



The Graduate Medical Education System and Physician Supply in Texas

**As Required By
Texas Health and Safety Code Section 105.009**



**Department of State Health Services
July 2016**

- This page is intentionally left blank -

Table of Contents

Executive Summary1

Introduction2

Background2

Stakeholder Engagement Process.....4

Medical Specialties and Subspecialties at Critical Shortage Levels.....4

 Stakeholder Survey Results.....4

 Critical Shortage by Specialty 4

 Elements of Critical Shortage Definition 5

 Geographic Designation 5

 Preliminary Data and Results5

 Analytical Model for Defining Critical Shortage Levels6

Texas’ Graduate Medical Education System7

 Stakeholder Survey Results.....7

 Preliminary Data/Results.....7

 Assessment of GME System Capacity9

Conclusion9

Appendix 1: Stakeholder Survey Questions10

Appendix 2: Using Hospital-Based Specialties to Test the Model.....14

 General Surgery 14

 Emergency Medicine..... 15

- This page is intentionally left blank -

Executive Summary

[Senate Bill 18](#) (S.B. 18), 84th Texas Legislature, Regular Session, 2015 added [Section 105.009](#) to the Texas Health and Safety Code to require the Department of State Health Services (DSHS) to conduct research on physician shortages in Texas and the capacity of the state's graduate medical education (GME) system. While basic methods for identifying physician shortages currently exist, DSHS is working to identify critical shortage levels by physician specialty and subspecialty.

This report lays out the DSHS work plan for addressing the requirements of Health and Safety Code Section 105.009. To estimate physician demand for specific specialties and subspecialties, DSHS is having an analytical model developed. This model will consider county-level demographic information, health risk factors, and current health care utilization. Estimates of physician need and supply will rely on DSHS data on physician supply, state and national medical school and GME data, and state and national data on physician practice preferences. Using these data and through the application of statistical methods, measures of current and projected physician supply and demand, as well as a method for defining specialty-specific critical shortage levels, will be developed. The analytical model will quantify any critical shortages that may exist and can be compared to GME data from Texas Higher Education Coordinating Board to identify any ways to improve the system.

In an addendum to this report, to be published prior to the 85th Legislative Session, the model produced will be tested and validated using two hospital-based physician specialties, general surgery and emergency medicine. After working closely with various stakeholders to prioritize the necessary work, these specialties were chosen as the focus of the first report due to the current adequacy and availability of patient demand data, and because stakeholders identified these specialties as being of interest. Based on survey results, DSHS anticipates that its 2018 report will respond to stakeholder interest by incorporating a broader set of specialties, including primary care and psychiatry.

Introduction

The 2015 Texas State Government Effectiveness and Efficiency Report prepared by the Legislative Budget Board (LBB) included a finding that Texas should align new graduate medical education (GME) funding with the health care needs of the state. Included in this report, was a recommendation that the Department of State Health Services (DSHS) conduct research about the appropriate mix of primary care to specialty physicians to meet current and future needs of Texas. S.B. 18, 84th Texas Legislature, Regular Session, 2015 added [Section 105.009 to the Health and Safety Code](#) to require DSHS to conduct research on the state's GME system. This research must identify all medical specialties and subspecialties that are at critical shortage levels in the state, as well as the geographic location of physicians in those specialties and subspecialties. Additionally, the research must consider the overall supply of physicians in this state and any other issues that are relevant to the status of the GME system and the ability of that system to meet the current and future health care needs in Texas.

S.B. 18 requires that each even-numbered year, the Statewide Health Coordinating Council (SHCC) report the results of the research conducted by DSHS to the LBB, the Texas Higher Education Coordinating Board (THECB), the Office of the Governor, and the standing committees of each house of the legislature with primary jurisdiction over state finance or appropriations.

Background

GME is a term used to describe formal education that occurs after an individual graduates from medical school. The Accreditation Council for Graduate Medical Education (ACGME) is a private non-profit that is responsible for setting standards for GME (residency and fellowship) programs across the country. ACGME identifies 28 specialty categories, which are divided into three main groups: surgical specialties, medical specialties, and hospital-based specialties.¹

Many factors influence the demand for, and supply of, physicians in Texas, including the state's GME system, and the demographics of its population.^{2,3} Physicians often establish their careers where they receive their training; therefore, the number of filled GME positions, by specialty and location, largely defines the number of new physicians entering a state's workforce and is a predictor of where in the state they practice. Changes in demographics, especially a growing population, shifting age distributions, and geographic dispersal of patients and physicians,

¹ Accreditation Council for Graduate Medical Education. ACGME Data Resource Book. Accreditation Council for Graduate Medical Education. <http://www.acgme.org/About-Us/Publications-and-Resources/Graduate-Medical-Education-Data-Resource-Book>. September 2015. Accessed June 23 2016.

² North Texas Regional Extension Center. (2015). *The Physician Workforce in Texas: An Examination of Physician Distribution, Access, Affiliations, and Practice Patterns in Texas' 254 Counties*.

³ Whitcomb, M. (2011). Commentary: Meeting Future Medical Needs: A Perfect Storm on the Horizon. *Academic Medicine*, 86(12), 1490-1491.

directly affect the adequacy of the physician workforce. Additionally, economic factors often impact physicians' choices regarding practice specialty and location of practice.⁴

Generally, physician shortages are measured as a ratio of physicians to 100,000 population. For the country at-large, it is estimated that there are between 226 and 250 physicians per 100,000 people.⁵ By comparison, in 2015, DSHS estimated that Texas had 177 physicians per 100,000.⁶ These estimates do not differentiate physicians by individual specialty, but can be used to highlight regions and communities with general physician shortages.

The U.S. Department of Health and Human Services Health Resources and Services Administration (HRSA) identifies health professional shortage areas (HPSAs) in primary care, dental, and mental health specialties.⁷ HRSA defines a HPSA for primary care physicians using a ratio of 1 physician for every 3,500 in population and psychiatrists at 1:30,000.⁸

HPSAs are useful in identifying areas with the greatest shortages of primary care physicians and psychiatrists. However, HPSAs just provide information on the number of physicians compared to the total population. They are not designed to consider other factors impacting the availability of physicians, such as variation in the utilization of health services or differences in the needs of various populations. Individual communities differ based on the age of their population, proximity to urban centers, and the availability of other providers such as advanced practice nurses and physician assistants. While physician to population ratios, including HPSAs, serve as a guide in determining physician shortages, because they do not take into account other important factors, a more nuanced and data-driven approach to identifying critical shortage levels of physicians is needed. This research will provide important information about the ability of the GME system to meet the current and future health care needs of the state.

DSHS recognizes that the requirement to conduct research on the GME system, as outlined in Health and Safety Code Section 105.009, is ongoing, and the scope of studying all specialties and subspecialties is substantial. The purpose of this report is to provide a detailed description of the work plan that has been developed based on the availability of data and stakeholders input. The work plan will serve as a road map for the GME research being done this biennium as well as future biennia. An addendum to this report, with in-depth analysis of some of the most critical issues related to the state's GME system, will be published prior to the 85th Texas Legislative Session. DSHS developed an implementation plan whereby the initial report, which will be released later this year, will provide detailed analysis of some of the specialties subject matter experts have identified as most important. Subsequent reports will build this work by analyzing additional issues related to the GME system in Texas.

⁴ Grover, A., Orlowski, J., & Erikson, C. (2016). The Nation's Physician Workforce and Future Challenges. *The American Journal of Medical Sciences*, 351(1), 11-19.

⁵ Whitcomb, M. (2011). Commentary: Meeting Future Medical Needs: A Perfect Storm on the Horizon. *Academic Medicine*, 86(12), 1490-1491.

⁶ Texas Department of State Health Services, Health Professions Resource Center. (2015).

⁷ U.S. Department of Health and Human Services, Health Resources and Services Administration. (n.d.). Retrieved from <http://www.hrsa.gov/shortage>.

⁸ U.S. Department of Health and Human Services, Health Resources and Services Administration. (n.d.). Retrieved from <http://www.hrsa.gov/shortage>.

The purpose of this report is to provide a detailed description of the work plan that has been developed based on the availability of data and stakeholders input. The work plan will serve as a road map for the GME research being done this biennium as well as future biennia. An addendum to this report, with in-depth analysis of some of the most critical issues related to the state's GME system, will be published prior to the 85th Texas Legislative Session.

Stakeholder Engagement Process

In order to ensure the GME research being done by DSHS meets the needs of the stakeholders the research is meant to inform, DSHS engaged interested parties in various ways during the development of the work plan. Because S.B. 18 specifies that the SHCC should be involved in the research process, DSHS has provided the SHCC with information on the implementation of the bill and solicited feedback from its members during the SHCC meetings held October 22, 2015 and April 14, 2016.

DSHS also solicited input from THECB and professional organization in order to help identify the state's top priorities with respect to GME research. DSHS began by engaging subject matter experts and stakeholders through various conference calls and meetings. After conducting a literature review, DSHS developed an online survey in collaboration with the group of key stakeholders. The intent of the survey was to gain input from a larger and more diverse group of subject matter experts on the research topics that they feel are most critical to the ability of the state to meet current and future health care needs. Survey respondents were asked specific questions related to which specialties had perceived shortages, how critical shortage level should be defined, as well as on what geographic designations the research should focus (see Appendix 1 for a copy of the survey).

Email invitations requesting participation in the survey were sent to the state's medical schools, professional and industry-specific associations and organizations, advocacy groups, and other parties with a known interest in the state's physician workforce. Additionally, this invitation was sent to subscribers of the DSHS Health Professions Resource Center email distribution list and posted on the DSHS website. Recipients of this solicitation were also encouraged to share the survey link with other interested parties. DSHS received 267 completed surveys between April 4, 2016 and April 18, 2016.

Medical Specialties and Subspecialties at Critical Shortage Levels

Stakeholder Survey Results

Critical Shortage by Specialty

Given the wide array of physician specialties and subspecialties and differences in the availability of data needed to estimate supply and demand, DSHS and key stakeholders agreed to limit the number of specialties considered for this initial report. Using this approach, DSHS will do a detailed analysis of specific specialties each biennium, which will allow for more focused and substantive research than would be possible if all specialties and subspecialties were addressed at the same time.

The DSHS stakeholder engagement survey asked respondents which specialties they perceived to be at critical shortage levels in Texas. The specialties listed were those identified by the ACGME.⁹ Respondents most commonly identified psychiatry and primary care specialties, including family medicine, family practice, internal medicine, and pediatrics, as being at critical shortage levels. Within a hospital setting, general surgery and emergency medicine were most commonly identified as being at critical shortage levels in Texas.

Elements of Critical Shortage Definition

Before DSHS could identify where critical shortages occur, a definition for critical shortage needed to be developed. To ensure that the definition captured the elements subject matter experts found to be most important, the survey asked respondents to identify the most relevant factors. Over 67 percent of respondents indicated that physician specialty to population ratios were the most important elements in defining a ‘critical shortage area’ in Texas. Stakeholders also identified the distance required to travel to a physician and the wait time required to make an appointment as important elements to include in the definition of critical shortages.

Geographic Designation

As Texas Health and Safety Code Section 105.009 requires the consideration of the geographic location of physicians in the state, DSHS asked stakeholders about the geographic designations that they found most useful with respect to physician shortages. More than 66 percent of respondents indicated that the distinction between rural and urban was very or extremely important. Counties were also identified as very or extremely important by over half (57 percent) of those who responded to the survey.

Preliminary Data and Results

The Office of the State Demographer estimates that Texas’ population will grow by 21.7 percent (more than 6 million people) between 2015 and 2025.¹⁰ As the state’s population increases, so will the need for physician services. Yet as noted above, Texas currently trails the nation in physician supply and shortages can be particularly acute in rural areas. For example:

- The 5 most populated counties in Texas account for 43 percent of the population and 57 percent of the physician workforce.¹¹
- The 175 counties with populations less than 40,000 people account for 8 percent of the population, but only 3 percent of the physician workforce.¹²

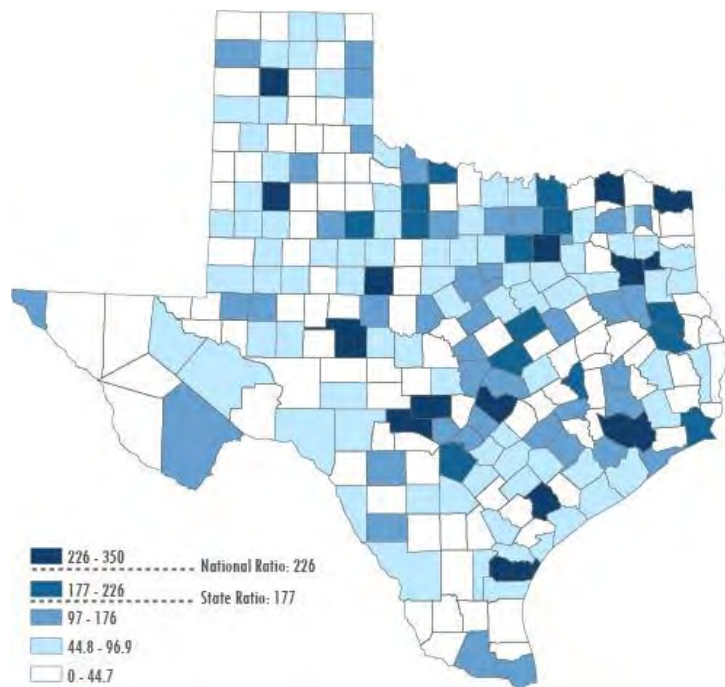
⁹ Accreditation Council on Graduate Medical Education. (n.d.). *Specialties*. Retrieved from <http://www.acgme.org/Specialties/Overview>

¹⁰ Texas Demographic Center. (n.d.). *Texas Population Projections Program*. Retrieved from <http://osd.texas.gov/Data/TPEPP/Projections/>

¹¹ Texas Department of State Health Services, Health Professions Resource Center. (2015).

¹² Texas Department of State Health Services, Health Professions Resource Center. (2015).

Map 1. Direct Patient Care Physicians per 100,000 Population by County¹³



In all, only 15 Texas counties have physician to 100,000 population ratios that exceed the national ratio of 226. Thus, using this metric, nearly 18 million Texans live in counties with a relative physician shortage.¹⁴ However as noted above, such a metric fails to consider variation in numerous factors that can effect shortages, including patient demand for services, the mix of various physician specialties, and population and physician demographics, among others. For this reason, DSHS is in the process of developing a methodologically robust approach to identify shortages that will use available data to account for factors beyond just physician to population ratios.

Analytical Model for Defining Critical Shortage Levels

To meet the requirements of Texas Health and Safety Code Section 105.009, by doing a robust and thorough analysis of the state’s GME system and physician supply, DSHS will contract with a third party with expertise in economic modeling. The contractor will create a model aimed at quantifying the shortage of hospital-based physician specialties and subspecialties by geographic area of the state.

Doing so requires the development of an analytical model that can accurately and precisely estimate patient demand for health services, the number of physicians needed to meet this demand, and physician supply. In estimating physician demand, the model being developed will consider county-level demographic information, health risk factors, and current health care utilization. Estimates of physician need and physician supply will rely on DSHS data on

¹³ Texas Department of State Health Services, Health Professions Resource Center. (2015).

¹⁴ Texas Department of State Health Services, Health Professions Resource Center. (2015).

physician supply, state and national medical school and GME data, and state and national data on physician practice preference. Using these data and through the application of statistical methods, the contractor will develop measures of current and projected physician supply and demand, as well as a method for defining specialty-specific critical shortage levels. The contractor will develop current and projected future physician supply and demand for 2020 and 2030.

For the current report, the model produced will be tested and validated using two hospital-based physician specialties, general surgery and emergency medicine. These were chosen because they were the specialties identified as high priorities for stakeholders that also has adequate accurate demand data currently available, namely data from the Health Care Data Collection (HCDC) program.¹⁵ HCDC data provide detailed information about care being provided in hospitals (by hospital based specialists). There is not currently similar data available for care being provided outside of the hospital setting by non-hospital based specialists. Once developed, the model will identify critical shortages at the county level. It will also compare the extent of shortage in urban and rural counties.

For the 2018 report, DSHS will build off of the work done this biennium and expand the research to include additional specialties. Based on stakeholder survey results, DSHS anticipates that its 2018 report will include research on primary care and psychiatry. While data and resource constraints limited the ability to focus on non-hospital based specialties in this report, because these specialties were identified as priorities by survey respondents, DSHS plans to target primary care and psychiatry in the next report.

Texas' Graduate Medical Education System

Stakeholder Survey Results

Survey respondents were asked to identify factors they perceived to be important in ensuring the adequacy of the state's GME system. The following were identified as priorities:

- More than 80 percent of stakeholders indicated that the number of total residency or GME slots was very or extremely important to ensure the adequacy of the state's GME system.
- Over 70 percent of respondents identified the reduction of debt incurred as a student as very or extremely important.
- Approximately, 75 percent of respondents identified the availability of residency slots by specialty as very or extremely important.

Preliminary Data/Results

GME programs in Texas are near or have already reached capacity.¹⁶ Efforts to make residency positions available in non-teaching hospitals are constrained due to a lack of resources and

¹⁵ The Health Care Data Collection program, formerly the Texas Health Care Information Collection program, collects and reports data on health care activity in hospitals and health maintenance organizations operating in Texas. The goal is to provide information that will enable consumers to have an impact on the cost and quality of health care in Texas.

¹⁶ Whitcomb, M. (2011). Commentary: Meeting Future Medical Needs: A Perfect Storm on the Horizon. *Academic Medicine*, 86(12), 1490-1491.

qualified staff that are able to take on the requirements of training residents. At the federal level, a lack of communication between the GME funding system and the residency placement system was identified as being partially responsible for the continued discrepancy between rural and urban physician levels. This discrepancy has affected the placement of new physicians in rural and underserved areas.¹⁷

H.B. 2908, 82nd Texas Legislature, Regular Session, 2015 directed the THECB to conduct an assessment of the state's GME system. This assessment was included in the 2012 Coordinating Board Strategic Plan, 2013 through 2017. It identified residency position shortages in the state that would result in an estimated 137 medical school graduates to seek training outside of Texas annually. With an average of \$168,000 of state funds spent on their medical education, an estimated \$23 million annually would be spent on medical education for physicians undertaking out-of-state residencies.¹⁸

New medical schools are being opened in Austin and the Rio Grande Valley and student capacity is increasing in existing schools. In conjunction with the increase in medical school graduates, funding for residency training increased in each of the last two legislative sessions, 2013 and again in 2015, by a total of \$53 million.¹⁹ The increase in GME funding will increase medical residency by 200 positions and move Texas closer to the goal established by the Texas Medical Association and THECB of 1.1 residency positions for every one graduate.²⁰

Texas has taken significant steps to increase the number of GME positions for medical school graduates, but the increase in available positions does not address physician shortages in specific areas such as primary care physicians and physicians that practice in rural areas.²¹ To complement the increase in GME funding, the Texas Legislature authorized additional funding in 2013 for new pipeline programs that encourage physicians to practice primary care and family medicine physicians.²² Chapter 61 of the Texas Education Code establishes a program for the repayment of certain physician loans. Additionally, in 2015, the Texas Legislature passed S.B. 239, creating a new loan repayment program for psychiatrists and other mental health professionals.²³

The importance of ensuring the availability of residency positions for medical school graduates is critical as physicians who complete their GME in Texas are more than three times as likely to practice here in Texas. The state ranks second in the retention of physicians from undergraduate medical education (59.9 percent) and fifth in physicians retained from GME (57.9 percent).²⁴

¹⁷ Chen, C., Xierali, I., Piwnica-Worms, K., & Phillips, R. (2013). The Redistribution of Graduate Medical Education Positions in 2005 Failed to Boost Primary Care or Rural Training. *Health Affairs*, 32(1), 102-110.

¹⁸ Texas Higher Educating Coordinating Board. (2012). 2012 Coordinating Board Strategic Plan, 2013 through 2017.

¹⁹ Chen, C., Xierali, I., Piwnica-Worms, K., & Phillips, R. (2013). The Redistribution of Graduate Medical Education Positions in 2005 Failed to Boost Primary Care or Rural Training. *Health Affairs*, 32(1), 102-110.

²⁰ Sorrel, A. (2015). GME a Top Priority for 2015 Legislature. *Texas Medicine*, 111(5), 45-50.

²¹ Dickey, N. (2015). Retaining Medical Graduates in Texas. *Texas Medicine*, 112(2), 68-70.

²² Sorrel, A. (2013). Feeding the Physician Pipeline. *Texas Medicine*, 109(11), 37-40.

²³ Chen, C., Xierali, I., Piwnica-Worms, K., & Phillips, R. (2013). The Redistribution of Graduate Medical Education Positions in 2005 Failed to Boost Primary Care or Rural Training. *Health Affairs*, 32(1), 102-110.

²⁴ Dickey, N. (2015). Retaining Medical Graduates in Texas. *Texas Medicine*, 112(2), 68-70.

Due to the cost associated with the training of physicians during residency programs it is economically advantageous to retain graduates in the state.²⁵ Graduates who have indicated an interest in completing their GME out of state due to the unavailability of residency positions most commonly occur in the otolaryngology, preliminary and general surgery, emergency medicine, and orthopedic specialties.²⁶

Assessment of GME System Capacity

With the above-described analytical model providing a basis for estimating the need for physicians across the state by specialty, DSHS will be able to assess the ability of the state's GME system to meet these needs. The analytical model will quantify any critical shortages that may exist and can be compared to GME data from THECB to identify any inadequacies in the system. This analysis will be included in an addendum to this report, which will be released prior to the 85th Texas Legislative Session.

Conclusion

Texas has made progress in reducing the shortage of acting physicians through a number of initiatives. By 2019, it is estimated that these interventions will increase the ratio of physicians to 100,000 population by roughly 3 percent.²⁷ Although these efforts are already helping alleviate the shortage of physicians in Texas, shortages are expected to persist. Moreover, these shortages will not be geographically uniform, with rural and border areas expected to be more severely affected. Additionally, Texas may experience varying levels of shortage for specific specialties and subspecialties.

In response to Texas Health and Safety Code Section 105.009, DSHS is working towards the development of an analytical framework and model for understanding current and future physician shortages in the state. This model will contribute to health professions workforce planning by informing policymakers and stakeholders on where, and in what specialties and subspecialties, more physicians are needed in Texas. Prior to the convening of the 85th Texas Legislative Session, DSHS will publish its model and the results of its model validation using two hospital-based physician specialties: general surgery and emergency medicine. As DSHS continues to collect necessary data and refine its efforts, the agency anticipates that its 2018 report will incorporate a broader set of specialties, including primary care and psychiatry.

²⁵ Sorrel, A. (2013). Feeding the Physician Pipeline. *Texas Medicine*, 109(11), 37-40.

²⁶ Dickey, N. (2015). Retaining Medical Graduates in Texas. *Texas Medicine*, 112(2), 68-70.

²⁷ North Texas Regional Extension Center. (2015). *The Physician Workforce in Texas: An Examination of Physician Distribution, Access, Affiliations, and Practice Patterns in Texas' 254 Counties*.

Appendix 1: Stakeholder Survey Questions

1) Please provide your contact information below.

Name: _____

Organization: _____

City/Town: _____

State: _____

Email Address: _____

2) SB18 directs the Department of State Health Services (DSHS) "to identify all medical specialties and subspecialties that are at critical shortage levels in this state." Based on your knowledge and experience, which specialties appear to have the greatest shortages and are most in need of analysis? (You may select up to 5 responses.)

- Allergy and Immunology
- Anesthesiology
- Colon and Rectal Surgery
- Dermatology
- Emergency Medicine
- Family Medicine
- Family Practice
- Internal Medicine
- Internal Medicine - Pediatrics
- Medical Genetics
- Neurological Surgery
- Neurology
- Nuclear Medicine
- Obstetrics and Gynecology
- Ophthalmology
- Orthopedic Surgery
- Otolaryngology
- Pathology - Anatomic and Clinical
- Pediatrics
- Physical Medicine and Rehabilitation
- Plastic Surgery
- Preventive Medicine
- Psychiatry
- Radiation Oncology
- Radiology - Diagnostic
- Sleep Medicine
- Surgery - General
- Thoracic Surgery
- Urology

- 3) SB18 directs DSHS to define a 'critical shortage level' for physician specialties. What elements would you consider in defining a 'critical shortage level'? (For example, elements might include distance between patient and provider, population to provider ratios, or availability of hospital services.)
- 4) SB 18 further directs DSHS to consider "the geographic location of the physicians in those specialties and subspecialties". For each of the following geographic designations, please indicate how helpful each would be in describing physician shortages.

	Not at all helpful	Slightly helpful	Helpful	Very helpful	Extremely helpful
Urban/rural	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Non-border/border	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Public health/health service region	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Counties	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Other (please specify)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

- 5) For each of the following, please indicate the importance of each in ensuring the adequacy of the overall supply of physicians in this state.

	Not at all important	Slightly important	Important	Very important	Extremely important
Population to physician ratio	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Population to physician ratios by specialty	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Geographic distribution of population to physician ratios	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Other (please specify)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

6) For each of the following topics, please indicate how important each is ensuring the adequacy of the state's graduate medical education system.

	Not at all important	Slightly important	Important	Very important	Extremely important
Total number of residency slots	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Achieving a 1.1-to-1 ratio of first year residency positions to Texas medical school graduates	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Distribution of residency slots by specialty	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Geographic distribution of residency slots	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Reduction of student loan debt for newly practicing physicians	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Incentives available for residency positions by specialty	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Other (please specify)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

- 7) Thank you very much for your time and helping us to better understand the background to this important research. If you have any questions, please don't hesitate to contact the Health Professions Resource Center within DSHS by email (hprc@dshs.state.tx.us) or phone (512-776-6541). Are there any other comments or suggestions that you would like to provide regarding this research?

Appendix 2: Using Hospital-Based Specialties to Test the Model

As noted above, general surgery and emergency medicine were the hospital-based specialties most commonly identified by stakeholders as being at critical shortage levels in the state. While DSHS will contract for the development of a model aimed at measuring shortage areas in a broad range of hospital-based specialties, these two specialties will be used to test and validate this model.

General Surgery

The Association of American Medical Colleges defines a general surgeon as a physician that is trained in the central core knowledge of surgical procedure. This specialized training includes the areas of anatomy, physiology, metabolism, immunology, nutrition, pathology, wound care, shock and resuscitation, intensive care, and neoplasia.²⁸ Surgical intervention can be managed by general surgeons in almost any area of the body. General surgeons do not only perform the actual surgery but are also involved in diagnosis, preoperative, operative, and postoperative care and consult other physicians regarding critically ill patients that have underlying surgical conditions. The most common areas of focus for general surgeons include the abdomen, breasts, peripheral vasculature, skin and the neck. Common procedures performed include appendectomies, biopsies of the breast and thyroid, cardiovascular bypass surgery, and cesarean section.²⁹

General surgery, as a specialty, has decreased an estimated 26 percent over the last 25 years. Throughout the United States, the ratio of population to general surgeons declined from 7.68 per 100,000 in 1981 to 5.69 per 100,000 in 2005.³⁰ A national survey estimated that between 30 percent and 50 percent of medical students who choose to become surgeons enter fellowships and residency programs where they specialize even further reducing the overall number of general surgeons available to conduct routine surgical procedures.³¹

As of April 2016, there were 1,340 general surgeons in Texas. The general surgeon workforce in Texas falls just below the national average at 4.8 surgeons per 100,000 residents. General surgeons, not unlike most other physician specialties, are concentrated in urban counties. Just over 89 percent of general surgeons practice in metropolitan areas. There are 135 counties, with over two million residents that do not have a general surgeon.³²

²⁸ American Association of Medical Colleges. (n.d.). *Surgery-General*. Retrieved from <https://www.aamc.org/cim/specialty/list/us/336874/surgery-general.html>

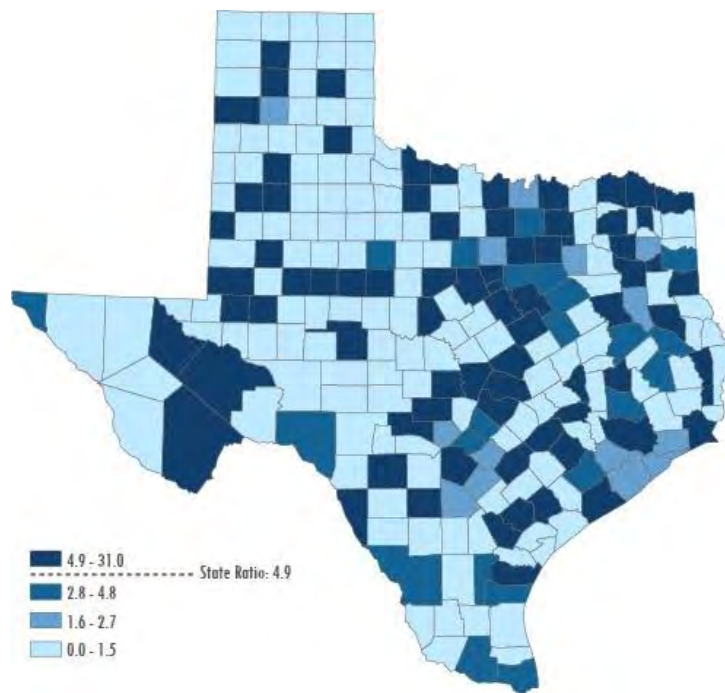
²⁹ Stanford Health Care. (n.d.). *General Surgery - Common Surgical Procedures*. Retrieved from <https://stanfordhealthcare.org/medical-treatments/g/general-surgery/procedures.html>

³⁰ Lyng, D., Larson, E., Thompson, M., Rosenblatt, R., & Hart, L. (2008). A Longitudinal Analysis of the General Surgery Workforce in the United States, 1981-2005. *Archives of Surgery*, 143(4), 345-350.

³¹ Grover, A., Orłowski, J., & Erikson, C. (2016). The Nation's Physician Workforce and Future Challenges. *The American Journal of Medical Sciences*, 351(1), 11-19.

³² Texas Demographic Center. (n.d.). *Texas Population Projections Program*. Retrieved from <http://osd.texas.gov/Data/TPEPP/Projections/>

Map 2. General Surgeons per 100,000 Population by County³³



Emergency Medicine

Emergency medicine physicians specialize in emergency and often lifesaving medical care. Physicians must be able to make immediate decisions and perform emergency procedures to prevent the loss of life or further disability for a patient. This high pressure specialization requires the physician to recognize, evaluate, and stabilize patients ranging from infants to the elderly at a moment's notice. Physicians must have a broad knowledge of medicine in order to treat any illness or injury. Emergency medicine physicians often work in hospital emergency departments, but in Texas and throughout the country are increasingly working in independent emergency care clinics that are not located within a hospital setting.³⁴

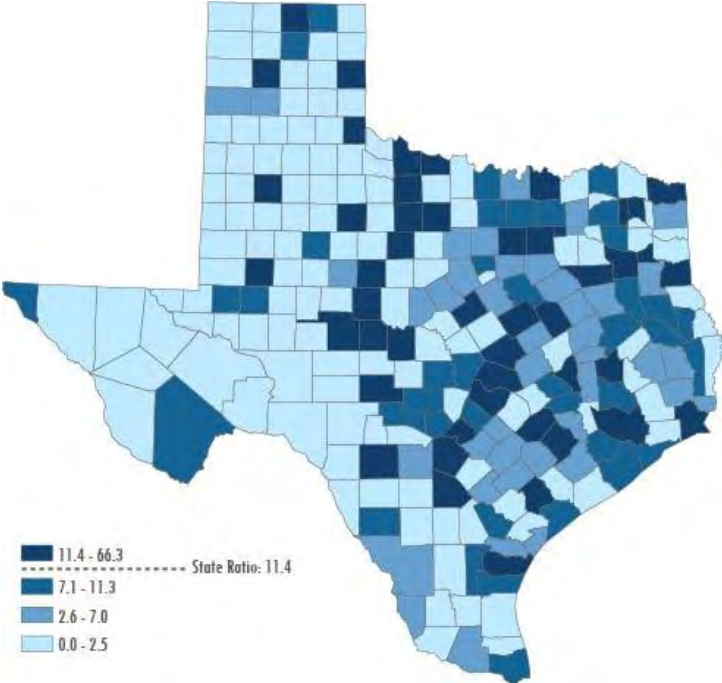
In Texas, as of April 2016, there were 3,155 emergency medicine physicians (Map 1). The proportion of physicians to population is approximately 11.7 physicians per 100,000 residents. An overwhelming percentage of Texas emergency medicine physicians practice inside of metropolitan areas (94.2 percent) and 95 percent practice in non-border areas.³⁵

³³ Texas Department of State Health Services, Health Professions Resource Center. (2015).

³⁴ American Association of American Medical Colleges. (n.d.). *Emergency Medicine*. Retrieved from https://www.aamc.org/cim/specialty/list/us/336838/emergency_medicine.html

³⁵ Texas Department of State Health Services, Health Professions Resource Center. (2015).

Map 3. Emergency Medicine Physicians per 100,000 Population by County³⁶



³⁶ Texas Department of State Health Services, Health Professions Resource Center. (2015).