Geospatial mapping and characterization of head and neck cancer research

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ABSTRACT

Objective: To report geographic distribution and characteristics of head and neck cancer clinical trials in the United States.

Methods: ClinicalTrials.gov was used to search for head and neck cancer clinical trials from 1/1/2017 to 12/31/2021 using search terms “head and neck cancer” or “head and neck neoplasms.” Data were analyzed using descriptive statistics and ArcGIS mapping software.

Results: 381 clinical trials met inclusion criteria, with 2,181 active trial opportunities. Trial opportunities were correlated with population density, with 72% of the United States population within a 25-mile radius of clinical trials. 165 (43.3%) clinical trials were about systemic therapy outcomes, of which 138 (83.6%) involved immunotherapy/targeted therapies. The remaining clinical trial topics included 36 (9.4%) radiation, 25 (6.6%) surgery, 3 (0.8%) unconventional treatment modalities, 58 (15.2%) treatment side effects, 23 (6.0%) HPV-related, 18 (4.7%) imaging, 17 (4.5%) patient wellbeing, 9 (2.4%) patient navigation, 6 (1.6%) cancer biology, 5 (1.3%) cancer prevention, 2 (0.5%) cancer detection, and 14 (3.7%) others. Principal investigator specialty was 125 (32.8%) medical oncology, 78 (20.5%) otolaryngology, 76 (19.9%) radiation oncology, 10 (2.6%) speech/communication science, 9 (2.4%) oncology nursing, 7 (1.8%) radiology, 7 (1.8%) behavioral science, 6 (1.6%) surgical pathology, 42 (11.0%) others, and 21 (5.5%) unknown. The sponsor institutions included 296 (77.7%) academic/research, 155 (40.7%) industry, 80 (21.0%) National Institutes of Health, and 7 (1.8%) United States Federal Government.

Conclusion: Our study demonstrates disparity in geographic distribution of head and neck cancer trials favoring densely populated urban areas, which may create selection bias among recruited participants. Additionally, concentration of active trial opportunities may result in travel burden, limiting patient access to clinical trials. Studies are heavily skewed towards immunotherapy/targeted drug trials, with fewer radiation and surgery investigations. Females and surgeons are underrepresented as study PIs.

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INTRODUCTION

- Head and neck cancers (HNC) were the 7th most common cancer in 2018 and were responsible for 890,000 new cases and 450,000 deaths
- Prior studies only analyzed clinical trials until 2017; did not analyze the following factors: clinical trial geographic distribution, non-treatment related trials, and potential bias introduced by principal investigator (PI) characteristics
- Objective was to characterize current United States (U.S.) clinical trials in head and neck cancer including geographic distribution, research topics, specialty involvement, PI demographics, and funding to highlight gaps in knowledge and areas for future investigation

METHODS AND MATERIALS

- ClinicalTrials.gov was searched on 3/10/2022 for HNC clinical trials performed in the United States from 1/1/2017-12/31/2021 using the terms “head and neck cancer” or “head and neck neoplasms
- Maps were created using ArcGIS software. Each clinical trial may have one or more geographic sites, all of which were all included
- A radius of 25 miles was used as a previously reported mean travel distance to demonstrate population access to clinical trials.

RESULTS

- The search yielded 538 trials, of which 381 met inclusion criteria. 2,181 active trial opportunities across the U.S. (Figure 1).
- Most trial opportunities were in the Midwest (671, 30.8%) followed by the South (633, 29.0%), Northeast (452, 20.7%) and West (426, 19.5%)
- Trial opportunities were correlated with population density, with 72% of the U.S. total population within a 25-mile radius of clinical trials
- The following treatment modalities were the most common: Systemic therapy (n = 165), radiation (n = 36), surgery (n = 25) and unconventional
- Trial funding sources are as follows: Academic & research institutions (n = 296), industry (n = 155), National Institute of Health (n = 80), United States Federal Government (n = 7)
- Overall, 180 PIs were men and 106 were women
- Primary investigator specialty was as follows: Medical oncology (n = 125), otolaryngology (n = 78) and radiation oncology (n = 76)

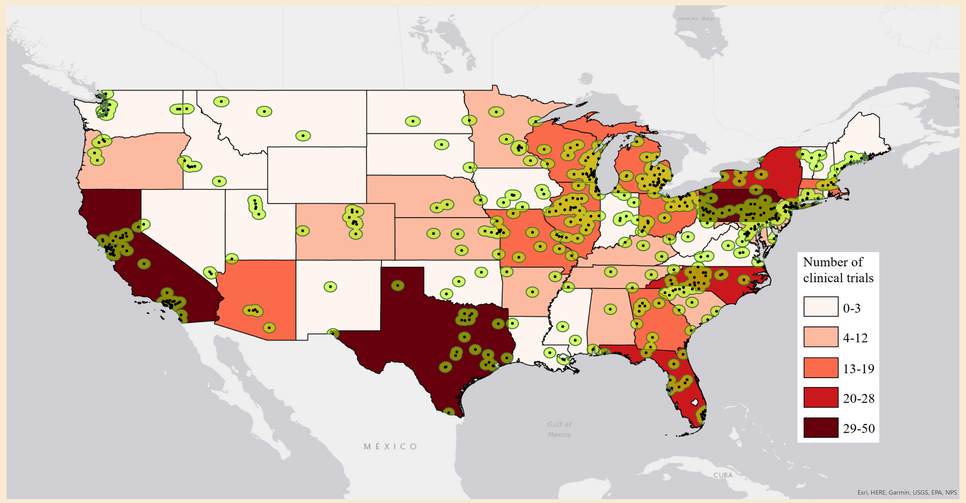

Figure 1. Geographic distribution of head and neck cancer clinical trials (N = 2,181 active trial opportunities represented by black dots). States colored by number of clinical trials (see figure legend). A radius of 25 miles was used for green buffer zones to represent average travel distance to clinical trials.

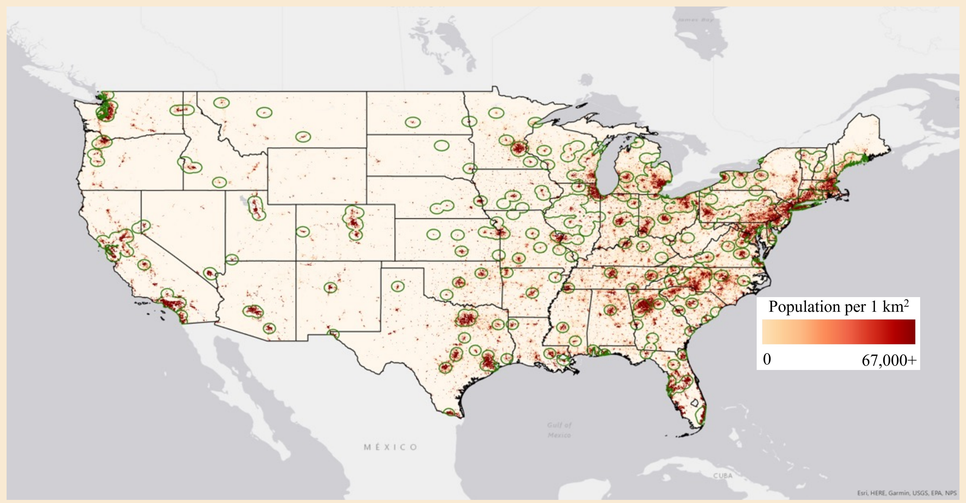

Figure 2. United States total population map (see figure legend) overlaid with head and neck cancer clinical trials (N = 2,181 active trial opportunities). A radius of 25 miles was used for green buffer zones to represent average travel distance to clinical trials (N = 246,212,195 people within buffer zones). Figure 2 includes the same trial opportunities as Figure 1 without black dots and shading of travel buffer zones to better demonstrate population density. The reader may use the figures side by side to aid in clarity.

DISCUSSION

- HNC clinical trials in the U.S. are concentrated in urban academic medical centers in California, Pennsylvania, and New York
- HNC clinical trial concentration may disproportionately recruit wealthy, urban patients creating biased results that may not be generalizable to other populations
- Clinical trial investigations in the last 5 years have pivoted from traditional surgery and radiation HNC treatment to immunotherapy and targeted therapies
- This study is the first to report PI gender involved in HNC clinical trials. Only 38% of PIs conducting HNC clinical trials were female, and only a quarter of otolaryngologist investigators were female.
- Most clinical trials were led by medical oncologists, followed by radiation oncologists and otolaryngologists
- Most PIs held only an MD degree, with about 16% holding both MD and PhD degrees
- Academic centers participate in most HNC clinical trials, followed by industry-sponsored studies, with NIH-funded trials representing a minority.

CONCLUSIONS

- Head and neck cancer clinical trials are concentrated in densely populated urban areas, resulting in travel burden for HNC patients outside these geographic areas thereby limiting access
- Studies are heavily skewed towards immunotherapy/targeted drug trials, with fewer investigations in radiation and surgery as treatments
- Surgeons and females were underrepresented as PIs
- We recommend more interdisciplinary studies and increased female representation among investigators

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