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Information Statement

The Current Distribution of MSTS Members in the United States

Summary Statement

In the 40 years since the establishment of the Musculoskeletal Tumor Society (MSTS), the membership has grown from the 17 founders in 1977, to over 100 orthopaedic oncologists in 2000, to over 200 in 2017. Each year, an average of 12-13 musculoskeletal oncology fellows are trained and enter practice, outnumbering the number of physicians retiring. We found geographic variability in the distribution of orthopaedic oncologists in the US, raising the question whether some parts of the country are adequately served. In addition, the minimal number of oncologic procedures surgeons must perform annually to maintain an adequate skill level and provide optimal care remains unknown. This may be relevant in regions where there are a relatively high number of orthopaedic oncologists or in small population centers where rare pathology is encountered infrequently. This information statement is a snapshot of the current distribution of MSTS members in the United States. Finally, in order to continue gathering accurate information in the future, the Evidence Based Medicine Committee encourages all active MSTS members to ensure that their information in the MSTS website is current and accurate.

Statement of Clinical Concern

The American Cancer Society estimates nearly 1.7 million new cancer diagnoses in the US in 2017, resulting in 600,000 deaths. Sarcoma is a rare malignancy affecting both children and adults, understood to represent 1% of all cancer, or over 15,000 new diagnoses in the US annually. Orthopaedic oncologists are recognized to serve a critical function in treating extremity sarcoma, but the responsibility of the specialty extends to benign tumors of bone and soft tissue, complex infections and other conditions requiring skeletal reconstruction, and metastatic disease of bone. The last category, metastatic disease of bone, is likely to play a larger role in the specialty in the future. With the improvement of systemic therapies, patients with disseminated carcinoma, multiple myeloma, and lymphoma are living longer. As a result, skeletal stabilizations, often performed by orthopaedic surgeons without formal oncology training, that were once definitive and durable may no longer be. Orthopaedic oncologists have a substantial responsibility to the public to ensure these patients are managed appropriately, and procedures are performed to maximize function and quality-of-life, while minimizing pain, recovery time, complications, and repeat surgical intervention.

As of October 2017, there are 203 active and candidate orthopaedic surgeon members of the MSTS residing in the United States. The 2010 US census estimated a population of 323 million individuals in 2016, or an average of approximately 1 orthopaedic oncologist per every 1.6

million people, with substantial regional variation. Information on the current distribution of orthopaedic oncologists may be of particular interest for residents considering orthopaedic oncology as a career, recently trained tumor fellows, fellowship directors, practitioners interested in changing practices, policy makers, and hospital systems considering expansion of clinical capabilities.

The objective of this information statement is to display a brief and general overview of geographical distribution of the current members of the MSTS in relation to the population density of the United States. This information may be helpful in identifying areas that are either overrepresented or underserved.

Background and Literature Review

The relationship between procedural volume and outcomes is a topic of increasing interest in surgical specialties, and to all stakeholders involved in oncologic care. Within orthopaedics, it has been shown that surgeons with higher caseloads demonstrate lower mortality and fewer complication rates in total ankle arthroplasty, total hip replacement, and total knee replacement.[1-3] To date, it is unclear whether tumor surgery would show the same correlation. From one perspective, it is possible that regionalization at higher volume centers, or with higher volume surgeons, could result in better outcomes for patients. Ultimately, providing complete musculoskeletal oncology care requires more than just an orthopaedic oncologist, and smaller centers may have difficulty providing access to novel clinical trials and expertise in medical oncology, radiation oncology, musculoskeletal radiology, and musculoskeletal pathology. Alternatively, it may be that increasing access to orthopaedic oncologists in smaller communities and health systems could result in more positive outcomes by expediting referrals, enhancing local awareness of musculoskeletal neoplasia, and diminishing the travel and financial burden of seeking subspecialty care.

Orthopaedic residents are increasingly pursuing fellowship training. In 2013, nearly 90% (a 15% increase from the 2003) of trainees planned to pursue fellowship training, and an increasing number of those trainees planned to pursue two fellowships.[4] Orthopaedic surgery had the highest percentage of trainees pursuing fellowship training among the major surgery specialties.[5] Due to changes in postgraduate training, increasing subspecialization, and a constantly expanding lexicon of knowledge, it has been suggested that fellowship training has become almost mandatory for surgeons to be adequately prepared for the current job market.[5]

Data from the American Board of Orthopaedic Surgery (ABOS) Part II Database demonstrated that 78% of procedures performed by fellowship trained surgeons were within their area of specialization.[6] A survey of MSTS members in 2009 estimated that 71% of their practice was within their field of musculoskeletal oncology.[7] On a subsequent investigation using self-reported case logs, this number was found to be much lower for recently trained fellows, who reported fewer than 60% of their procedures within the subspecialty. These trainees also reported a large range in the number of procedures performed both overall and within orthopaedic oncology.[8] An exploration of the ABOS Part II Database specifically for orthopaedic oncology fellows demonstrated that only one third of recently trained tumor fellows performed more than 50% of their procedures within the field, and the proportion of tumor procedures performed

decreased from 45% in 2004 to 36% 2013.[9] Other disciplines within orthopaedics have found that increased training of a specialty workforce may result in fewer employment opportunities for fellowship graduates. Specialized trauma surgeons have seen an increase in the number of trained fellows, which has resulted in concern for job availability.[10] A recent survey of early career pediatric orthopaedic surgeons showed that the majority of graduates are entering jobs that have been created, rather than replacing a retiring physician.[11] It is important to note that within orthopaedics each subspecialty has specific considerations that influence relationships between physician supply and demand. Given the rarity of primary musculoskeletal tumors, orthopaedic oncology has unique characteristics that must be considered when assessing access to care, institutional resources, and anticipated surgical volume.

Current Distribution of MSTS members

On October 6th, 2017, the MSTS website (www.msts.org) was used to identify orthopaedic surgeon MSTS members with a reported practice within the United States. The website allows for search by state, and the resulting information displays member status (active or candidate) and the office location. There are clearly flaws to this methodology, most notably that the database contains self-reported data without confirmation or a defined protocol of routine updating or quality control. Specifically, there are no mechanisms to reliably identify practitioners who have changed office locations and is therefore dependent on MSTS members supplying current information, and MSTS administrative staff updating the website. In the course of writing this statement, we became aware of several inconsistencies between practice locations in reality and as listed in the database. Unfortunately, this is the most accurate method we have to estimate practice locations, and we hope that publication of these statistics will stimulate practitioners to confirm the accuracy of their personal information and update it if incorrect. This should ensure increasing accuracy as this exercise is repeated over time. In addition, this is not an exhaustive database of all sarcoma surgeons, and our data are limited to orthopaedic oncologists who are MSTS members. Any details about each individual's practice, specifically the number or proportion of musculoskeletal oncology patients, are unknown. Further, listing surgeons by state rather than by metropolitan area may not reflect the true population that is served. Therefore, conclusions should be drawn with care. However, we believe these data may be informative despite the limitations, and this brief report could be used to track future changes and inform discussions regarding the subspecialty workforce.

There are currently 203 active or candidate members of the MSTS living in the United States serving an estimated population of 323 million individuals. There are currently 9 states without a MSTS member listed in the MSTS database: Alaska, Delaware, Hawaii, Maine, Montana, New Hampshire, North Dakota, South Dakota, and Wyoming. Conversely, California, Florida, New York, Texas, and Washington have 10 or more members. In general, the distribution of members follows the population density of the United States (Table 1).

Table 1. State Populations and Surgeon Density

State	Population	# Surgeons	Population/Surgeon
District of Columbia	681,170	2	340,585
Connecticut	3,576,452	6	596,075
Vermont	624,594	1	624,594
Minnesota	5,519,952	8	689,994

Washington	7,288,000	10	728,800
Oregon	4,093,465	5	818,693
West Virginia	1,831,102	2	915,551
Nebraska	1,907,116	2	953,558
Maryland	6,016,447	6	1,002,741
Utah	3,051,217	3	1,017,072
New Mexico	2,081,015	2	1,040,508
Rhode Island	1,056,426	1	1,056,426
Colorado	5,540,545	5	1,108,109
Wisconsin	5,778,708	5	1,155,742
South Carolina	4,961,119	4	1,240,280
New York	19,745,289	15	1,316,353
Tennessee	6,651,194	5	1,330,239
Massachusetts	6,811,779	5	1,362,356
Arizona	6,931,071	5	1,386,214
Ohio	11,614,373	8	1,451,797
Kansas	2,907,289	2	1,453,645
Arkansas	2,988,248	2	1,494,124
Missouri	6,093,000	4	1,523,250
Texas	27,862,596	18	1,547,922
Iowa	3,134,693	2	1,567,347
Alabama	4,863,300	3	1,621,100
Michigan	9,928,300	6	1,654,717
Indiana	6,633,053	4	1,658,263
Idaho	1,683,140	1	1,683,140
North Carolina	10,146,788	6	1,691,131
New Jersey	8,944,469	5	1,788,894
Pennsylvania	12,784,227	7	1,826,318
Florida	20,612,439	10	2,061,244
Georgia	10,310,371	5	2,062,074
Illinois	12,801,539	6	2,133,590
California	39,250,017	15	2,616,668
Nevada	2,940,058	1	2,940,058
Mississippi	2,988,726	1	2,988,726
Oklahoma	3,923,561	1	3,923,561
Virginia	8,411,808	2	4,205,904
Kentucky	4,436,974	1	4,436,974
Louisiana	4,681,666	1	4,681,666
Alaska	741,894	0	0
Delaware	952,065	0	0
Hawaii	1,428,557	0	0
Maine	1,331,479	0	0
Montana	1,042,520	0	0
New Hampshire	1,334,795	0	0
North Dakota	757,952	0	0
South Dakota	865,454	0	0
Wyoming	585,501	0	0

United States	**323,127,513**	**203**	**1,591,761**

In addition to the state population information, a map of the U.S. with county level population density per the 2010 U.S. census and the current location of MSTS active and candidate members can assist in visualizing areas where there are high and low densities of surgeons (Figure 1). The eastern half of the country has a higher density of surgeons and citizens, many clustered in the heavily populated northeast, while the western half of the county has far fewer surgeons and are separated by greater geographical distances. There are several regions that do not have MSTS members in close proximity, most apparently the northern great plains of Montana, Wyoming, North Dakota, and South Dakota. Conversely, there are some metropolitan areas that have a very high density of surgeons like Seattle, Washington D.C., and Boston. Although the ideal distribution of and access to orthopaedic oncologists is undefined, it is clear that there is a great deal of variation across the United States and is primarily influenced by population density.

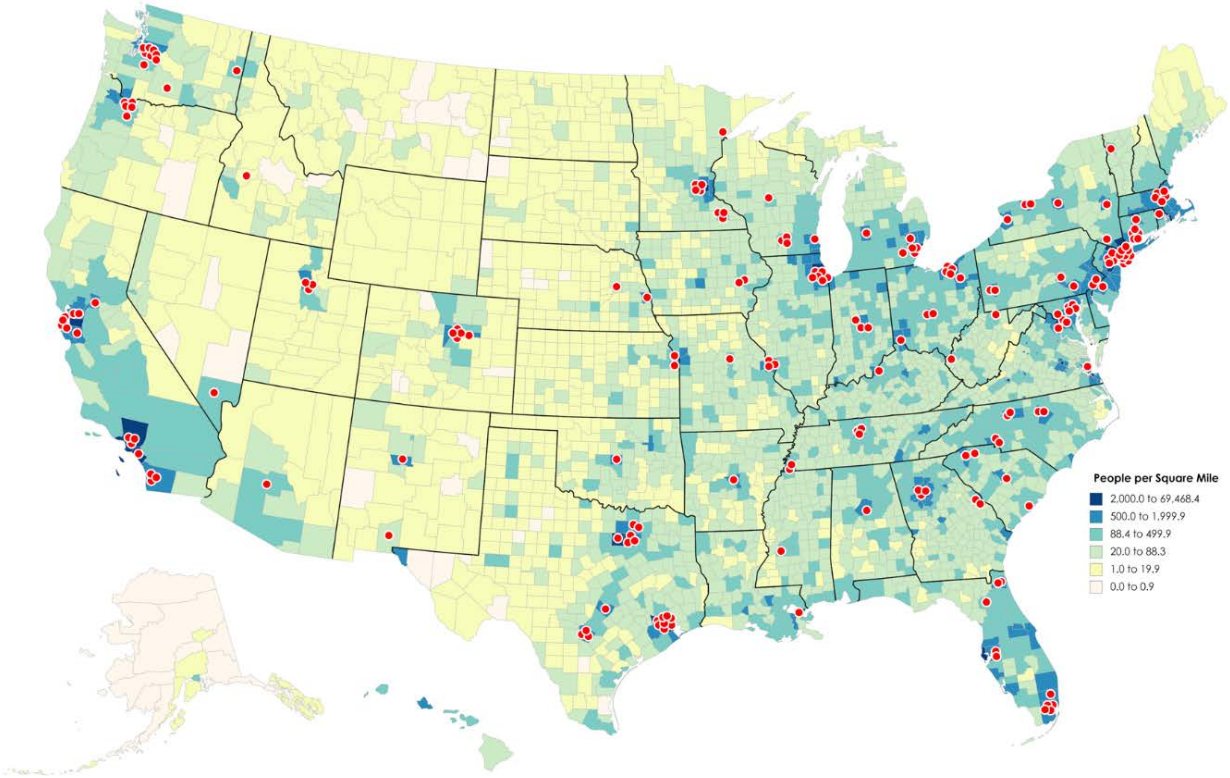

Figure 1. Location of MSTS Active and Candidate Members

Proposed Intervention or Management

The information presented may be helpful in identifying areas of the country where access to trained tumor surgeons can be improved and where the need is not as apparent. The distribution of surgeons does generally follow population density, and many of the more rural states and geographical areas have few MSTS members within a reasonable distance. Although the population may be too limited to support an orthopaedic oncologist, these may be targets for

modern interventions such as electronic imaging review and telemedicine to recognize and triage patients in need of a higher level of care. Per capita numbers and distribution may be of particular interest for recently trained tumor fellows, who typically report a lower percentage of oncology cases early in their practice, so they may be aware of regional need and coverage when evaluating an employment opportunity. Further research regarding access to care and the role of individual and institutional volume on oncologic and functional outcomes is needed to make any definitive conclusions regarding the current adequacy and optimal density of orthopaedic oncologists. Finally, the MSTS is currently working to create a society-wide tumor registry. Universal participation in this effort will also improve estimates of patient need and appropriate resource allocation, which should result in improved access, quality, and treatment outcomes.

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