show advantages of radiopharmaceutical therapies over conventional chemotherapy, and early unpublished data from industry support the presence of substantial efficacy of new* ^{177}*Lu prostate cancer therapies* (*2*). This bodes well for the greater growth and development of radiopharmaceutical therapies and for the field of nuclear medicine in general.

The SNMMI Therapy Task Force developed a wide-ranging survey on radiopharmaceutical therapies that was opened to all members of the society. The overarching goal of this survey was to gather information to evaluate the current status of radiopharmaceutical therapies and to identify opportunities to enhance and implement training, education, and operational strategies for the future.

METHODOLOGY

The Task Force developed a comprehensive survey questionnaire with 39 questions related to demographics, types of therapies, current volume (number of patients/year, number of treatment administrations/year), types of specialties administering these therapies, referral patterns, dosimetry, and physician concerns related to several specific therapies. Additional questions about future prospects, perceptions of specialty capabilities and the most appropriate specialist engagement, and radiopharmaceutical therapy nomenclature were included. These questions were designed to inform SNMMI on the current status of the field, gaps in our delivery systems, and opportunities for future initiatives.

The survey was distributed using an email-based tool (SurveyMonkey; SVMK, Inc., San Mateo, CA). The target audience included all active SNMMI members (physicians, scientists, technologists, pharmacists, and others), as well as in-training members and international members. Responses were anonymous, although the membership type of each respondent was known. The survey was launched on August 1, 2020, and was open for responses until August 21, 2020. A reminder email was sent to nonrespondents after 14 days.

RESULTS

Demographics

The survey questionnaire was emailed to 13,140 SNMMI members, and 601 completed responses (4.6% response rate) were received from individuals in 31 countries. Of the 601 responses, 37% (n = 220) were from physicians (4.9% response rate). The results described in this article are based only on these physician responses. Nonphysician responses will be reported separately. Physician respondents could select more than 1 specialty if applicable. About 85% (n = 184) of respondents were nuclear medicine physicians, followed by 25% radiologists (n = 25), 14% radiologists with special competency in nuclear radiology (n = 30), 2% radiation oncologists (n = 5), and 2% trainees (n = 5). The "Other" category included medical oncologists (n = 3) and 1 internist.

A large majority of physicians (69%, n = 143) worked in academic institutions/medical centers, followed by nonuniversity-affiliated hospitals (18%, n = 38), private practice/outpatient settings (3%, n = 7), military clinic/hospitals (2%, n = 4), freestanding imaging facilities (2%, n = 4), and 1 respondent each from a government laboratory and industry. The "Other" category (4%, n = 9) included responses such as hospital-based cancer center, other types of hospitals, and student and unemployed statuses.

About 95% (n = 196) of physician respondents considered themselves to be part of multidisciplinary teams performing radiopharmaceutical therapies. The other 5% planned to start performing these therapies in the next 1–2 years and identified ^{131}I, ^{177}Lu, and ^{223}Ra as their top 3 choices with which to begin.

We received responses from physicians in 27 different countries. The majority were from the United States and its territories, including Puerto Rico (n = 150), followed by Canada (n = 14), India (n = 6), Japan (n = 4), Germany (n = 3), Australia (n = 3), South Africa (n = 3), and Italy, the United Kingdom, and Mexico with 2 each to round off the top 10.

Type and Volume of Radiopharmaceutical Therapies

Survey respondents were asked about the different types and volumes of radiopharmaceutical therapies administered at their institutions, including number of patients/year as well as treatment administrations/year (Table 1). A list of common radiopharmaceutical therapies was provided with the option of adding other therapies. The most common types of radiopharmaceutical therapies performed were with oral ^{131}I, followed by ^{223}Ra, ^{90}Y-microspheres, and ^{177}Lu-DOTATATE. Respondents were provided 5 different ranges of yearly therapy volumes from which to choose. We asked separate questions for numbers of patients/year and numbers

of treatment administrations/year. The responses for these questions were similar, with oral ^{131}I being the highest volume, followed by ^{223}Ra, ^{177}Lu, and ^{90}Y-microspheres.

A limitation in the way in which this set of questions was framed was observed in the many responses in the 0–10/year range. We could not differentiate responses that were 0 (meaning respondents were performing no therapy) from those that were between 1 and 10/year. Resolution of this question could be part of a second, more focused follow-up. However, it can be inferred that for some of the less common therapies (e.g., Zevalin) no cases were performed in the large majority of centers.

Radiopharmaceutical Therapies by Specialties

To identify all the specialties administering radiopharmaceutical therapies, a list was provided to survey respondents. Responses (n = 150) included nuclear medicine with 88% (n = 132), followed by interventional radiology with 30% (n = 45), nuclear radiology with 27% (n = 41), radiation oncology with 19% (n = 28), radiology with 7% (n = 10), and endocrinology with 4% (n = 6) as the top specialties administering radiopharmaceutical therapies at their institutions. Medical oncology, urology, and pediatric oncology were each selected by 1 respondent. We also asked about the percentage breakdown of different radiopharmaceutical therapies by medical specialties at their institutions (Table 2).

Referral Patterns

According to 93% (n = 137) of survey respondents, patient referrals come from a variety of settings. The majority of patient referrals for radiopharmaceutical therapies were internal (from their own institutions), followed by external referrals from physicians working in nonuniversity hospitals (73%, n = 117), physicians from multispecialty offices (62%, n = 92), physicians from private offices (62%, n = 92), and physicians from other university hospitals (53%, n = 79). Other referrals were from patients themselves (20%, n = 30), treating physicians or self-referrals (7%, n = 11), and referrals from insurance companies (7%, n = 10).

Medical specialties most frequently referring patients for radiopharmaceutical therapies included endocrinology (99%, n = 145; i.e., at a given center, 99% reported referrals from endocrinology), followed by medical oncology (86%, n = 126), radiation oncology (54%, n = 79), urology (52%, n = 77), hepatopancreatobiliary surgery (39%, n = 58), ear/nose/throat (32%, n = 47), and others (12%, n = 18; including surgical oncology, internal medicine, interventional radiology, and cardiology).

Dosimetry

When asked whether they perform any dosimetry for radiopharmaceutical therapies administered at their institutions, 54% (n = 79) of physician respondents replied affirmatively and 46% (n = 67) replied that they did not. However, about 71% (n = 50) of those not performing dosimetry were either considering or planning to do so. Lack of necessary physics support, dosimetry not proven useful, lack of tools to perform dosimetry, lack of access to quantitative SPECT/CT, and lack of training were selected as top reasons by those who did not plan to perform dosimetry. Table 3 shows the percentages of patients in whom dosimetry is performed for specific radiopharmaceutical therapies.

We also asked about the type of dosimetry performed. For those respondents who selected organ dosimetry for safety, the most common organs listed were lung, liver, kidney, bone marrow, and thyroid (Table 4).

Physician Concerns: Administration of Radiopharmaceutical Therapies

Survey respondents were provided with a list of top concerns or issues they might encounter or perceive to be impediments to the growth of radiopharmaceutical therapies. Respondents were prompted to pick up to 3 concerns or issues, even if they were not currently administering these therapies. As expected, the top concerns for some newer therapies (e.g., radiopharmaceutical therapy for joints and prostate radiopharmaceutical therapy) were that respondents did not have sufficient information or were not adequately trained to perform the procedure.

However, for some of the other therapies that were U.S. Food and Drug Administration (FDA)–approved not long ago, like ^{223}Ra (Xofigo) and ^{177}Lu-DOTATATE (Lutathera), the top concern was that the treatment is "too expensive." The same was true for other therapies, including ^{131}I-meta-iodobenzylguanidine (^{131}I-MIBG; Azedra or generic), ^{90}Y- radioimmunotherapy (Zevalin), and ^{90}Y-microspheres (SIRSpheres and TheraSpheres). Also of note, for therapies like oral ^{131}I (>33 mCi), oral ^{131}I (≦33 mCi), and ^{131}I-MIBG, respondents had concerns about radiation safety. The top 3 concerns/issues for each radiopharmaceutical therapy are listed online in Supplemental Table 1.

Future of Radiopharmaceutical Therapies

This survey had questions about SNMMI member perceptions of the future of radiopharmaceutical therapies. Respondents were asked about the future volume of radiopharmaceutical therapies (increase or decrease), and about 93% (n = 129) believed it would definitely or probably increase, whereas about 4% (n = 5) each were either uncertain or thought it would not increase.

Another question asked whether radiopharmaceutical therapy administration should be limited to nuclear medicine physicians, and 73% (n = 102) of respondents believed that it should, whereas 17% (n = 23) reported that it should not be limited to any single specialty. About 10% (n = 14) picked the "Other" option, with varied responses that included restricting radiopharmaceutical therapies to American Board of Nuclear Medicine–certified physicians (nuclear medicine physicians and nuclear radiologists), opening administration up to qualified radiologist and radiation oncologists, and the need to train true "nuclear oncologists."

Respondents were also asked whether radiation oncologists were more qualified than nuclear medicine physicians to administer these therapies. About 93% (n = 129)

TABLE 1

Percentages of Respondents Reporting Numbers of Patients and Types of Radiopharmaceutical Therapies Performed at Their Institutions

	No. patients per year (respondents, total 143)						No. treatment administrations per year (respondents, total 140)					
Procedure	0–10	11–20	21–30	31–40	>40	Total*	0–10	11–20	21–30	31—40	>40	Total*
Oral ^{131}I (≦33 mCi)	18% (26)	22% (32)	18% (26)	8% (11)	34% (49)	144	17% (23)	20% (27)	20% (27)	9% (12)	36% (49)	138
Oral ^{131}I (>33 mCi)	18% (24)	15% (21)	15% (21)	9% (13)	42% (58)	137	17% (23)	14% (19)	14% (19)	10% (13)	44% (58)	132
^{223}Ra (Xofigo)	48% (50)	25% (26)	10% (10)	5% (5)	13% (14)	105	38% (39)	13% (13)	12% (12)	11% (11)	26% (27)	102
^{177}Lu-DOTATATE (Lutathera)	34% (29)	16% (14)	15% (13)	3% (3)	31% (27)	86	29% (24)	12% (10)	7% (6)	10% (8)	42% (35)	83
^{90}Y-microspheres (SIRSpheres	46% (39)	13% (11)	14% (12)	12% (10)	15% (13)	85	43% (37)	14% (12)	13% (11)	13% (11)	17% (15)	86
^{90}Y-microspheres (TheraSpheres)	33% (24)	18% (13)	15% (11)	12% (9)	23% (16)	73	35% (25)	15% (11)	15% (11)	10% (7)	24% (17)	71
^{153}Sm-EDTMP (Quadramet)	93% (67)	3% (2)	0%	0%	4% (3)	72	95% (69)	1% (1)	1% (1)	0%	3% (2)	73
^{89}Sr (Metastron)	95% (57)	0%	2% (1)	0%	3% (2)	60	93% (56)	2% (1)	2% (1)	0%	3% (2)	60
^{90}Y anti-CD 20 (Zevalin)	98% (58)	0%	0.00%	0%	2% (1)	59	96% (55)	2% (1)	0%	0%	1% (1)	57
Prostate radionuclide therapy	59% (33)	16% (9)	11% (6)	2% (1)	13% (7)	56	56% (35)	14% (9)	6% (4)	8% (5)	16% (10)	63
^{131}I-MIBG (Azedra or generic)	81% (44)	13% (7)	4% (2)	0%	2% (1)	54	80% (48)	13% (8)	2% (1)	3% (2)	2% (1)	60
Radionuclide therapy for joints	93% (41)	0%	2% (1)	0%	5% (2)	44	90% (46)	4% 2)	0%	0%	6% (3)	51
Others**	83% (24)	7% (2)	0%	0%	10% (3)	29	85% (29)	3% (1)	3% (1)	0%	9% (3)	34

*Total survey respondents for each survey item.

**Including ^{177}Lu-EDTMP, ^{131}I-anti CD45 in leukemia, ^{225}Ra-PSMA/DOTATATE, ^{186}Re-labeled nanoliposomes for glioblastoma, and ^{90}Y-radiosynoviorthesis.

TABLE 2
Percentages of Respondents Reporting Types of Therapy Performed by Specialties at Their Institutions (Respondents, total 139)

Specialty/radiopharmaceutical therapy (total no. of respondents re: each therapy)	<25% (*n*)	25%–50% (*n*)	50%–75% (*n*)	75%–100% (*n*)
Nuclear medicine				
Oral ^{131}I (≦33 mCi) (117)	3% (3)	5% (6)	4% (5)	88% (103)
Oral ^{131}I (>33 mCi) (110)	3% (3)	6% (7)	3% (3)	88% (97)
^{223}Ra (Xofigo) (71)	1% (1)	7% (5)	1% (1)	91% (64)
^{177}Lu-DOTATATE (Lutathera) (61)	3% (2)	5% (3)	0%	92% (56)
^{153}Sm-EDTMP (Quadramet) (51)	6% (3)	2% (1)	0%	92% (47)
^{90}Y-microspheres (SIRSpheres) (43)	12% (5)	12% (5)	0%	76% (33)
^{89}Sr (Metastron) (38)	3% (1)	0% (0)	0%	97% (37)
^{90}Y anti-CD 20 (Zevalin) (36)	3% (1)	6% (2)	0%	91% (33)
Prostate radionuclide therapy (35)	6% (2)	3% (1)	0%	91% (32)
^{131}I-MIBG (Azedra or generic) (30)	0% (0)	0%	0%	100% (30)
Radionuclide therapy for joints (18)	6% (1)	0%	0%	94% (17)
Others (11)	0%	0%	0%	100% (11)
Radiology/nuclear radiology				
^{90}Y-microspheres (SIRSpheres) (50)	2% (1)	8% (4)	0%	90% (45)
Oral ^{131}I (≦33 mCi) (28)	11% (3)	18% (5)	0%	71% (20)
Oral ^{131}I (>33 mCi)) (23)	13% (3)	17% (4)	0%	70% (16)
^{223}Ra (Xofigo) (16)	6% (1)	19% (3)	0%	75% (12)
^{177}Lu-DOTATATE (Lutathera) (13)	0% (0)	15% (2)	0%	85% (11)
^{90}Y anti-CD 20 (Zevalin) (12)	8% (1)	17% (2)	0%	75% (9)
^{153}Sm-EDTMP (Quadramet) (10)	10% (1)	10% (1)	0%	80% (8)
Prostate radionuclide therapy (7)	0%	0%	0%	100% (7)
^{89}Sr (Metastron) (6)	17% (1)	0%	0%	83% (5)
^{131}I-MIBG (Azedra or generic) (5)	0%	0%	0%	100% (5)
Radionuclide therapy for joints (1)	0%	0%	0%	100% (1)
Others (2)	0%	0%	0%	100% (2)
Radiation oncology				
^{223}Ra (Xofigo (16))	0%	25% (4)	6% (1)	69% (11)
Oral ^{131}I (>33 mCi) (5)	0%	0%	0%	100% (5)
Oral ^{131}I (≦33 mCi) (2)	50% (1)	0%	0%	50% (1)
^{90}Y anti-CD 20 (Zevalin) (4)	0%	0%	0%	100% (4)
^{90}Y-microspheres (SIRSpheres) (3)	0%	33% (1)	0%	67% (2)
^{177}Lu-DOTATATE (Lutathera) (3)	33% (1)	33% (1)	0%	33% (1)
Prostate radionuclide therapy (2)	0%	0%	0%	100% (2)
^{131}I-MIBG (Azedra or generic) (2)	50% (1)	0%	0%	50% (1)
Others (1)	0%	0%	0%	100% (1)
Endocrinology				
Oral ^{131}I (≦33 mCi) (7)	29% (2)	0%	42% (3)	29% (2)
Oral ^{131}I (>33 mCi) (6)	17% (1)	0%	50% (3)	33% (2)
^{223}Ra (Xofigo) (1)	0%	0%	0%	100% (1)
^{90}Y-microspheres (SIRSpheres) (1)	0%	0%	0%	100% (1)
^{177}Lu-DOTATATE (Lutathera) (1)	0%	0%	0%	100% (1)
^{131}I-MIBG (Azedra or generic) (1)	0%	0%	0%	100% (1)

disagreed, whereas 7% ($n = 10$) responded that this was either true or was dependent on the individual radiation oncologist. Two respondents mentioned that radiation oncologists have regular clinics and may be well suited to patient evaluation and follow up.

Finally, survey respondents were asked about the lack of uniformity in nomenclature for radiopharmaceutical therapies. Although these therapies have long been a part of nuclear medicine, several names may be used to describe them as a group. A list of the most commonly used names was provided, and respondents were asked to pick the top 3. Most respondents (52%, $n = 72$) picked "radionuclide therapy" as their first choice, followed by "targeted radionuclide therapy" (42%, $n = 58$), "theranostics" (34%, $n = 47$), "targeted radiopharmaceutical therapy" (31%, $n = 43$), and "radiopharmaceutical therapy" (29%, $n = 40$).

Limitations

Online or email-based web surveys are an efficient and attractive means of data collection; however, they are not without methodologic challenges. Responses are based on self-selection, and certain groups in the target audience may be underrepresented. There is also the possibility of nonresponse bias; for example, physicians who are either performing radiopharmaceutical therapies now or are planning to start in the near future may be more likely to respond to this type of survey than those who are not. The overwhelming majority of this survey's physician respondents were nuclear medicine physicians, mainly working in the academic setting, which may have skewed the results but is reflective of the SNMMI physician membership.

Because of the brevity of the survey, more detailed follow-up questions on important topics, such as dosimetry, could not

TABLE 3
Percentages of Respondents Reporting Dosimetry for Specific Radiopharmaceutical Therapies at Their Institutions

Radiopharmaceutical therapy (total no. of respondents re: each therapy)	<25% (*n*)	25%–50% (*n*)	50%–75% (*n*)	75%–100% (*n*)
Oral ^{131}I (>33 mCi) (73)	56% (41)	12% (9)	5% (4)	26% (19)
Oral ^{131}I (≦33 mCi) (64)	63% (40)	3% (2)	3% (2)	31% (20)
^{223}Ra (Xofigo) (44)	84% (37)	0%	2% (1)	14% (6)
^{90}Y-microspheres (SIRSpheres) (43)	28% (12)	7% (3)	2% (1)	63% (27)
^{177}Lu-DOTATATE (Lutathera) (41)	68% (28)	5% (2)	0%	27% (11)
^{90}Y-microspheres (TheraSpheres) (39)	33% (13)	3% (1)	0%	64% (25)
^{131}I-MIBG (Azedra or generic) (29)	45% (13)	3% (1)	0%	52% (15)
^{90}Y anti-CD 20 (Zevalin) (28)	86% (24)	0%	0%	14% (4)
^{153}Sm-EDTMP (Quadramet (27)	81% (22)	0%	0%	19% (5)
Prostate radionuclide therapy (23)	57% (13)	13% (3)	0%	30% (7)
^{89}Sr (Metastron) (20)	80% (16)	0%	0%	20% (4)
Radionuclide therapy for joints (17)	82% (14)	0%	0%	18% (3)
Others (11)	45% (5)	0%	0%	55% (6)

be included. Another limitation was that for some questions, respondents were not provided dropdown lists of options.

DISCUSSION

The SNMMI Therapy Task Force was formed with representatives from various entities within SNMMI, with the mandate of ensuring that SNMMI will serve as the leader in implementation of high-quality radiopharmaceutical therapies to our patients as an important part of personalized patient care. A therapy strategic plan was developed by the Task Force with sections focusing on adequate reimbursement of radiopharmaceutical therapies, developing processes and quality standards for performing dosimetry, and standardizing therapies by providing appropriate training and education.

We were able to collect substantial baseline information about the types and volumes of therapies currently being performed, their referral patterns, and information about specialties performing these therapies. However, additional focused follow-up surveys are needed to collect more specific information related to these topics.

For example, under nuclear medicine in Table 2, ^{223}Ra is mentioned as the third most performed therapy by percentage. More than 91% of respondents stated that at their institutions nuclear medicine performs 75%–100% of these therapies. At the same time, under radiation oncology, ^{223}Ra was mentioned as the number 1 therapy by percentage with more than 69% stating that radiation oncology performs 75%–100% of these therapies at their institutions. However, recent research by Morgan et al. (*3*) on the pharmacoeconomics of ^{223}Ra indicates that radiation oncology is the number 1 specialty being reimbursed for ^{223}Ra by the Centers for Medicare and Medicaid Services (*4*). Because the number of responses varied from question to question on ^{223}Ra and other therapies, it is likely that some of the answers were preferentially provided by those already offering these therapies. It is perhaps not surprising that a great majority of nuclear medicine physicians reported that they were the most qualified to administer radiopharmaceutical therapies. This seems reasonable given the complexity of the imaging and therapy decision-making processes involved. However, there is clearly great interest by other specialties—notably, "teams" of physician providers were identified as the norm for radiopharmaceutical therapy by most surveyed.

TABLE 4
Percentages of Respondents Reporting Dosimetry at Their Institutions

Radiopharmaceutical therapy (total no. of responses re: each therapy)	Organ dosimetry for safety (*n*)	Tumor dosimetry for efficacy (*n*)	Other (*n*)	No dosimetry (*n*)
Oral ^{131}I (>33 mCi) (67)	57% (38)	27% (18)	4% (3)	25% (17)
Oral ^{131}I (≦33 mCi) (63)	22% (14)	27% (17)	2% (1)	57% (36)
^{223}Ra (Xofigo) (49)	6% (3)	10% (5)	2% (1)	84% (41)
^{90}Y-microspheres (SIRSpheres) (47)	70% (33)	51% (24)	2% (1)	23% (11)
^{177}Lu-DOTATATE (Lutathera) (42)	36% (15)	29% (12)	7% (3)	55% (23)
^{90}Y-microspheres (TheraSpheres) (41)	66% (27)	46% (19)	2% (1)	24% (10)
^{153}Sm-EDTMP (Quadramet) (34)	9% (3)	9% (3)	0%	88% (15)
Prostate radionuclide therapy (33)	27% (9)	18% (6)	3% (1)	67% (22)
^{90}Y anti-CD 20 (Zevalin) (32)	9% (3)	6% (2)	0%	87% (28)
^{131}I-MIBG (Azedra) (28)	46% (13)	14% (4)	0%	54% (15)
^{131}I-MIBG (generic) (28)	18% (5)	18% (5)	0%	75% (21)
^{89}Sr (Metastron) (28)	14% (4)	4% (1)	0%	86% (24)
Radionuclide therapy for joints (24)	12% (3)	8% (2)	0%	83% (20)
Others (20)	20% (4)	10% (2)	5% (1)	75% (15)

The appropriate nomenclature for the field was a survey element of interest. "Radiopharmaceutical therapy" was the most popular of the names assessed, but others were also popular, including "theranostics," "targeted radiopharmaceutical therapy," and "radiopharmaceutical therapy." Agreement on a consistent nomenclature is important for the field. Names such as "molecular radiotherapy" and "molecular-targeted radiopharmaceutical therapy" were viewed with less enthusiasm than the simpler and more traditional "radionuclide therapy" and "radiopharmaceutical therapy." We suggest the use of "radiopharmaceutical therapy," abbreviated as RPT, as a useful term, because it clearly indicates that our therapeutic radioactive agents are pharmaceuticals and because it distinguishes the systemic internal administration of radioactivity from external-beam radiation therapy. Some respondents emphasized that RPT is not simply another form of radiation therapy. This confusion could occur by using terms like targeted radionuclide therapy or molecular-targeted radionuclide therapy, for example. Others noted that "theranostics," while an attractive term linking our diagnostic and therapeutic efforts, is not sufficiently focused on radiopharmaceutical therapies to be a clear terminology for this evolving field.

This survey also highlighted certain areas that require additional education and training to dispel any potential negative perceptions about the utilization of radiopharmaceutical therapies. For example, many physician respondents reported that recently approved novel therapies, such as ^{223}Ra and ^{177}Lu-DOTATATE, are "too expensive." Many types of newer cancer therapies, notably cellular therapies, can cost hundreds of thousands of dollars, so that "too expensive" may be a relative term for RPTs. That said, if many nuclear medicine physicians believe our treatments to be too expensive and that professional reimbursement is poor, it may be difficult to drive the use of these treatments forward, at least by nuclear medicine physicians. The SNMMI Therapy Task Force should consider funding pharmacoeconomic analyses of utilization of these therapies, specifically with head-to-head comparisons with other recent FDA-approved therapies. Similar efforts should be made to develop refresher educational primers on radiation safety, raised as another concern for radiopharmaceutical therapies. Additional concerns highlighted the need for more training in RPT.

This survey complements and builds upon data from a 2017 European Association of Nuclear Medicine survey that focused on dosimetry (*5*). As in that survey, we found dosimetry was most commonly used in ^{90}Y-microsphere procedures. Consistent with the European data, our responses indicated that most radiopharmaceutical therapies are performed using a fixed dose of radioactivity; thus, although dosimetry is emerging in importance, it is not yet routine in deployment.

We acquired substantial baseline information in this survey, but, given the rapidity of change in the field, additional focused follow-up surveys are needed to guide SNMMI Therapy Task Force activities. Future topics may include questions related to training of residents, fellows, and the current workforce, as well as interest in participating in the Radiopharmaceutical Therapy Registry currently under development and in proposed Therapy Center of Excellence programs. Additional questions about coding and reimbursement as well as dosimetry would be helpful. It is expected that surveys regarding RPT will be conducted regularly in the coming years to help inform and guide growth in this important area of nuclear medicine.

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