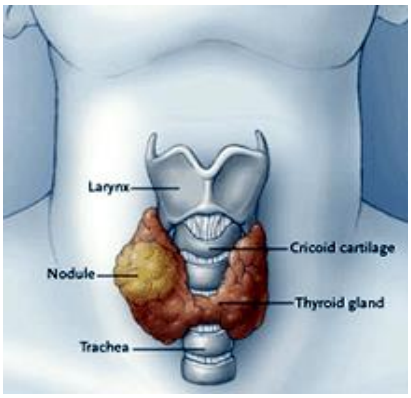
ENDOCRINE SOCIETY

Hormone Science to Health

June 2014



HEALTH CARE AND HUMAN SERVICES POLICY, RESEARCH, AND CONSULTING—**WITH REAL-WORLD PERSPECTIVE.**

Endocrine Clinical Workforce: Supply and Demand Projections

Prepared for: **The Endocrine Society**

Co-sponsored by: **Association of Program Directors in Endocrinology, Diabetes, and Metabolism**

Submitted by: **The Lewin Group**

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EXECUTIVE SUMMARY

The *Endocrine Society* commissioned *The Lewin Group* to undertake a workforce study of clinical endocrinologists. The purpose of the study was to better understand the factors affecting the supply and demand of endocrinologists, to quantify the factors where possible, to project the likely evolution of the workforce, and to assess the implications of the results. The work was guided by a panel of endocrinologists who were knowledgeable about the medical workforce and could give guidance and expertise on the subject. A survey of the endocrinology workforce and a literature review contributed to the knowledge foundation for the study. The literature identified that demand is exceeding supply due to a number of factors related to age and obesity. Diabetes and age-related conditions were the major contributors to the demand side of the equation.

In 2010, the U.S. physician workforce began focusing its attention on the Patient Protection and Affordable Care Act (PPACA), increasing health care access and coverage for at least 30 million people not previously covered. The effect of the PPACA on the demand for endocrinology services is incorporated into this analysis.

Endocrinologist Supply

As of 2011, there were 5,496 board certified adult endocrinologists and 1,016 pediatric endocrinologists, a total of 6,512 board certified endocrinologists age 70 or less.[1] Of these board certified endocrinologists, we estimate that approximately 4,841 adult endocrinologists and 893 pediatric endocrinologists were engaged in clinical practice in 2011.[2]

An additional 4,000 physicians report some role in endocrinology and nutritional services, primarily in diabetes management. Reproductive endocrinologists were not included in this analysis. The mean age of adult endocrinologists in 2011 was 51 and the median age was 48. The mean age of pediatric endocrinologists was about 50 in 2011 and the median age was about 48.5. About 62 percent of adult endocrinologists are male, while only about 49 percent of pediatric endocrinologists are male. Approximately one-quarter of endocrinologists are international medical graduates. Younger women entering endocrinology are replacing older male colleagues. The study baseline assumption was that the number entering adult endocrinology each year is constant at 280 board certified endocrinologists and the number entering the pediatric workforce was constant at 73.[3] Similar to most physician specialists, the geographic distribution of endocrinologists is predominately metropolitan-based with concentrations east of the Mississippi River, the west coast, and with smaller concentrations in the Midwest, Texas and Florida. There is minimal distribution of endocrinologists in the northern tier states.

A survey of endocrinologists for this study reported that, of those over age 50, 12 percent were working part-time. The median salary (excluding benefits) of full-time endocrinologists who

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1 American Medical Association Master File extract, 2011.

2 To be engaged in clinical practice, their primary activity, as reported in the AMA Master File, could not be research or administration, and they could not be classified as inactive. In addition of those in office based practice, we did include those who were hospital staff, those who were medically teaching, and those with no classification in the count of those engaged in clinical practice.

3 These new entrants are assumed to be distributed between clinically active activities and non-clinical activities at the same rates and ages as historical cohorts.

reported more than one year in medical group practice was $211,400. The mean number of adult out-patient visits per annum was approximately 3,000 with a range of 2,754 to 3,661.[4]

Endocrinologist Demand

A major factor affecting the anticipated demand for health care services is the aging population. In 2010, there were 37.5 million people age 65 or over, constituting about 12.7 percent of the total population, and by 2025 the population age 65 or over will number 62.5 million (17.9 percent of the population). Due to the greater prevalence of many of the diseases in older age groups, like osteoporosis, diabetes, obesity, and thyroid nodules, the growth in the population age 65 or over will exert a major influence on the demand for endocrine services.

Diabetes, by itself, is a major driver of demand. The incidence of Type 2 diabetes rises dramatically with age, and with obesity. In an increasingly overweight population an estimated 22.3 million people in the U.S. are diagnosed with diabetes as of 2012, representing about 7 percent of the population. This estimate is higher than but consistent with those published by the CDC for 2010.[5,6] The percentage of the population with diagnosed diabetes continues to rise, with one study projecting that as many as one in three U.S. adults could have diabetes by 2050 if current trends continue.[7]

In addition to age, socioeconomic and demographic changes in the population will also influence the demand for endocrinology over the next two decades. Demand for treatment of endocrinopathies, such as diabetes, obesity, and hypothyroidism, will increase due to lifestyle changes, economic growth, policy changes related to health insurance, regulatory requirements and technological innovation.

Supply and Demand Projections, 2011-2025

Our baseline projections indicate that there is a substantial gap, about 1,484 full-time equivalent endocrinologists between the adult endocrinology services demanded, measured in terms of the services that an adult endocrinologist can provide when working full time in patient care, and the amount that can be supplied by the current and projected numbers of clinically active adult endocrinologists, in 2015. The gap between the supply and demand of full-time equivalent endocrinologists is likely to persist through 2025, where we estimate it to fall slightly to 1,344. The reasons for this gap are multifactorial and include an aging population, an age and gender shift of endocrinologists, changing lifestyle of physicians, and implementation of the health care reform. We estimate that the growth in new entrants necessary to close this gap in 5 years is about 14 percent per year, and to close in 10 years would require growth of about 5.5 percent per year.

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4 Please note that the response rate for the study was about 19 percent. Because of this, the data from the survey should be interpreted cautiously.

5 "2011 National Diabetes Fact Sheet." Centers for Disease Control and Prevention. http://www.cdc.gov/diabetes/pubs/estimates11.htm (accessed January 16, 2013).

6 "Number (in Millions) of Civilian, Noninstitutionalized Persons with Diagnosed Diabetes, United States, 1980–2010." Centers for Disease Control and Prevention. http://www.cdc.gov/diabetes/statistics/prev/national/figpersons.htm (accessed January 17, 2013).

7 Boyle, James P., Theodore J. Thompson, Edward W. Gregg, Lawrence E. Barker, and David F. Williamson. "Projection of the year 2050 burden of diabetes in the U.S. adult population: dynamic modeling of incidence, mortality, and prediabetes prevalence." Popul Health Metr 8, no. 1 (2010): 29.

In contrast, there is only a modest excess demand gap for pediatric endocrinologists. Under our baseline assumptions, this gap is about 100 full-time equivalent pediatric endocrinologists in 2015. Our baseline projections suggest that this gap can be closed by 2016 and, by 2025, a surplus of about 200 FTE pediatric endocrinologists will have emerged. The primary reason for the difference in the pediatric and adult endocrinology markets is the major role that the aging population plays in the demand for adult endocrinologists, while the aging population has a much less profound effect on the demand for pediatric endocrinologist services. In the case where the prevalence of diabetes increases from the current level to about 12 percent over the entire population, there is an increase in the demand for both adult and pediatric endocrinologists' services. This results in a somewhat smaller projected surplus of pediatric endocrinologists.

Conclusion

This forecast study indicates that the number of adult endocrinologists entering the workforce is not sufficient to meet the excess demand—a gap in supply and demand which is projected to be about 1,484 by 2015—and is unlikely to meet future demand. Some researchers have suggested that there will be a significant physician shortage. The American Association of Medical Colleges, for example, has recently published revised estimates suggesting a shortage of 63,000 physicians by 2015, of which 28,900 is estimated to be primary care.[8] However, a contrary view was recently expressed by the Robert Wood Johnson Synthesis Project for primary care:

> *Data do not support the suggestion that the United States is currently experiencing or facing an imminent shortage of primary care providers; numbers of physicians, nurse practitioners and physician assistants have grown in recent years relative to the general population.*[9]

Moreover, a recent article in Health Affairs suggests that new ways of delivering care may significantly mitigate any emerging shortages.[10] Most researchers agree, however, that because of demographics and because of the increased demand that is likely to result from greater insurance coverage under the Affordable Care Act, the health workforce market will become increasingly tighter over the next ten years.

While a significant portion of the recent literature on the adequacy of physician supply predicts shortfalls for both primary care and specialty care, endocrinology is likely to be different than the typical specialty. In addition to the increasing utilization demand due to an aging population, some researchers are predicting a significant increase in the incidence and prevalence of diabetes.[11] Hence, it is likely that, among specialties, endocrinology will be in strong demand.

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8 American Association of Medical Colleges, "The Impact of Health Care Reform on the Future Supply and Demand for Physicians Updated Projections Through 2025," June 2010. https://www.aamc.org/download/158076/data/updated_projections_through_2025.pdf

9 Catherine Dower and Edward O'Neil, "Primary care workforce in the United States," Robert Wood Johnson Synthesis Project, July 2011.

10 See "Primary Care Shortages Can Be Alleviated," Linda V. Green, Sergei Savin, and Lina Yu, Health Affairs, 32 no.1, 2013:11-19.

11 See, for example, Boyle, James P., Theodore J. Thompson, Edward W. Gregg, Lawrence E. Barker, and David F. Williamson. "Projection of the year 2050 burden of diabetes in the U.S. adult population: dynamic modeling of incidence, mortality, and prediabetes prevalence." *Popul Health Metr* 8, no. 1 (2010): 29; and Narayan, K. M., James P. Boyle, Linda S. Geiss, Jinan B. Saaddine, and Theodore J. Thompson. "Impact of recent increase in incidence on future diabetes burden U.S., 2005–2050." *Diabetes Care* 29, no. 9 (2006): 2114-2116.

Despite an increase in the supply of endocrinologist from 1999 to the present, demand will continue to exceed supply through 2025. Strategies to narrow this gap are discussed in this report.

List of Abbreviations

Abbreviation	Definition
AAMC	Association of American Medical Colleges
ABIM	American Board of Internal Medicine
AMA	American Medical Association
Bop	Bureau of Health Professions
COGME	Council on Graduate Medical Education
CPT	Current Procedural Terminology
DO	Doctor of Osteopathy
ES	Endocrine Society
FDA	Federal Drug Administration
FTE	Full time equivalent
GMENAC	Graduate Medical Education National Advisory Committee
GME	Graduate medical education
HRSA	Health Resources and Services Administration
ICD-9	International Classification of Diseases, Ninth Revision
IMG	International medical graduate
MBBS	Bachelor of Medicine, Bachelor of Surgery
MD	Medical doctor
MEPS	Medical Expenditure Panel Survey
MGMA	Medical Group Management Association
NIH	National Institutes of Health
NP	Nurse practitioner
NPC	Non-physician clinician
PA	Physician assistant
PPACA	Patient Protection and Affordable Care Act of 2010
TEP	Technical Expert Panel
UHG	UnitedHealth Group
VA	Veterans Affairs

I. INTRODUCTION

The *Endocrine Society* commissioned *The Lewin Group* to undertake a workforce study of clinical endocrinologists. The purpose of the study is to better understand the factors affecting the supply of and demand for endocrinologists, quantify the factors where possible, project the likely evolution of the workforce, and assess the implications of the results. This report presents the results of this workforce study which was a collaborative effort between the Endocrine Society and Lewin. Following this introductory section, which provides an overview of the endocrinology workforce, this report consists of the following major sections. Section II describes the methods used to project demand and supply. Section III focuses on the characteristics of the workforce and factors affecting the supply of endocrinologists and provides a baseline supply projection. Section IV describes the factors affecting the demand and provides a baseline demand projection. Section V combines both demand and supply projections in a baseline case and several alternative projection scenarios. The last two sections consist of discussion and conclusion.[12]

Research question: This work centers around a major question: *What is the projected supply of U.S. endocrinologists and the demand for their services?*

Overview of Workforce Studies Regarding Endocrine Workforce

Interest in physician workforce issues can be traced to the 1960s. The predominant concern was the adequacy of the physician workforce—ensuring that there were sufficient physicians to meet patient needs. To address this workforce issue, the Graduate Medical Education National Advisory Committee (GMENAC) was founded in 1976 by the U. S. Department of Health Education and Welfare. The goal was to estimate the need for physicians, by specialty, in the year 1990. The primary concern was to ensure that there would be sufficient physicians to meet the need. The Committee systematically began estimating the need for various physician specialties, using estimates based on the judgments of experts—a method that has come to be known as the "GMENAC" method.

While the notion of centralized planning of physician supply was implicit in GMENAC, it became somewhat more explicit with the establishment of the Council on Graduate Medical Education (COGME) in 1986. The emphasis shifted from concern regarding too few physicians, in general, to concern that there were too many specialists relative to generalists. Centralized planning of residency positions became explicit in the Clinton Administration's proposal for health care reform, the Health Security Act, in 1993.

The prospect of centralized planning of residency positions placed a premium on determining whether a given physician specialty was a shortage specialty or a surplus specialty. The challenge of centralized planning for physician supply has gained importance with the Patient Protection and Affordable Care Act (PPACA).

[12] A literature review of the issues surrounding the supply of and demand for endocrinologists, *The Endocrinology Workforce Literature Review*, was produced in April, 2012, by The Lewin Group.

Patient Protection and Affordable Care Act (PPACA)

The PPACA requires most Americans to have health insurance. To be assured access to affordable coverage, the Act expands the Medicaid program to cover all low-income adults living below 133 percent of the federal poverty level (FPL). The Act also provides a new premium subsidy program for people living below 400 percent of the FPL ($89,000 for a family of four). These subsidies are available for coverage purchased through new state health insurance exchanges established under the Act. People who do not have coverage will generally be subject to a penalty. Non-insuring employers with 50 or more workers will also pay a penalty.

Beginning in the new century, physician workforce studies have indicated an impending shortage of physicians, particularly specialists.[13,14,15] In 2003, COGME projected a shortage of approximately 85,000 physicians, mostly specialists, by 2020 unless there was a modest increase in U.S. medical school capacity.[16] This shift resulted from changes in two assumptions. First, the 1994 projections assumed continued growth of staff model HMOs, with the implication that this would restrain utilization of specialists. Second, the more recent models assume that continued economic growth will increase demand for specialty care. The premise of this argument was that advances in technology provide for an unlimited spectrum of services, particularly specialist services, providing health benefits, and use of these services is constrained only by our ability and willingness to pay.[17]

The topic that has focused the attention on the U.S. physician workforce more than anything else is the passage of the Patient Protection and Affordable Care Act (PPACA). This Act increases health care coverage by at least 30 million people not previously covered. Access to care will increase under this provision as it is rolled out over the decade. How this will affect the demand for endocrinology service is part of this analysis.

1. Incidence and Prevalence of Endocrine Disorders

Golden and colleagues published their synthesis of the literature of endocrine disorders within the U.S. in 2009. The prevalence estimates of an endocrinopathy of at least 5 percent in adults included diabetes mellitus, impaired fasting glucose, impaired glucose tolerance, obesity, metabolic syndrome, osteoporosis, osteopenia, mild-moderate hypovitaminosis D, dyslipidemia, and thyroiditis. Erectile dysfunction had a high incidence in males and osteopenia/osteoporosis had the highest incidence in females. The least prevalent conditions, affecting less than 1 percent of the U.S. population, were diabetes mellitus in children and pituitary adenoma. Conditions with the lowest incidence were adrenocortical carcinoma, pheochromocytoma, and pituitary adenomas. Certain disorders, such as hyperparathyroidism and thyroid disorders, were more common in females. The prevalence of diabetes mellitus was highest among ethnic minorities.

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13 Sargen M, Hooker RS, Cooper RA. "Gaps in the Supply of Physicians, Advance Practice Nurses, and Physician Assistants." *J Am Coll Surg*. 2011; 212 (6): 991-999.

14 Cooper RA, Getzen TE, McKee HJ, Laud P. "Economic and demographic trends signal an impending physician shortage." *Health Affairs*. 2002;21:140–154.

15 Bureau of Health Professions. "Changing Demographics and the Implications for Physicians, Nurses, and Other Health Workers." Washington, DC: U.S. Department of Health and Human Services; 2003.

16 Council on Graduate Medical Education. "Physician Workforce Policy Guidelines for the U.S. for 2000-2020." Washington, DC, U.S. Department of Health and Human Services; 2003.

17 A complementary hypothesis is simply that health care is a "normal" good. As real income per capita grows, the demand for many goods and services, including health, increases. It may be the case that the demand for specialty care increases by more than the demand for primary care as real income grows.

Data on the general population regarding pituitary, adrenal, and gonadal disorders were less known.[18]

2. Endocrinology Workforce

Endocrinologists are physicians trained in managing, diagnosing, and treating disorders of the endocrine system: thyroid, parathyroid, adrenal glands, hypophyseal and hypothalamic axes, ovaries, testes, and pancreas. Their role involves controlling diabetes mellitus, menopause, hyperthyroidism and other conditions involving metabolism. While most endocrinologists are internists by background, some are pediatricians or gynecologists. Pediatric endocrinologists also care for patients with disorders of growth, development and sexual differentiation. Moreover, because of the prevalence of some endocrinopathies, such as diabetes, primary care physicians, who are not endocrinologists, care for endocrine disorders.

Pediatric Endocrinologists complete four years of medical school, and three years of pediatric residency. After completing residency, individuals are eligible to become board certified in Pediatrics. Those interested in the subspecialty of Pediatric Endocrinology must then undergo three or more years of fellowship training in Pediatric Endocrinology, after which they are eligible to become certified in Pediatric Endocrinology through the American Board of Pediatrics.

Adult Endocrinology training in the United States consists of four years of medical school followed by a residency in Internal Medicine and then a fellowship of two years or more in Endocrinology. Overall, an endocrinologist's training may take more than nine years to complete.

Practice areas of endocrinologists include a variety of public and private settings. Public practice areas in the state and federal government include the Food and Drug Administration (FDA), National Institutes of Health (NIH), Veterans Affairs (VA), the Department of Defense and state and local departments of health. Private practice areas range from solo to diverse medical groups to small specialized group practices, and hospital settings, including teaching hospitals. Other practice areas include industry, academia, and research, though only a few endocrinologists solely conduct research and do not see patients.

In this study, we use three concepts of an endocrinologist. First, we consider only physicians who are board certified endocrinologists as endocrinologists. Second, of those who are board certified, we consider the number who are clinically active. That is, we consider board certified endocrinologists who are actively engaged in direct patient care, rather than, for example, full time research or administration. Third, we consider the notion of a **full-time equivalent endocrinologist**. The full time equivalent endocrinologist is an empirical definition and represents the services that are provided in a year by the typical or average board-certified endocrinologist engaged in clinical care. We distinguish between FTE adult endocrinologists and FTE pediatric endocrinologists. Because the typical pediatric endocrinologist is in an academic setting and spends less time in direct patient care, an FTE for a pediatric endocrinologist represents fewer services, compared to an adult endocrinologist.

[18] Golden SH, Robinson KA, Saldanha I, Anton B, Ladenson PW. Prevalence and incidence of endocrine and metabolic disorders in the United States: A comprehensive review. *J Clin Endocrinol Metab.* 2009, 94(6): 1853-1878.

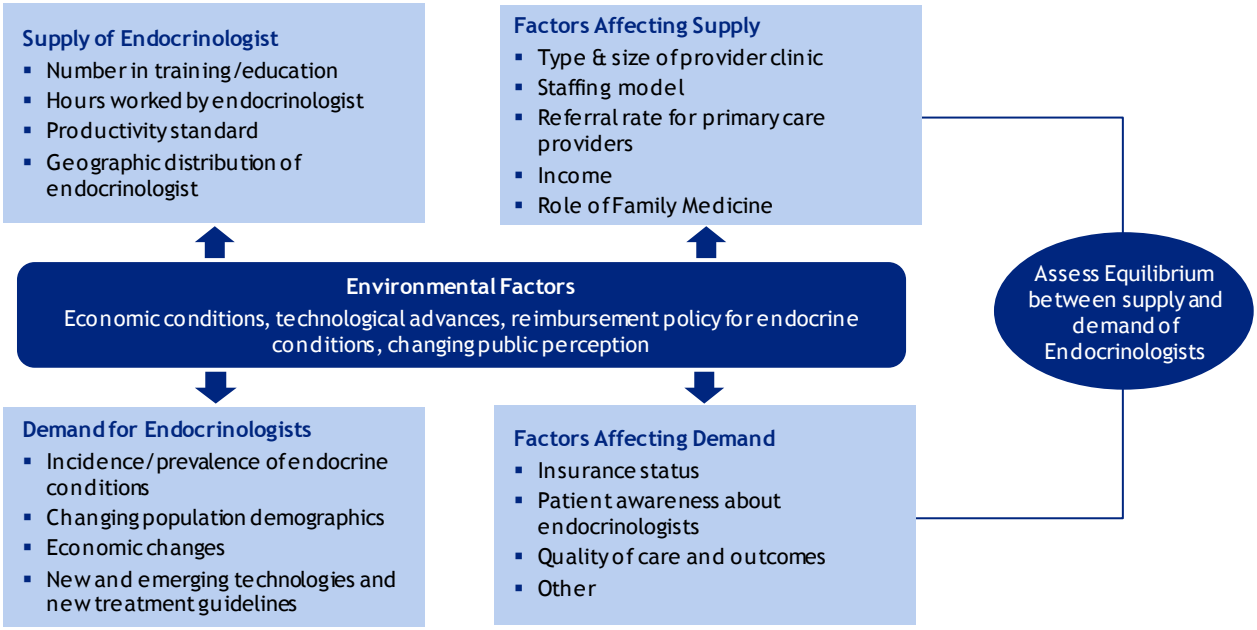
The first endocrinology workforce study, undertaken by The Lewin Group, used historical data leading up to 1999.[19] With the guidance of a panel of expert endocrinologists, the study used supply and demand modeling methods that drew data from a wide range of sources. In 1999, there were 3,623 adult endocrinologists and 719 pediatric endocrinologists who were board certified and/or fellowship trained. Of all endocrinologists, the median age was 49 years, with 72 percent male and 28 percent female (median age of 51 years and 44 years, respectively). Sixty-six percent of total endocrinologists held office-based practices. Both total office visits and services performed increased substantially in the 1990s, particularly in the area of diabetes management. Compared with a closed panel health maintenance organization, the national supply of endocrinologists (1999) was 12 percent lower than demand. The gap between supply and demand was not predicted to close, largely due to an inadequate supply of new endocrinologists and an aging population. A number of steps to stop the decline in the number of endocrinologists were recommended in the 2003 study. In retrospect, the HMO-controlled referral model did not evolve. As a result of this and other factors, the 2003 study underestimated the current demand. The definition of an endocrinologist in that earlier study was board certified and/or fellowship trained.

[19] Rizza RA, Vigersky RA, Rodbard HW, Ladenson PW, Young WF, Surks MI, KahnR, Hogan PF. A model to determine workforce needs for endocrinologists in the United States until 2020. Diabetes Care; 2003; 26(5): 1545-1552.

II. METHODOLOGY

In this section, we provide a description of the methods for projecting the supply of and demand for the services of endocrinologists. First, we consider factors affecting supply. In particular, we examine the number and fill rate of fellowship positions and trends in subspecialization among residents in internal medicine. We also consider trends in retirement and withdrawal from the labor force. Next, we consider factors affecting demand. The final step is to analyze estimates of the current services provided by endocrinologists and the share that other providers of the endocrinology and metabolic services may compete. ***Exhibit 1*** is a conceptual framework of assessing the supply and demand of endocrinologists and their services.

Exhibit 1. Conceptual Framework of Factors Affecting Endocrinologists' Supply and Demand



We approach the analysis of supply and demand using a variety of methods and data sources. One reason for this approach is that the data for the analysis of supply and demand for physician specialties, particularly specialties composed of physicians under 10,000, is small when national samples are used. Another reason is the need to triangulate data to see if findings from different sources are in agreement. Data used for the analysis of the endocrinologist supply and demand model included the following methods: expert consultations, survey investigation, and analysis of proprietary and publicly available databases.

The Endocrine Society Technical Expert Panel (TEP), an advisory group chaired by Robert A. Vigersky, M.D., contributed a significant source of institutional and clinical information relevant to the endocrinology physician workforce, in addition to further guidance for this study. The TEP provided their opinion and judgment of the current and future state of the health care market for endocrinology services, including its influencing factors. The TEP high-value perspective was integrated in the model, along with objective sources of data.

Endocrinology Workforce Technical Expert Panel

Robert Vigersky, MD (Chair)
Lisa Fish, MD
Kenneth Hupart, MD (APDEM Representative)
Stephanie Kutler
Paul Ladenson, MD
Michael McDermott, MD
Andrew Stewart, MD

The Lewin Group undertook an Endocrinologist Survey of the current workforce (***Appendix A***). The 46-question survey assessed endocrinologist demographics, and clinical and non-clinical practice characteristics (***Exhibit 2***). The survey was fielded to 1,689 board certified endocrinologist contacts randomly sampled from an AMA master file listing of board certified endocrinologists. A total of 355 survey responses were received (19 percent response rate). The survey results provided insight on real-time data that aligned with the data from other sources, including physician databases that were used as supply and demand sources. Sources used for the supply and demand projections are summarized below (***Exhibit 3)***.

Exhibit 2. Characteristics Examined from the Endocrinologist

Endocrinologist Characteristics	Select Metrics
Demographics	Race/Ethnicity, Citizenship, Medical Degree and Fellowship (type, location, and year of completion), Practice Characteristics (duration, location, employment status and setting), Job Satisfaction, Income
Clinical Practice	Type of Care, Duration in Each Practice Setting, Patient Load, Patient Population (age, diagnoses, insurance type), Technology Available, Research/Clinical Trials
Non-Clinical Practice	Future Employment Plans (reduced work hours and retirement plans), Research/Clinical Trials, Academic Setting

The effective supply depends on the number of clinically-active board certified endocrinologists, the number of physicians becoming board certified in Endocrinology and entering clinical practice, the number retiring or departing the endocrine workforce, and the number of working hours that the workforce contributes to direct patient care. For the purposes of this study, estimates of available clinical full time equivalent (FTE) in all practice areas were adjusted to reflect estimates of time spent in direct patient care. Baseline projections begin with a number of assumptions. In this model, we assume the number of entrants to the endocrine workforce remains at the current levels within age and gender categories. However, because the demographic composition of the population shifts over time, average direct patient care hours per endocrinologist may decline modestly over time.

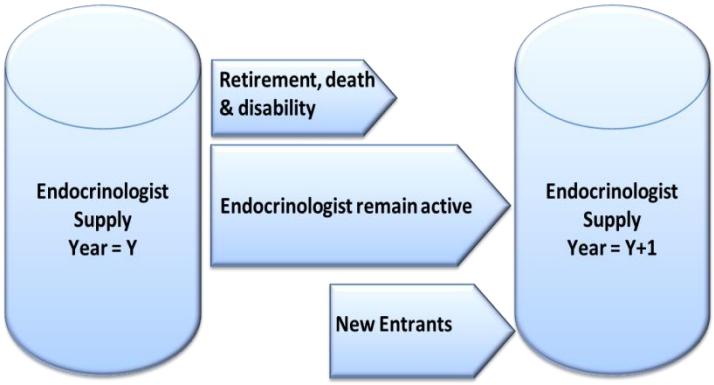
Exhibit 3. Data Sources of Supply and Demand Projections

Parameter	Data Sources
SUPPLY PROJECTIONS	
Active Supply	American Medical Association's Master File which included information on board-certified endocrinologists. Information on this list of board-certified endocrinologists was further enhanced using Provider 360
New Entrants	ABIM, Historical trends in number of fellowship, American Board of Pediatrics
Attrition Rate	Retirement rates from American Association of Medical Colleges' Over 50 Survey, Mortality Rates from U.S. Census 2010
DEMAND PROJECTIONS	
Population Projection	U.S. Census Projections, The Lewin Group Benefit Simulation Model for Impact due to PPACA
Utilization Rate	2008 and 2009 MEPS, Data from Medicare 5% sample and commercial claims data from OptumInsight's de-identified Normative Health Information system (dNHI)
Annual Visits Provided by Endocrinologists	Lewin Endocrinologist Survey, MGMA

We project the active supply of endocrinologists from 2010 through 2025. Supply projections of the endocrine workforce are based on an inventory model framework (***Exhibit 4***). The projection starts with the number of board certified endocrinologists in the base year (2011), and adds new entrants into the model each year. The attrition (subtraction) aspect of the model consists of endocrinologists who leave the workforce for reasons of emigration, change in professional activity, extended leave, retirement or death. We measure the count of endocrinologists in two ways. First, we present the "active supply" (sometimes referred to as the "stock"). The base year is adjusted to reflect only clinically active board certified endocrinologists by removing those who indicate in the 2011 AMA Master File, that their primary activity is administration, research, or that they are inactive. Projecting forward, clinically active endocrinologists are estimated by starting with the total number of board certified endocrinologists and subtracting out those whose primary activity that does not typically involve patient care (adjusted for the historical rate, by age and gender). , This method, thereby, adjusts new entrants into the profession to reflect the historical rate at which some of them will not be engaged in clinical care. The second measure is full-time equivalent supply or "FTE supply." This measure normalizes the count of physicians each year by average hours worked per physician in that year relative to the average hours worked by physicians in 2011.

To determine FTE supply, we use an empirical definition based on the survey. The "typical" or average endocrinologist is defined as the average hours and average productivity (visits per hour) estimated from the survey responses to the Endocrinologist Survey. The expected number of visits per year for the "typical" endocrinologist is defined as one full time equivalent endocrinologist. Note that, while an FTE endocrinologist is defined by the average or typical, endocrinologists of various age and sex combinations may provide more, or less, than one FTE, depending on how hours of work and productivity vary by age and sex.

Exhibit 4. Inventory Model Framework



Mathematically, active supply in the next year (Y+1) is a function of supply in the current year (Y) plus new entrants and minus attrition:

$$\text{Active Supply}_{Y+1} = \text{Active Supply}_{Y} + \text{New Entrants}_{Y} - \text{Attrition}_{Y}$$

New entrants (accessions) are physicians completing fellowship training, becoming board certified, and entering the workforce. Attrition is defined as physicians who have retired, died, or left the endocrinology workforce. The attrition rate based on AAMC survey[20] responses regarding intent to retire was not adequate for analysis.

The primary demand model is the population or more precisely the population ratio, augmented by estimates of the effect of health care reform and other providers derived from the econometric model. Using Medical Expenditure Panel Survey (MEPS)[21] along with private insurance claims[22], we calculated utilization rates for services provided by endocrinologists by patient age, gender, insurance status and region. We projected the demand for services provided by endocrinologists by multiplying the population projections with the age, gender and insurance-specific utilization rate for services provided by endocrinologists.

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[20] AAMC analysis of AAMC-AMA Survey of Physicians over Age 50 https://members.aamc.org/eweb/upload/The%20Complexities%20of%20Physician%20Supply.pdf

[21] MEPS is a major source of national data used for demand of medical services purposes, and it is composed of large-scale surveys of families and individuals, their medical providers, and employers across the United States. MEPS is the most complete source of data on the cost and use of health care and health insurance coverage. The MEPS 2008 data was used to construct utilization rates for the endocrinology specialty. It should be noted that the MEPS classifies physicians based on their self-reported primary specialty, while this report classifies physicians (specifically endocrinologists) based on their training and board certification.

[22] UnitedHealth Care proprietary claims data were probed to validate endocrinologist types of services.

Projecting demand for services provided by endocrinologists =

Population projections (age, gender, insurance)	**X**	**Utilization Rate (age, gender, insurance)**

The number of FTE endocrinologists needed to meet the demand is calculated by dividing the projected demand for services provided by endocrinologists with the average annual visits provided by endocrinologists. The supply model and the population-driven demand model form a system from which future projections are obtained.

Number of FTE Endocrinologists Needed =

$$\frac{\text{Projected demand for services provided by endocrinologists measured in visits}}{\text{the average number of annual visits provided by an FTE endocrinologist}}$$

***** *Adjusted by age, gender, region, and specialty*

Note that the concept of an FTE endocrinologist is the services that can be provided by a typical endocrinologist who is engaged in patient care on a full time basis. We use "FTE endocrinologist" to measure demand, in that the number of FTE endocrinologists demanded is a measure of the services (represented by an FTE endocrinologist) that are demanded. We also use an FTE endocrinologist to represent supply, because the number of full time equivalent endocrinologists that the workforce represents is a measure of the capacity of that workforce to deliver health care services. A common metric is necessary to compare supply and demand, and our method uses the FTE concept for this comparison.

III. RESULTS PART I: SUPPLY OF ENDOCRINOLOGISTS

The endocrinology workforce is defined as those physicians who are board certified in endocrinology. This includes adult endocrinologists and pediatric endocrinologists but, for the purposes of this study, excludes reproductive endocrinologists. Successful completion of an endocrinology fellowship program is a prerequisite for board certification. An estimated one percent of endocrinologists are from an era (before 1972) preceding board certification. They were given "grandfathered" certification status and are included in this analysis, though many actually took the board examination and passed. Moreover, endocrinologists who were initially board certified prior to 1990, estimated to be about 2,760, are not required to recertify every ten years as are other board certified endocrinologists.

A. Current Workforce

As of 2011, there were 5,496 adult endocrinologists and 1,016 pediatric endocrinologists, a total of 6,512, who were board certified and age 70 or less.[23] Of these board certified endocrinologists, approximately 4,841 adult endocrinologists and 893 pediatric endocrinologists were engaged in clinical practice.[24]

Exhibit 5. Number of Physicians Board Certified in Endocrinology and Number Engaged In Clinical Practice

	Board Certified			Clinical Practice		
	Male	Female	Total	Male	Female	Total
Adult	3,454	2,042	5,496	2,994	1,847	4,841
Pediatric	513	503	1,016	434	459	893
Total	**3,967**	**2,545**	**6,512**	**3,428**	**2,306**	**5,734**

Source: American Medical Association (AMA) 2011

There were about 15.5 adult, board certified endocrinologists in clinical practice per million persons in in the United States in 2011. Restricting the population to those over 18, there were approximately 21 clinically active board certified adult endocrinologists per one million population over the age of 18, while there were about 11 clinically active board certified pediatric endocrinologist per million of the U.S. population age 18 or under. Compared to other internal medicine subspecialties, the number of board certified adult endocrinologists falls in the middle of the distribution. There are slightly fewer rheumatologists, compared to adult endocrinologists, and slightly more infectious disease specialists.

1. Demographic Characteristics

Understanding the statistical characteristics of the endocrinologist workforce population is important for modeling the quantity of clinical care that can be delivered by that workforce.

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[23] American Medical Association Master File extract, 2011.

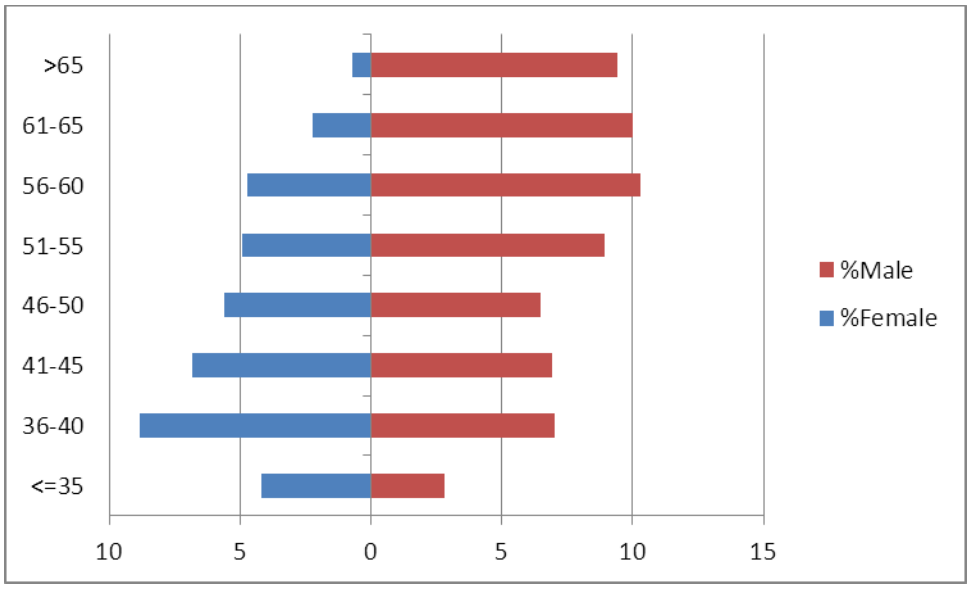
[24] To be engaged in clinical practice, their primary activity, as reported in the AMA Master File, could not be research or administration, and they could not be classified as inactive. In addition to those in office-based practice, we did include those who were hospital staff, those who were medically teaching, and those with no classification in the count of those engaged in clinical practice.

Characteristics include age, gender, education, employment setting, effort devoted to clinical activities and geographical deployment.

Age and Gender

The 2011 population-pyramid of board certified, clinically active adult endocrinologists shows the age and gender distribution of all adult endocrinologists, with approximately 62 percent male endocrinologists and 38 percent female in ***Exhibit 6.*** The mean age of adult endocrinologists in 2011 was 51 and the median age was 48. A high percentage of males are in the age range above 50 years and this band of males is being replaced by a large proportion of females in age bands less than 50 years. One implication is that a significant proportion of the workforce will be retiring by 2020 or earlier. In 2011, the mean age of adult endocrinologists was 51 years and the median age was 48 years.

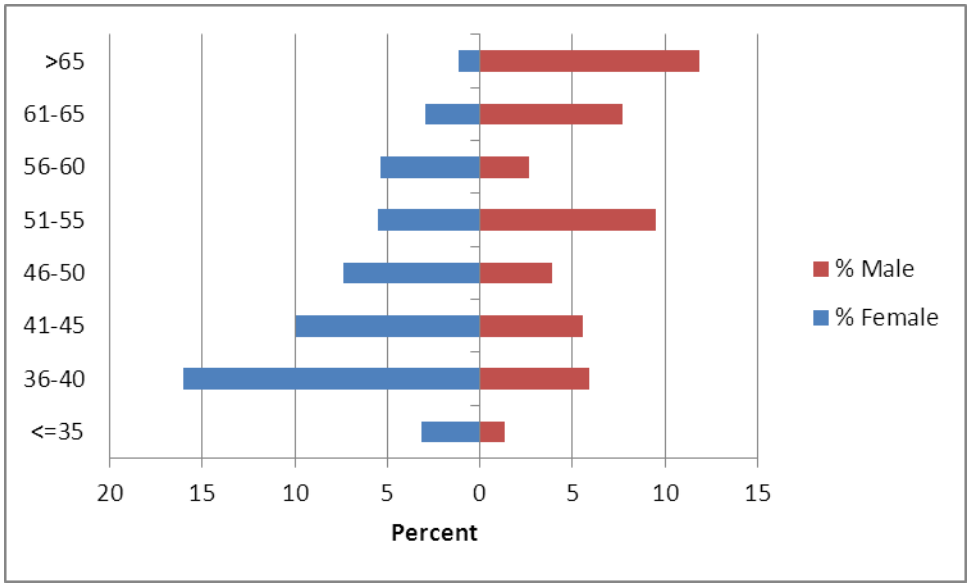
Exhibit 6. Profile of Adult Endocrinologists by Age and Gender in 2011
38 Percent Female and 62 Percent Male
(Percentage)



Source: The Lewin Group analysis of 2011 AMA Masterfile and Provider 360

Exhibit 7 shows the age and sex distribution for pediatric endocrinologists. The mean age of pediatric endocrinologists engaged in clinical practice was about 50 in 2011 and the median age was about 48.5. In contrast to adult endocrinologists, only about 49% are men.

Exhibit 7. Profile of Pediatric Endocrinologists by Age and Gender in 2011
51 Percent Female and 49 Percent Male
(Percentage)



Exhibits 8 and ***9*** show the age and gender distribution of adult endocrinologists and pediatric endocrinologists by age. Older adult endocrinologists are primarily male, while younger endocrinologists are more evenly distributed between the sexes. Pediatric endocrinologists are predominately female in the younger age cohorts. The average age of male adult and pediatric endocrinologists is significantly greater than the average age of female adult and pediatric endocrinologists.

Exhibit 8. Age Distribution of Adult Board Certified Endocrinologists In Clinical Practice

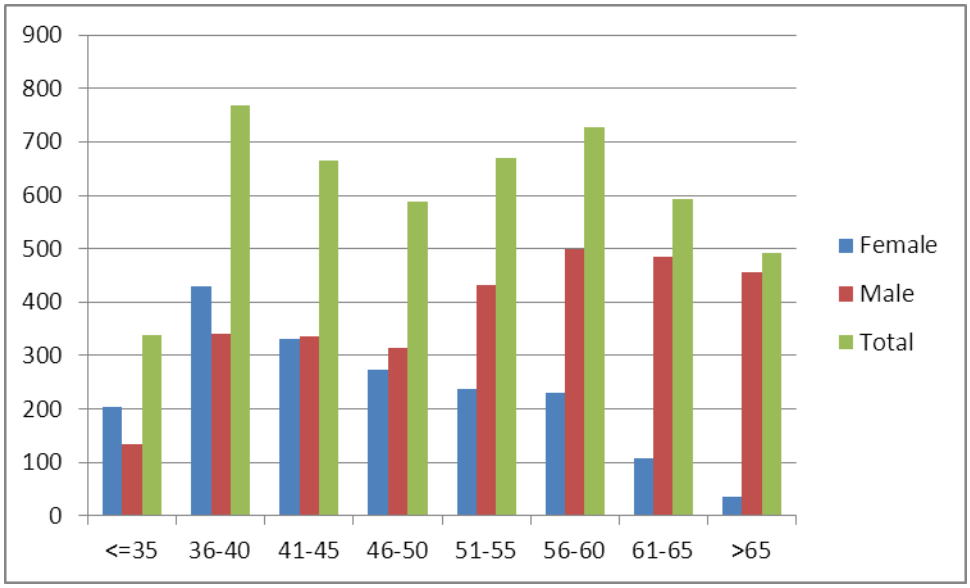
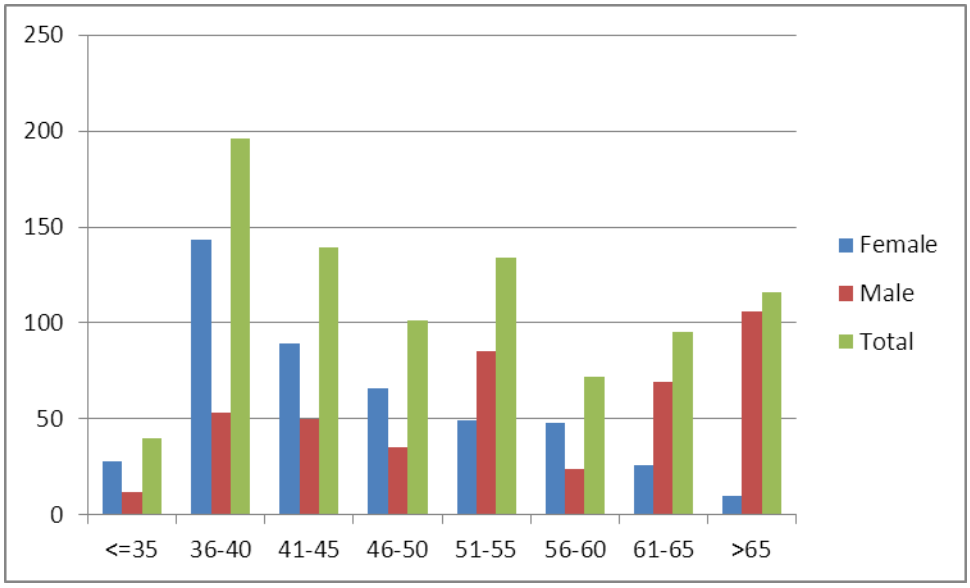


Exhibit 9. Age Distribution of Board Certified Pediatric Endocrinologists in Clinical Practice



Country of Education

International medical graduates (IMGs), physicians who graduate from a medical school outside of the U.S., represent nearly a quarter of the endocrinology workforce in the United States (***Exhibit 10***). This proportion is generally consistent with physicians specializing in internal medicine and with physicians in office-based medical practice.[25] Though precise numbers are not known, most studies of IMGs suggest that the vast majority of IMGs who become board certified in the United States remain in the country after completion of their training.[26] IMGs may be provided waiver visas to continue practicing in the United States. The proportion of IMGs in the endocrinologist workforce and in the workforce of internal medicine and its subspecialties is likely to increase over time. In 2010-2011, 47 percent of the endocrinology first year fellows were IMGs, while the percentage of first year residents in internal medicine who were IMGs was 45 percent. Among internal medicine subspecialties, the highest percentage of first year fellows who were IMGs was geriatrics, at 67 percent, while the lowest percentage was in gastroenterology, at 29 percent.

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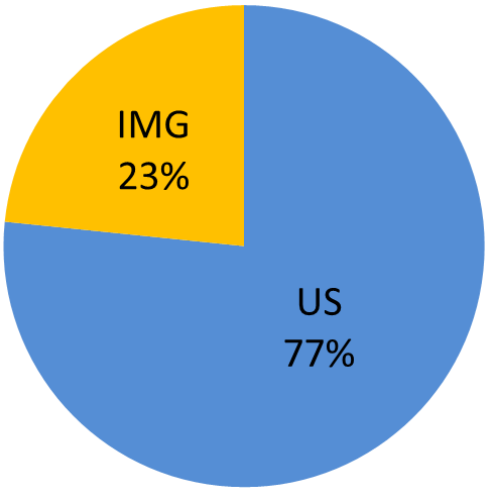
[25] For trends in International Medical School graduates in the United States, see Eli K. Aki, MD, PPH; Reem Mustafa, MD; Fadi Bdair, MD; and Holger J. Shunemann, MD, Ph.D., "The United States Physician Workforce and International Medical Graduates: Trends and Characteristics." *Journal of General Internal Medicine*, 2007 February 22(2):264-268. Also see Esther Hing, MPH and Susan Lin, DPH, "Role of International Medical School Graduates Providing Office-Based Care: United States, 2005-2006." National Center for Health Care Statistics Brief no. 13, February 2009. A table depicting IMG percentages in internal medicine and the internal medicine subspecialties is available from the American Board of Internal Medicine at http://www.abim.org/about/examInfo/data-fellow/chart-05.aspx.

[26] See Aki et al (2007) and Hing and Lin (2009), op. cit.

Exhibit 10. Proportion of International Medical Graduates among Endocrinologists



Source: The Lewin Group analysis of the 2012 Endocrinologists Survey, n=355

Primary Employment Activity

About 70 percent of adult endocrinologists practice in office-based settings compared to slightly more than 56 percent of pediatric endocrinologists (***Exhibit 11***). About 14 percent of pediatric endocrinologists indicate that they work in a hospital-based setting, compared to 8 percent of adult endocrinologists. Two percent of both adult and pediatric endocrinologists report medical teaching as their primary activity, while 11 percent of pediatric endocrinologists report research as their primary activity compared to 8 percent of adult endocrinologists.

It is doubtful that there will be a significant transition in the endocrinologist workforce from clinical practice to research areas, unless significant resources are devoted to funding research. Based on results from a web-based survey of physicians joining The Endocrine Society from 1991-2005,

> *"…approximately 69.7% of respondents reported that researchers receive less compensation than clinical care specialists. Similarly, 70.1% of respondents noted that research careers are unattractive relative to those involving clinical care due to expectations to produce publications and obtain extramural research support. About 58.8% of respondents noted that job uncertainty is a significant issue for researchers versus a career in the clinical service sector."*[27]

Additionally, the President's budget proposes only a modest increase for the National Institutes of Health for FY 2015; the budget provides NIH with $30.2 billion compared to $29.9 in FY 2014. Barring substantial increases in resources to research funding, a career in research is likely to be less appealing than clinical endocrinology due to lower compensation, publishing expectations, and job uncertainty.

Exhibit 11. Practice Activity for Adult and Pediatric Endocrinologists

	Office Based	Hospital	Medical Teaching	Admin.	Research	Not classified/ Other	Inactive
Adult	70%	8%	2%	1%	8%	8%	2%
Pediatric	56%	14%	2%	0%	11%	15%	1%

Source: American Medical Association Masterfile, 2011.

Geographic Distribution of Endocrinologists

The geographical distribution of endocrinologists is uneven. As is the case with many other specialists, endocrinologists are more highly concentrated in New England and Middle Atlantic

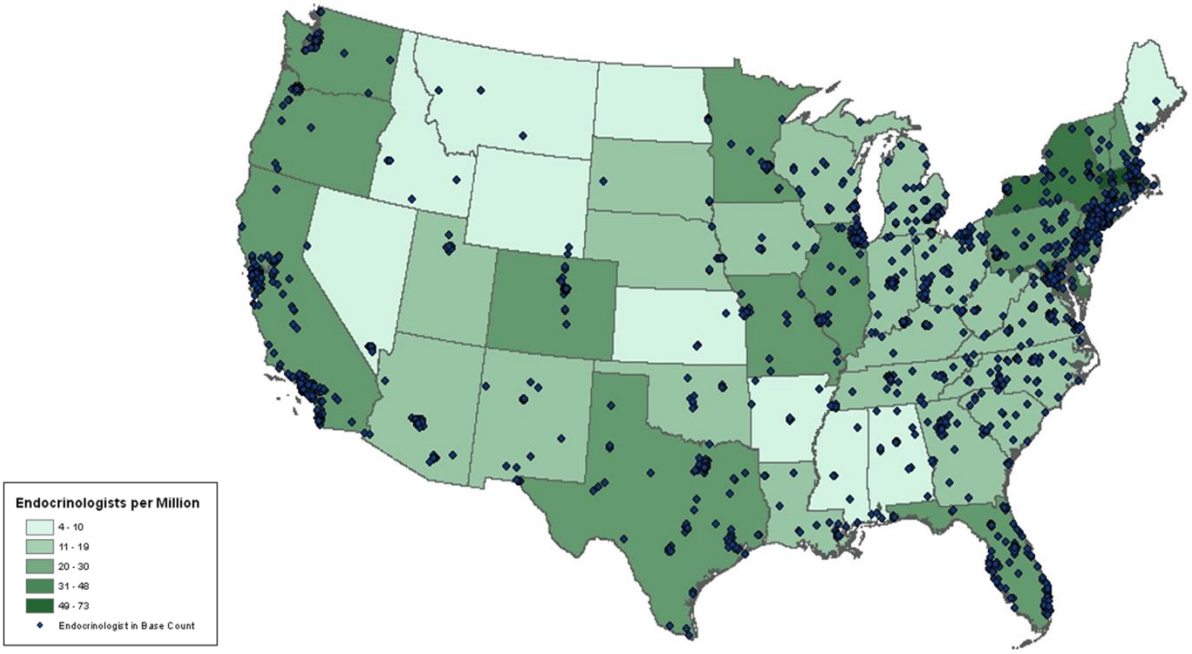
[27] Web-based Survey of Physicians Joining the Endocrine Society, Endocrine Society, 2006.

regions of the country (***Exhibit 12***). This has often been attributed, for specialties in general, to the phenomenon that physicians tend to practice in the geographic area near where they received their fellowship training. More generally, physicians tend to be over represented in the Northeast and in large urban areas.[28]

> *"When comparing the geographic distribution of physicians to the U.S. population at large, physicians were overrepresented in the Northeast and large metropolitan areas – likely reflecting in some cases patients traveling to urban areas for specialized services – and underrepresented in the South."*

Moreover, it is argued that specialists, such as endocrinologists, are more likely to choose to practice in more densely populated areas, compared to underserved or rural areas, because these areas provide for a more lucrative practice.[29] Endocrinologists are scarce in the South East Central, South West Central, North West Central and Mountain Central Census regions.

Exhibit 12. Concentration of Board Certified Endocrinologists Across the U.S



Source: The Lewin Group analysis of 2011 AMA Master File and Provider 360

Comparison to Lewin 2003 Study[30]

The difference in the supply of endocrinologists since the 2003 Lewin study, which analyzed data up to 1999, is due to a variety of political and societal changes. The earlier study defined an

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[28] Ellyn Boukos, Alwyn Cassil, and Ann O'Malley, "A Snapshot of U.S. Physicians: Key Findings from the 2008 Health Tracking Survey." Data Bulletin No.5, *Center for Studying Health System Change*. September, 2009.

[29] "Specialty and Geographic Distribution of the Physician Workforce: What Influence Medical Student and Resident Choices?" Robert Graham Center, March 2009.

[30] "Workforce Study of Endocrinologists," Paul F. Hogan et al, The Lewin Group. March, 2001.

endocrinologist as board certified and/or fellowship trained. In this study, we focus on board certified endocrinologists. However, the differences are likely to be small.

The number of board certified adult endocrinologists[31] in the base year, 1999, of the earlier study was 3,623, while the number of board certified adult endocrinologist in this study, for 2011 was, 5,496. This is a net increase of 1,873 or about 156 board certified endocrinologists per year. First year fellows, over this period, increased from about 160 in 1999 to 280 by 2010. Hence, taking into account attrition, the 1999 estimate and the 2011 estimate appear to be consistent with each other. Moreover, the original study baseline prediction of the supply of adult endocrinologists in 2011 was about 4,600. However, this held fellowship positions constant at the 1999 level. If we were to enter the actual fellowship positions in this projection, the original study forecast for 2011 would be roughly between 5,300 and 5,450 compared to the actual number of about 5,500.

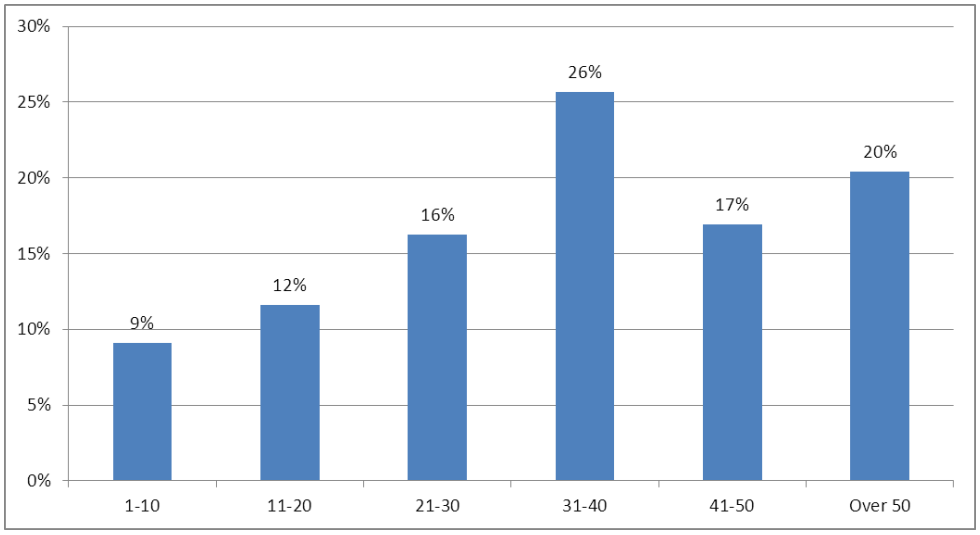
2. Hours of Work and Visit Capacity

A key factor affecting the supply of endocrinologists is the number of visits produced by each endocrinologist. ***Exhibits 13a to 13c*** show the distribution of survey respondents by number of hours in direct patient care for adult, pediatric, and all endocrinologists. The mean number of weekly hours in direct patient care is approximately 39. Almost 40 percent of the survey respondents indicated that they provide more than 40 hours of direct patient care per week. Note that the variance in hours is likely to be driven by the variance in the physician's primary activity. For example, those physicians largely engaged in office-based practice will have a much higher number of direct patient care hours than, for example, physicians who are on the faculty of a university. It is important to underscore that these "direct patient care" hours do not include hours used for teaching, administration, and continuing education, so that the total numbers of hours worked per week are actually substantially higher. They do include in-patient care as well as outpatient care.

Comparing ***Exhibit 13b*** and ***Exhibit 13c***, adult endocrinologists devote more time to direct patient care than do pediatric endocrinologists. This is because most pediatric endocrinologists are in an academic setting, where they must divide their time between clinical activities, teaching, and research.

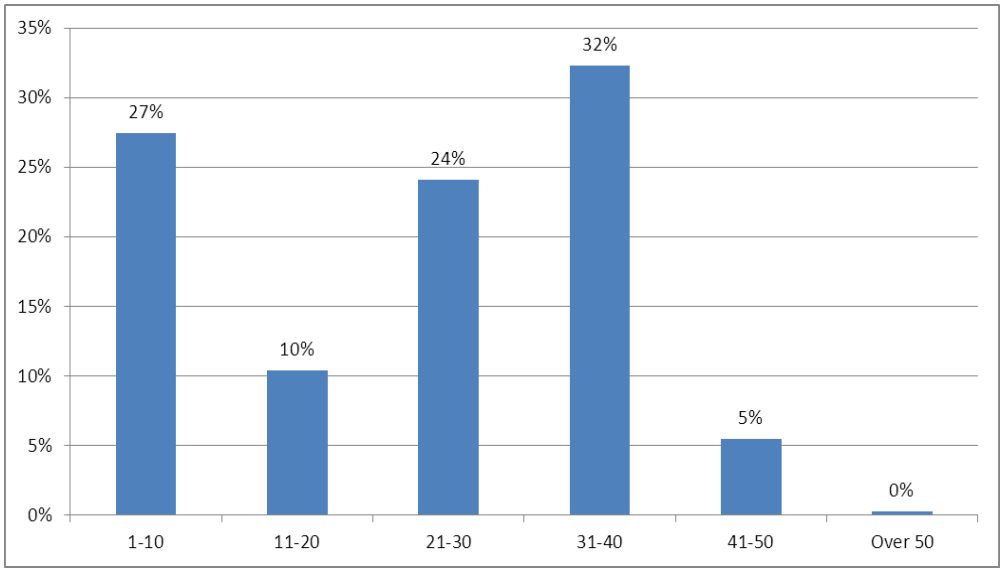
[31] The 2001 study included as board certified those endocrinologist who were "grandfathered" when certification began in 1973.

Exhibit 13a. Distribution of Survey Respondents by Number of Hours in Direct Patient Care (All Endocrinologists)



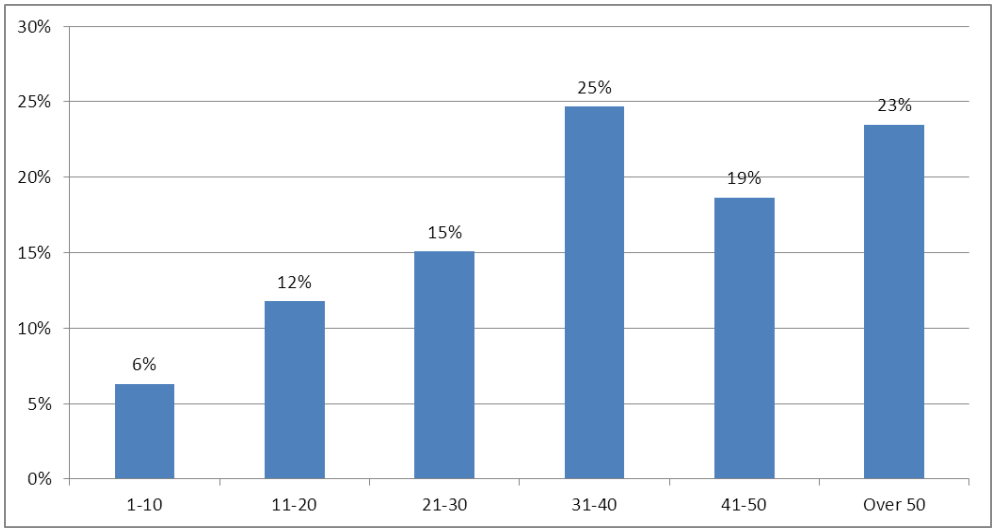
Source: The Lewin Group analysis of 2012 Endocrinologists Survey responses, n=355

Exhibit 13b. Distribution of Survey Respondents by Number of Hours in Direct Patient Care (Pediatric Endocrinologists)



Source: The Lewin Group analysis of 2012 Endocrinologists Survey responses, n=47

Exhibit 13c. Distribution of Survey Respondents by Number of Hours in Direct Patient Care (Adult Endocrinologists)



Source: The Lewin Group analysis of 2012 Endocrinologists Survey responses, n=308

Exhibits 14a to ***14c*** identify the average direct patient care hours for a typical week and the annual number of visits by age and gender for adult, pediatric, and all endocrinologists. These means are for endocrinologists who spend at least part of their time seeing patients. Note that individual cell means are based on the Endocrinologist Survey. The overall means are computed using population weights and hence represent the expected mean for the clinically active population of endocrinologists. The results in ***Exhibit 14a*** suggest that the average male endocrinologist provides about 35 percent more visits annually than the average female. The difference in direct patient care hours between male and female endocrinologists is higher in the younger age ranges. Since the share of women endocrinologist is expected to increase over the next 20 years, this suggests that the average number of visits produced annually by endocrinologists may decline. It is also important to note that endocrinologists over age 65 provide about 20 percent fewer visits than their younger colleagues.

Exhibit 14a. Average Weekly Direct Patient Care Hours and Visits per Year by Age and Gender (All Endocrinologists)

Age Range	Direct Patient Care Hours (Male)	Visits Per Year (Male)	Direct Patient Care Hours (Female)	Visits Per Year (Female)	Overall Direct Patient Care Hours	Overall Number of Visits per Year
35-40	37.9	3,410	31.4	2,433	34.0	2,815
41-45	66.5	4,606	35.9	2,461	48.2	3,475
46-50	44.3	2,870	60.0	2,911	52.3	2,891
51-55	38.0	3,447	37.4	2,222	37.8	2,981
56-60	40.5	2,990	36.5	2,355	39.3	2,809
61-65	37.7	3,761	26.1	1,734	35.5	3,271
Over 65	31.0	2,411	20.5	1,296	30.7	2,377
Overall	**40.8**	**3,299**	**37.8**	**2,444**	**39.6**	**2,955**

Source: The Lewin Group analysis of 2012 Endocrinologists Survey responses, n=355

Direct patient hours for pediatric endocrinologists (***Exhibit 14b***) are lower than adult endocrinologists because most pediatric endocrinologists are in an academic setting. Though clinically active, teaching and research reduce the time available for direct patient care for pediatric endocrinologists. Hence, a typical pediatric endocrinologist will provide fewer direct patient care services than the typical adult endocrinologist.

Exhibit 14b. Average Weekly Direct Patient Care Hours and Visits per Year by Age and Gender (Pediatric Endocrinologists)

Age Range	Direct Patient Care Hours (Male)	Visits Per Year (Male)	Direct Patient Care Hours (Female)	Visits Per Year (Female)	Overall Direct Patient Care Hours	Overall Number of Visits per Year
35-40	17.9	1,765	34.2	1,721	28.7	1,736
41-45	22.0*	1,532*	32.6	1,513	29.8	1,518
46-50	26.0	2,655	30.0	3,240	28.1	2,695
51-55	19.9	2,415	32.5*	2,268*	26.5	2,338
56-60	18.0	1,542	35.0	2,828	24.6	2,044
61-65	22.7	1,543	11.7	3,072	19.1	2,040
Over 65	24.0	1,675*	25.0	1,744*	24.1	1,683*
Overall	**21.7**	**1,840**	**31.0**	**2,158**	**26.3**	**1,964**

*Insufficient sample sizes required an imputation.
Source: The Lewin Group analysis of 2012 Endocrinologists Survey responses, n=47

Exhibit 14c. Average Weekly Direct Patient Care Hours and Visits per Year by Age and Gender (Adult Endocrinologists)

Age Range	Direct Patient Care Hours (Male)	Visits Per Year (Male)	Direct Patient Care Hours (Female)	Visits Per Year (Female)	Overall Direct Patient Care Hours	Overall Number of Visits per Year
35-40	39.8	3,474	30.9	2,573	34.6	2,956
41-45	66.5	4,606	36.8	2,834	50.7	3,818
46-50	44.6	2,907	62.0	2,885	53.3	2,896
51-55	39.9	3,508	37.4	2,222	38.9	3,002
56-60	42.3	3,071	36.7	2,258	40.7	2,860
61-65	39.0	3,902	28.1	1,704	37.0	3,354
Over 65	31.6	2,853	20.0	1,296	31.2	2,377
Overall	**42.2**	**3,434**	**38.7**	**2,484**	**40.8**	**3,080**

Source: The Lewin Group analysis of 2012 Endocrinologists Survey responses, n=308

Evidence from the 2012 Endocrinologists Survey suggests that the average number of visits provided annually by an adult endocrinologist varies depending on the age and gender of the endocrinologist. This result is generally consistent with the literature. There is a large cohort of adult endocrinologists who are between ages 61 and 65 years (***Exhibit 14c***). As this cohort ages,

the survey data indicates that they will likely reduce their work effort, resulting in a decline in the mean number of visits produced by the average endocrinologist.

3. Empirical Definition of a "Full-Time Equivalent" Endocrinologist

For supply and demand computations, we adopt an empirical definition of a full-time equivalent (FTE) endocrinologist. Our empirical definition is that an FTE is the expected number of clinical patient visits that the typical or average endocrinologist provides in a year. It is based on the results of the survey, weighted to the population.

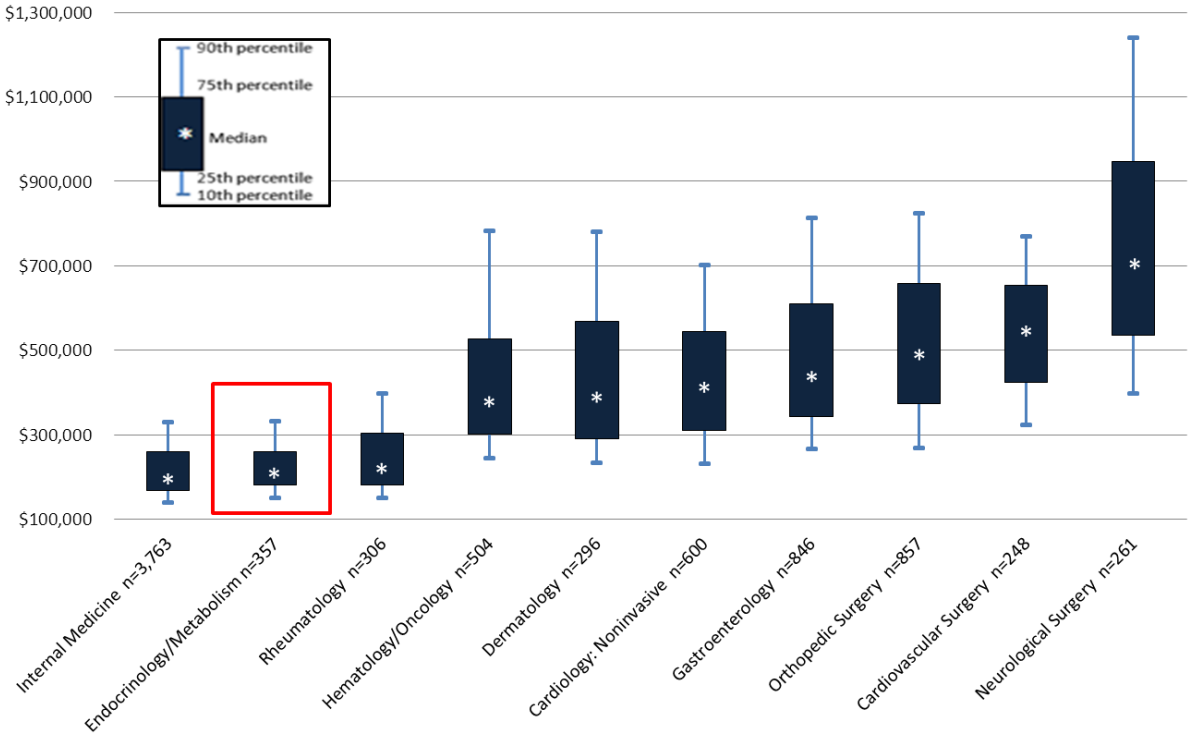
Based on this empirical definition, an FTE pediatric endocrinologist provides 1,964 visits per year, while an FTE adult endocrinologist provides about 3,038 visits per year. Note that these estimates are close to the estimate for endocrinologists from the Medical Group Management Association (MGMA) Physician Compensation and Productivity Report (2011) which estimates 1,922 visits per year for pediatric endocrinologists and 3,314 visits per year for adult endocrinologists.

Because hours and productivity vary by the age and sex of the endocrinologist, the average productivity of the workforce will change as the demographic mix of the workforce changes. We measure the workforce's productivity, however, relative to the empirical standard for an FTE we have established in the base year. Hence, the same number of endocrinologists may provide different FTEs, depending on the demographics of those endocrinologists.

4. Income Level of Endocrinologists

The median income of endocrinologists in 2010 was $211,400, based on the Medical Group Management Association (MGMA) non-self-reported administrative data (***Exhibit 15***). These figures are for endocrinologists employed in group practices for more than one year, and are similar to those reported in the 2012 endocrinologist survey (***Exhibit 16***). Median compensation for endocrinologists is relatively low compared to other, more procedure based subspecialties, such as noninvasive cardiology and gastroenterology (median incomes of $431,740 and $463,955, respectively), but similar to the other cognitive subspecialties, such as rheumatology. Typically, endocrinologists' compensation is not significantly different from an internal medicine (IM) specialist, even though an IM residency is required prior to beginning an endocrinology fellowship. Compared to other specialties, such as neurosurgery, dermatology, radiology, gastroenterology, hematology-oncology, orthopedics, ophthalmology, cardiology, etc., endocrinologists retire at a later age. This might be due to the more robust financial position at retirement of some other physician specialties compared to endocrinologists.

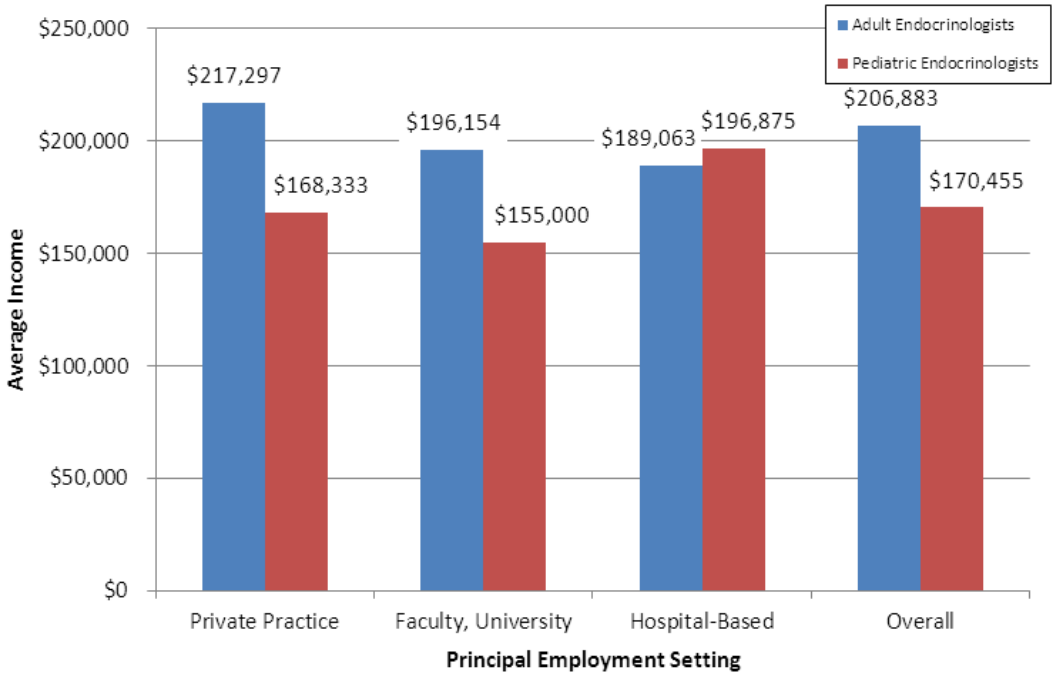
Exhibit 15. Comparison of Physician Compensation by Specialty (More than 1 year in Specialty)



Source: Medical Group Management Association (MGMA), Physician Compensation and Production Survey (2011)

Based on the results of the Endocrinologist Survey, adult endocrinologists have a higher income than pediatric endocrinologists (***Exhibit 16***). In addition, the endocrinologists in solo and group practice have a higher income than other endocrinologists. In the hospital-based setting, the pediatric endocrinologists have a higher income compared to adult endocrinologists.

Exhibit 16. Average Income of Endocrinologists by Principal Employment Setting, 2011



Source: The Lewin Group analysis of 2012 Endocrinologists Survey responses, n=355

B. Factors Affecting Supply

The main factors affecting the supply of endocrinologists are the number and fill rate of fellowship positions, the retention of the endocrinologist workforce in general, and the commitment of the endocrinologist to clinical practice compared to research or administration. We also consider trends in retirement and withdrawal from the labor force (i.e., attrition). The supply of endocrinologists is the stock of practicing endocrinologists, coupled with the net effects of the flow of new entrants from fellowship positions into the workforce and the flow out of the workforce due to retirement and mortality. Determination of new entrants to the endocrinology workforce from fellowship programs each year was used to estimate the future supply. Only fellowship trained endocrinologists are considered new entrants.

1. Trends in Fellowship

New Entrants of Adult Endocrinologists include accessions into a work field. The annual entrants into the endocrinology workforce in 2012 were estimated at 280, based on the same number of first year fellows in 2010 as reported by the ABIM for 2011. For modeling purposes, the assumption is that the endocrinology fellowship was completed within two years of the start date. From 2001 through 2011, there has been an increase of 73 first year fellowship positions, or an average increase of about 8 new fellowship positions per year. This is a growth rate in first year positions over this period of about 3.4 percent per year (***Exhibit 17***). This annual growth is consistent with the other internal medicine subspecialties such as nephrology, with annual growth in first year fellowship positions of about 14. However, all residency and fellowship positions funded by the Medicare graduate medical education (GME) program are currently capped. Moreover, there is an effort to shift more GME funded positions toward primary care and

away from subspecialty training. Fellowship programs may receive direct funding from their respective hospitals. Historically, however, self-funding has not been a major source of increasing fellowship positions. For the purposes of the current model, we held the entrants of endocrinology fellowships at 280, based on the 2011 ABIM information, but add in a scenario of an increase in annual fellowships.

Exhibit 17. Number of First-Year Fellows by Subspecialty

	01/02	02/03	03/04	04/05	05/06	06/07	07/08	08/09	09/10	10/11
Clinical Cardiac Electrophysiology	61	97	109	92	89	90	141	134	156	133
Endocrinology	**207**	**219**	**224**	**254**	**231**	**260**	**259**	**259**	**286**	**280**
Gastroenterology	383	396	403	419	429	427	452	457	479	515
Geriatrics	299	307	300	287	282	256	251	230	216	206
Infectious Disease	303	299	315	313	339	329	343	361	353	415
Interventional Cardiology	197	206	219	171	169	158	250	249	248	271
Nephrology	369	383	386	393	392	412	424	426	448	499
Hematology	19	16	9	11	13	11	13	12	11	16
Oncology	70	74	77	45	69	61	76	79	68	45
Hematology/Oncology	387	489	420	447	450	454	450	465	478	515
Pulmonary	53	56	58	51	55	40	56	38	39	44
CCM	93	100	105	84	81	97	101	102	115	129
Pulmonary/CCM	346	347	385	380	398	429	421	430	475	486
Rheumatology	163	167	166	173	188	178	191	199	211	219

Source: ABIM tracking database, 2001/2002 to 2010/2011 as of June 6, 2012

Growth of Pediatric Endocrinology Graduates has historically increased at a rate of 6.6 percent per year. A cumulative total of 1,461 Pediatric Endocrinologist Diplomat certificates have been issued through December 31, 2011, though the number of active board certified pediatric endocrinologists is less than this through mortality and retirement. Based on data from the American Board of Pediatrics' master file, there has been a substantial increase in first year fellowship positions in pediatric endocrinology, growing from 41 in 1998 to 94 in 2011, a growth rate of about of 6.6 percent per year (***Exhibit 18***)

Exhibit 18. Pediatric Endocrinology Training Level Tracking Data

Year Starting Jul 1	Training Level 1	Training Level 2	Training Level 3	Total
1998	41	28	27	93
1999	45	39	31	115
2000	49	32	38	119
2001	53	51	33	137
2002	73	47	50	170
2003	79	61	48	188
2004	71	72	57	200
2005	76	72	65	213
2006	89	75	66	230
2007	77	80	68	225
2008	93	81	76	250
2009	86	89	75	250
2010	98	79	84	261
2011	94	94	73	261

Source: the American board of Pediatrics 2011-2012

Issue of Recertification

For those endocrinologists who originally became board certified after 1990, recertification is required to maintain board certification every ten years. This recertification program is called Maintenance of Certification (MOC). Statistics indicate that over 90 percent taking recertification exams pass the first time, and the ultimate recertification pass rate is over 96 percent.[32] Endocrinologists who were initially board certified prior to 1990 are not required to recertify. There are approximately 69,000 diplomats of the American Board of Internal Medicine who have time-unlimited certification, often known as "grandfather status." Only about 1 percent of these individuals have chosen to become recertified by participating in the Maintenance of Certification program.[33] Some of the major reasons for not participating in the recertification process were: the amount of time required to prepare, lack of relevance to practice, expense of the process, and the fact that recertification was not required for employment.[34] While the examination is critical, as failure can affect a physician's practice (although physicians with time-unlimited certification do not lose their certification if they fail the examination), the ultimate pass rate is about 96% for all physicians.[35] For Endocrinology specifically, the pass rate for first-time takers with valid time-limited certificates rates improved over time (76% in 2007, 86% in 2008, 77% in 2009, 84% in 2010, 91% in 2011, 82% in 2012, and 86% in 2013).[36] Additionally, candidates who are unsuccessful on a

[32] See American Board of Internal Medicine, First Time Taker Pass Rates: Maintenance of Certification. http://www.abim.org/pdf/pass-rates/moc.pdf.
[33] http://www.nejm.org/doi/full/10.1056/NEJMclde1003227
[34] http://www.nejm.org/doi/full/10.1056/NEJMclde1003227
[35] http://www.nejm.org/doi/full/10.1056/NEJMclde1003227
[36] http://www.abim.org/pdf/pass-rates/moc.pdf

Maintenance of Certification exam can retake the exam during any future exam administration. There is no restriction on the total number of opportunities for re-examination.[37] However, of those certified in endocrinology between 1990 and 2002, only 79% have recertified by February, 2014 (http://www.abim.org/pdf/completion-rates/MOC-completion-rate-overview.pdf accessed on 9 APR 2014). Insurers and hospitals may impede the ability of these physicians who have not recertified from practicing in their specialty.

Because (1) most endocrinologists certified prior to 1990 are "grandfathered" and do not require recertification; (2) recertification is required only every ten years; and (3) because the ultimate pass rate is about 96 percent, we do not believe that failure to maintain certification is a significant form of attrition from the profession.[38] Finally, to our knowledge, there is no evidence at this time that the failure to recertify by those required to do so to maintain board certification has affected practice of those fellowship-trained endocrinologists.

2. Trends in Attrition

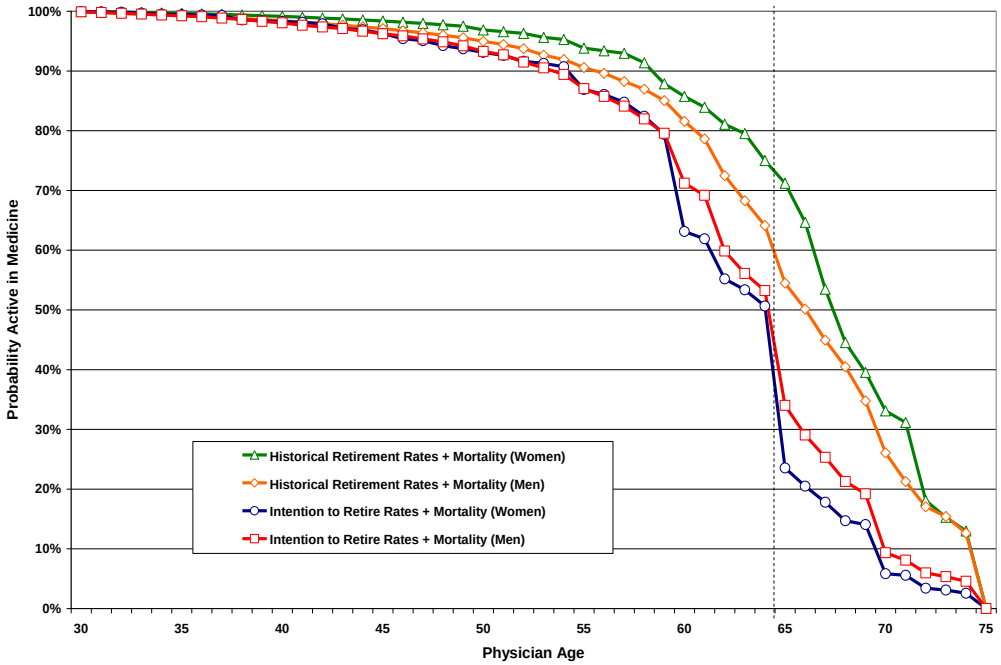
Attrition in this study is defined as anyone departing the workforce who claimed endocrinologist status, based on the AAMC over 50 physician survey responses of internists. Any person departing a workforce for any reason is assigned to the attrition category, whether it is due to retirement, death, emigration or leave of absence

Retirement is the point when a worker stops that work completely. The Association of American Medical Colleges (AAMC) surveyed physicians over and under 50 years of age. Internists were part of a sub analysis. Analysis of the data suggests that although female physicians expect to retire slightly earlier than their male colleagues, they have similar historical retirement patterns (***Exhibit 19***). Because women have lower mortality rates than men, overall attrition rates, based on intention to retire, are similar for men and women. In our model, we apply retirement and mortality rates that vary both by age and by sex.

[37] http://www.abim.org/moc/policies.aspx#other

[38] For those under age 50, the 4% (every ten years) failure rate would amount to an annualized attrition rate of 0.4% per year, beginning at about age 40.

Exhibit 19. Probability of Physician Remaining Active in Medicine by Age



Source: AAMC Analysis of AAMC-AMA Survey of Physicians Over Age 50 and CDC mortality rates, 2008

Retirement Rates for Endocrinologists

Our analysis assessed the factors that influence endocrinologists and other physicians to retire or reduce their work effort prior to retirement. Data by AAMC in conjunction with nine physician specialty associations provide the basis for this analysis.[39] We conduct both descriptive and multivariate analysis of these data.

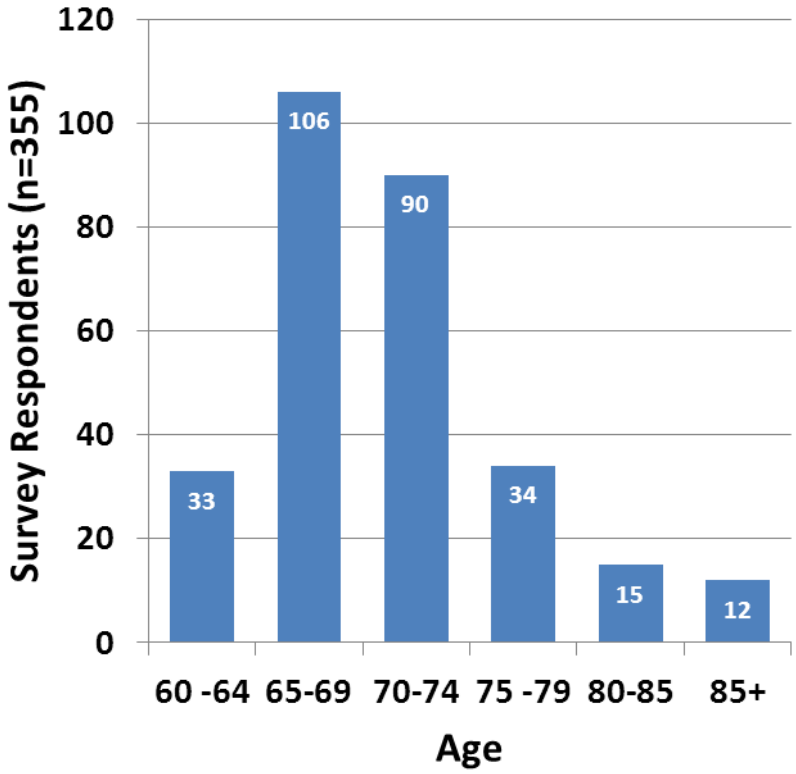
Overall, we find that endocrinologists have similar or slightly lower retirement rates relative to other medical specialists and surgical specialists. Age and health status are the most important factors in the retirement decision, factors over which there is limited influence. As a professional group, endocrinologists have a high level of satisfaction, an important factor in their decision to remain active in medicine. Several factors that influence professional satisfaction that were cited by AAMC as important to retirement planning for endocrinologists are: on-call responsibilities, increasing regulation in medicine, insufficient reimbursement, decreasing clinical autonomy, and stress of practice.

A second source of retirement data is the Endocrinologist Survey. Based on the results of the study survey, almost 30 percent of the survey respondents indicated they plan to completely retire between 65 to 69 years of age (***Exhibit 20***). A quarter of all Endocrine Society survey respondents indicated that they plan to retire between 70 to 74 years of age. Accuracy or reliability of intent to retire is problematic for predicting purposes. Self-reported intention to leave clinical practice had a sensitivity of 73.3 percent and a positive predictive value of 35.4

[39] Sabharwal, R."AAMC Survey of Physicians over Age 50." *American Association of Colleges of Medicine,* Center for Workforce Studies. 2007.

percent as a measure of actual departure from practice of a group of California physicians.[40] The strongest predictor of both the intention to leave clinical practice and actual departure from practice was older age. The older the respondent the more likely retirement will occur as stated. Physician dissatisfaction had a strong association with intention to leave clinical practice, but was not associated with actual departure from practice

Exhibit 20. Distribution of Intended Age to Retire



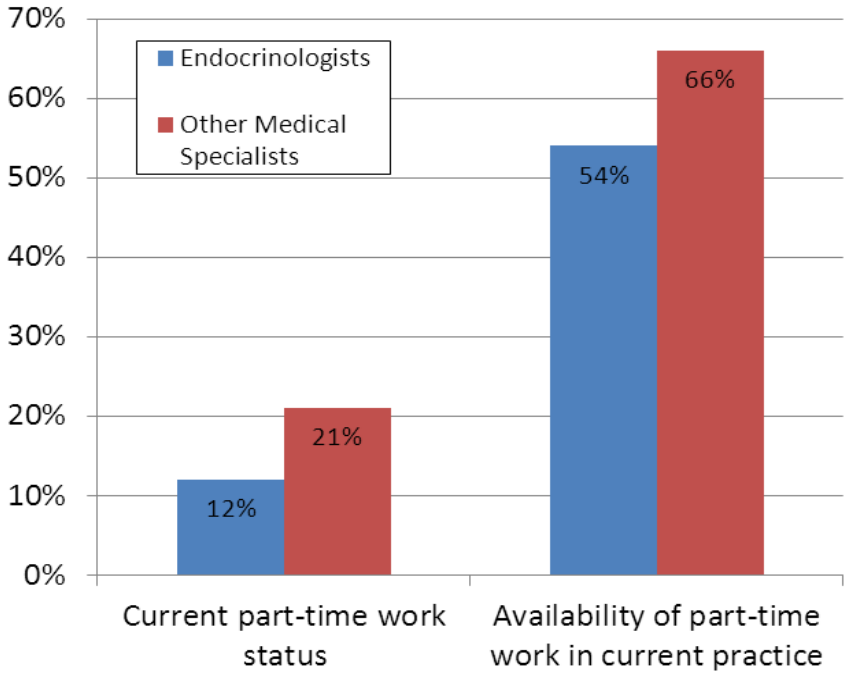
Source: The Lewin Group analysis of 2012 Endocrinologists Survey responses, n=355

Part-Time Work Status

The Endocrinologists Survey revealed that, relative to other medical specialties, endocrinologists have a similar level of interest in working part-time, but do less of it because less part-time work is available (***Exhibit 21***). Compared to other medical specialists, endocrinologists were less likely to work part-time (12% vs. 21%). Endocrinologists were also less likely than other medical specialists to indicate that part-time work was even available in their current practice (54% vs. 66%). While only 12 percent of active endocrinologists over 50 years of age currently work part-time, an additional 54 percent would be interested in working part-time prior to retirement.

[40] Rittenhouse DR, Mertz E, Keane D, Grumbach K. No exit: an evaluation of measures of physician attrition. Health Serv Res. 2004;39(5):1571-1588.

Exhibit 21. Part-Time Work Status



Source: The Lewin Group analysis of 2012 Endocrinologists Survey responses, n=355

C. Supply Projections

In this section, we use the Endocrinologist Workforce Model to project the supply of clinically active adult and pediatric endocrinologists under several sets of assumptions, demonstrated by the baseline scenario and scenario 1 (***Exhibit* 22**). The 2011 baseline numbers were calculated by adding the number of new entrants (number completing board certification every year) and excluding active endocrinologists by age- and gender-specific attrition rate (based on the AAMC Over 50 survey). The number of new entrants added was 280 for adult endocrinologists and 73 for pediatric endocrinologists while attrition was 195 for adult endocrinologists and 59 for pediatric endocrinologists. The **Baseline Scenario** for adult endocrinologists projects the future supply of adult endocrinologists under the assumption that the number of fellowship positions and fill rates will remain at 2011 number of 280 first year positions throughout the projection period. The corresponding Baseline Scenario for pediatric endocrinologists assumes that first year fellowship positions remain constant at 73 per year.

In addition to the baseline scenario, we also provide "sensitivity" analysis of factors affecting the future workforce market environment. **Scenario 1** assumes that the number of fellowships for adult endocrinologists will grow at the 10 year historical rate of 3.4 percent for adult endocrinologists and the historical rate of 6.6 percent for pediatric endocrinologists over the period 1998-2011. In addition to the U.S. medical graduates, we assume the same proportion of international medical graduates will practice in the U.S. after completing their fellowship. We assume that new entrants enter non-clinical activities, and therefore do not contribute to the supply of clinical services, at the same age and rates as the historical workforce. That is, if 1

percent of board certified adult endocrinologists at age 40 were in research, we assume that 1 percent of new entrants would be in research at age 40.

Exhibit 22. Supply Scenarios

Scenarios	Adult Endocrinologist	Pediatric Endocrinologist
Baseline	Number of entrants into fellowship positions is projected to remain constant at the 2011 level of 280 per year.	Number of entrants into first year fellowship positions is projected to remain constant at the 2011 level of 73 per year.
Scenario 1	First year fellowship positions are projected to continue to grow at the historical rate of 3.4% per year.	First year fellowship positions are expected to continue to grow at their historical rate of 6.6% per year.

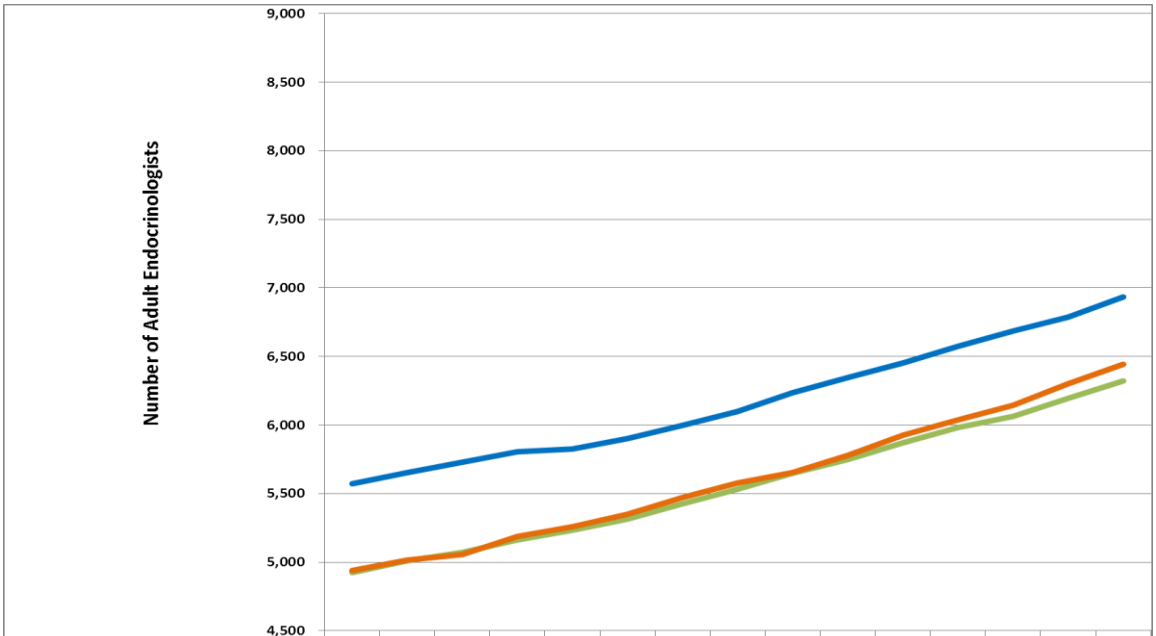
In the Baseline Scenario and in Scenario 1, we show both the number of clinically active adult and pediatric endocrinologists and the number of FTE equivalent. An FTE was defined as the annual number of hours worked and annual visits provided by the average or typical clinically active adult and pediatric endocrinologist. The FTE equivalent endocrinologist adjusts for differences in working hours by age and sex, and for productivity by age and sex. Hence, as the age and sex distribution of the workforce changes, the ratio of the number of endocrinologists to "FTE" endocrinologists may change slightly based on the changing age and sex distribution of the workforce (and implied hours of work and productivity) compared to the baseline FTE definition.

Our results for the two cases, for adult and pediatric endocrinologists, are shown in the exhibits below. ***Exhibit 23*** shows our baseline supply estimate for adult endocrinologists, under the assumptions described above. Note that three schedules are presented. The top line is the projected number of board certified adult endocrinologists. This number is adjusted downward in the middle line, reflecting the number of adult endocrinologists who are expected to be clinically active. Finally, the lowest line reflects a further adjustment to the number of clinically active adult endocrinologists to reflect expected hours of work and productivity by age. This adjustment results in the number of clinically active full time equivalent adult endocrinologists supplied. This, in effect, takes into account that an endocrinologist for whom patient care hours and productivity are only 90 percent of the standard for a full time clinical endocrinologist counts as only 0.9 of an FTE.

Exhibit 24 provides a similar baseline projection for pediatric endocrinologists. Both adult and pediatric workforces grow over time under these assumptions. Adult FTE endocrinologists are projected to increase by about 30 percent from 2011 to 2025, while pediatric FTE endocrinologists are projected to increase by about 66 percent under the baseline assumptions. The reason for this difference is that the number of new entrants for pediatric endocrinologists has experienced greater growth rate in recent years compared to adult endocrinologists.[41]

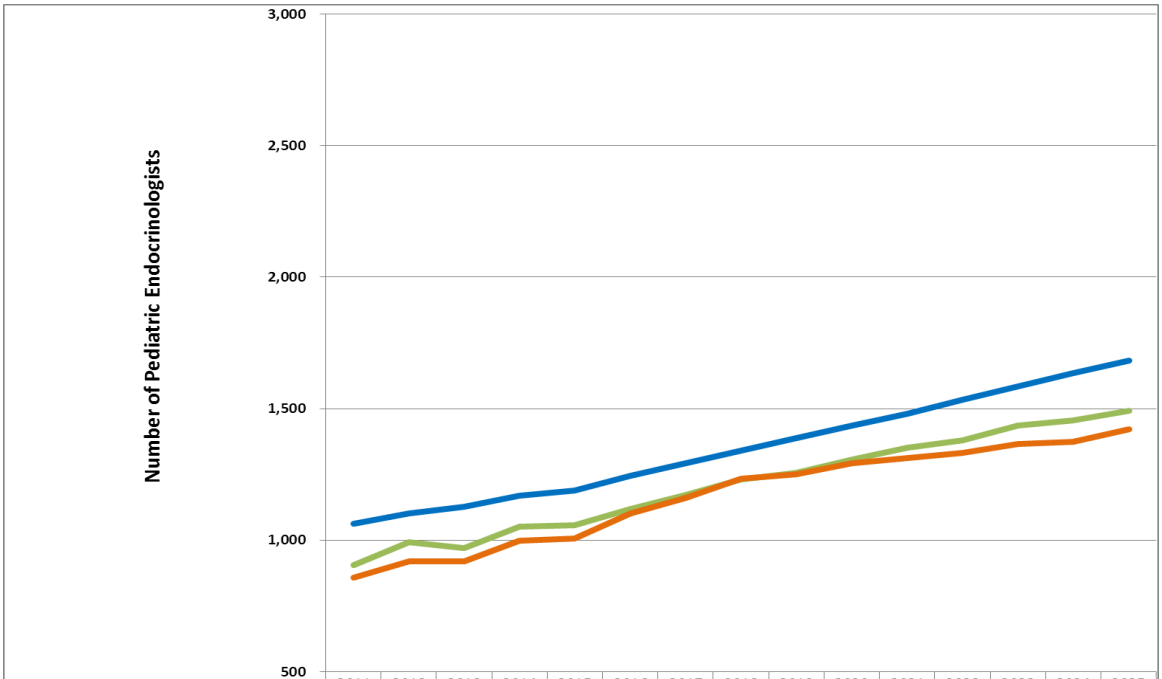
[41] That is, the ratio of new entrants to the existing supply of pediatric endocrinologists is higher currently, compared to its historical average, relative to that same ratio for adult endocrinologist.

Exhibit 23. Projected Baseline Supply of Adult Endocrinologists



	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025
Baseline Supply	5,573	5,652	5,729	5,804	5,827	5,899	5,995	6,096	6,234	6,347	6,452	6,575	6,683	6,788	6,931
Baseline Supply Clinically Active	4,926	5,009	5,071	5,160	5,234	5,312	5,426	5,530	5,648	5,749	5,872	5,981	6,064	6,193	6,322
Baseline Supply Clinically Active (FTE)	4,940	5,013	5,057	5,186	5,260	5,347	5,470	5,578	5,653	5,778	5,928	6,039	6,145	6,302	6,445

Exhibit 24. Projected Baseline Supply of Pediatric Endocrinologists



	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025
Baseline Supply	1,063	1,103	1,126	1,170	1,190	1,246	1,293	1,340	1,388	1,435	1,481	1,534	1,585	1,635	1,682
Baseline Supply Clinically Active	907	993	970	1,052	1,057	1,120	1,172	1,232	1,257	1,307	1,352	1,379	1,437	1,455	1,493
Baseline Supply Clinically Active (FTE)	858	919	920	998	1,007	1,102	1,162	1,235	1,249	1,293	1,311	1,331	1,366	1,374	1,423

Exhibits 25 and ***26*** show the age distribution of the workforce by projection year under the baseline case for adult and pediatric endocrinologists, respectively. In 2011, the mean age of adult endocrinologists was 51.7. As the baby boomers age out of the workforce, the average age is actually projected to decline, to about 46.9 by 2025. Similarly, the mean age of pediatric endocrinologists in 2011 was 50.6. The mean age is projected to decline to 46.0 by 2025.

Exhibit 25. Distribution by Age Band of Projected Adult Endocrinologists (Baseline)

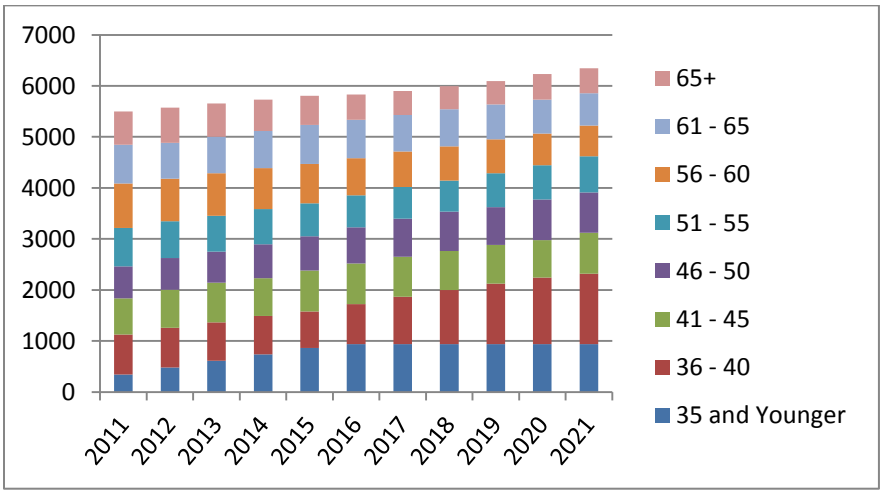
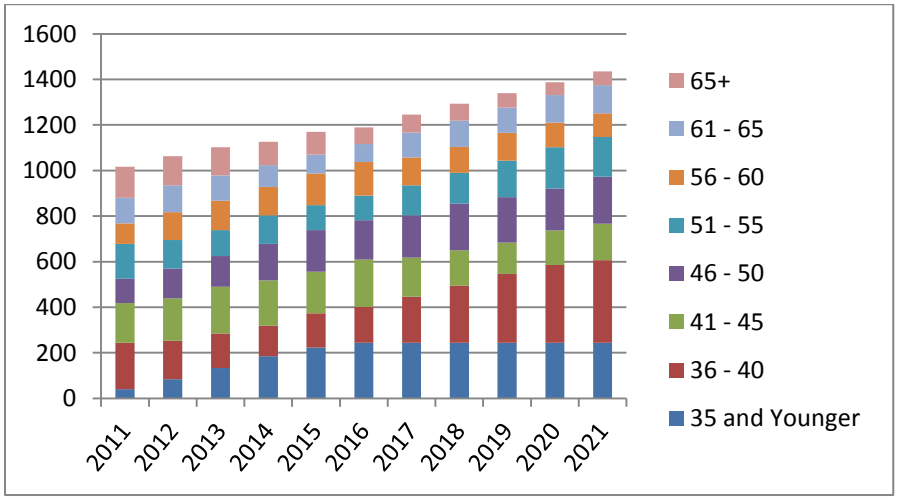
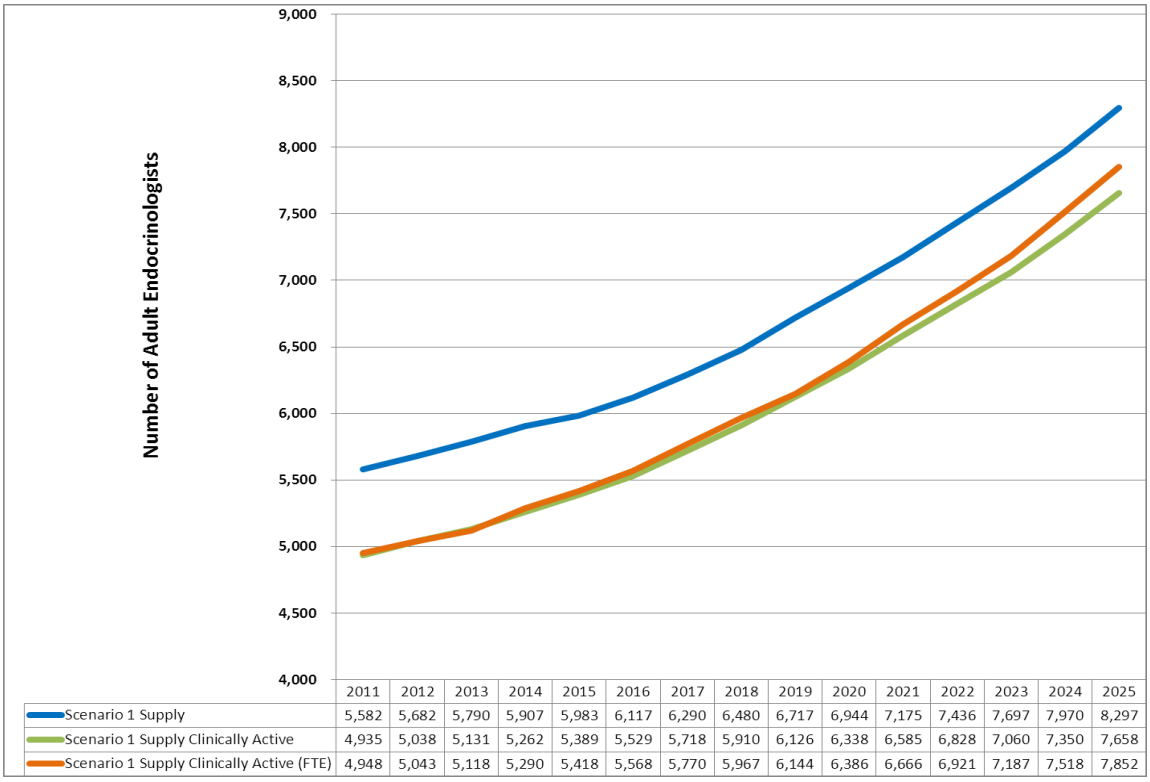


Exhibit 26. Distribution by Age Band of Projected Pediatric Endocrinologists (Baseline)



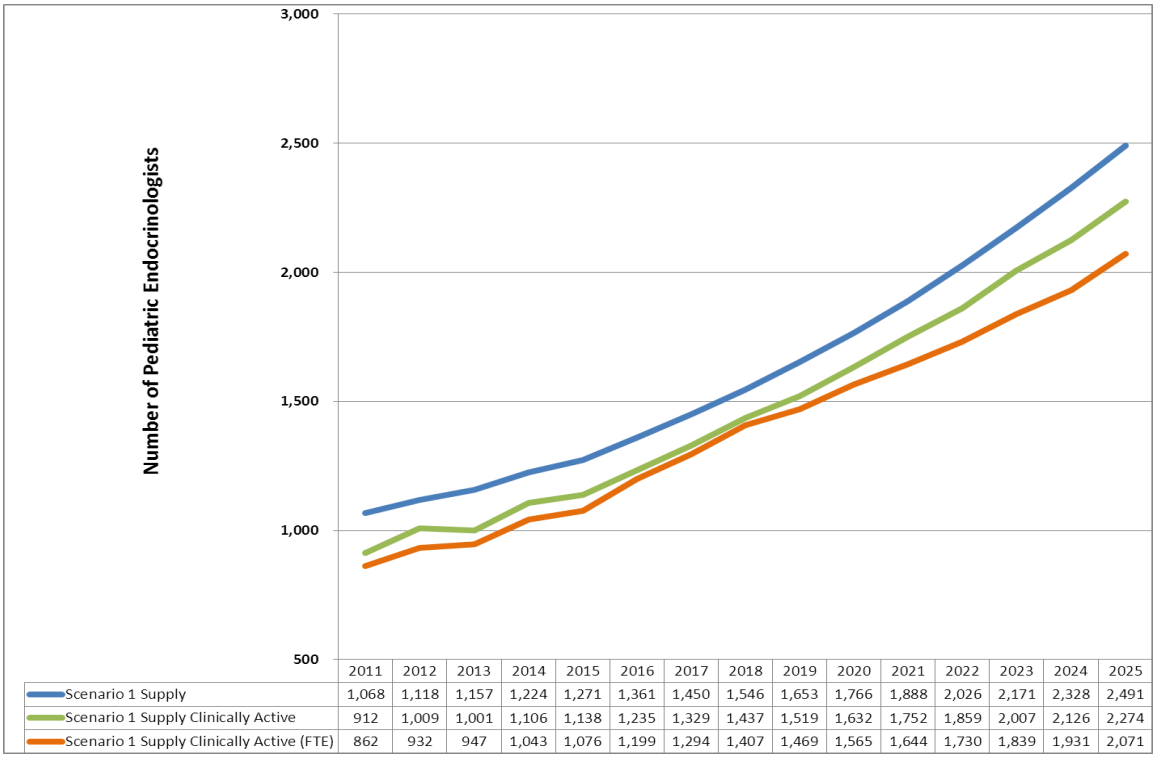
In Scenario 1, new entrants are assumed to grow over time at their recent historical rate. For adult endocrinologists, this rate is 3.4%, while for pediatric endocrinologists, this rate is 6.6 percent. The results are shown in ***Exhibits 27*** and ***28*** for adult and pediatric endocrinologists, respectively.

Exhibit 27. Projected Supply of Adult Endocrinologists (Scenario 1)



	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025
Scenario 1 Supply	5,582	5,682	5,790	5,907	5,983	6,117	6,290	6,480	6,717	6,944	7,175	7,436	7,697	7,970	8,297
Scenario 1 Supply Clinically Active	4,935	5,038	5,131	5,262	5,389	5,529	5,718	5,910	6,126	6,338	6,585	6,828	7,060	7,350	7,658
Scenario 1 Supply Clinically Active (FTE)	4,948	5,043	5,118	5,290	5,418	5,568	5,770	5,967	6,144	6,386	6,666	6,921	7,187	7,518	7,852

Exhibit 28. Projected Supply of Pediatric Endocrinologists (Scenario 1)



	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025
Scenario 1 Supply	1,068	1,118	1,157	1,224	1,271	1,361	1,450	1,546	1,653	1,766	1,888	2,026	2,171	2,328	2,491
Scenario 1 Supply Clinically Active	912	1,009	1,001	1,106	1,138	1,235	1,329	1,437	1,519	1,632	1,752	1,859	2,007	2,126	2,274
Scenario 1 Supply Clinically Active (FTE)	862	932	947	1,043	1,076	1,199	1,294	1,407	1,469	1,565	1,644	1,730	1,839	1,931	2,071

If new entrants were to continue to grow each year at recent historical rates, the adult workforce would increase by 50% by 2025 while the pediatric workforce would more than double. In the next section, we will introduce the demand side which will be followed by a comparison of expected demand and expected supply.

IV. RESULTS PART II: DEMAND FOR ENDOCRINOLOGISTS

In this demand section, we examine the distribution of services currently being provided by endocrinologists. First, we provide a brief description of our data sources. Then, we provide an overview of services provided by endocrinologists, identify potential alternate providers, and assess demand for endocrinologists.

This study draws on multiple sources of data for demand statistics. For services provided under the Medicare program, we use the Part-B Medicare Annual Data (BMAD) file. This file includes provider specialty, Current Procedural Terminology (CPT) code, payment amount, and number of units for claims billed under Medicare Part-B in a given fiscal year. For services provided to the population under age 65, we use an extract from the OptumInsight commercial claims database known as the de-identified Normative Health Information (dNHI) system, which includes claims information on beneficiary age, type of insurance coverage, CPT code, units of service and paid amount (i.e., allowed amount less beneficiary coinsurance and payments made by other insurers) for approximately 16 million covered beneficiaries.

Finally, for information on patient diagnosis and potential alternate endocrinology providers, we use the Medical Expenditure Panel Survey (MEPS), which includes observations for a national sample of medical office visits and produces visits per population. Each visit observation includes information on provider specialty, diagnosis, reason for visit and insurance coverage. We also use the MEPS to analyze patterns of health care use in the outpatient and inpatient setting.

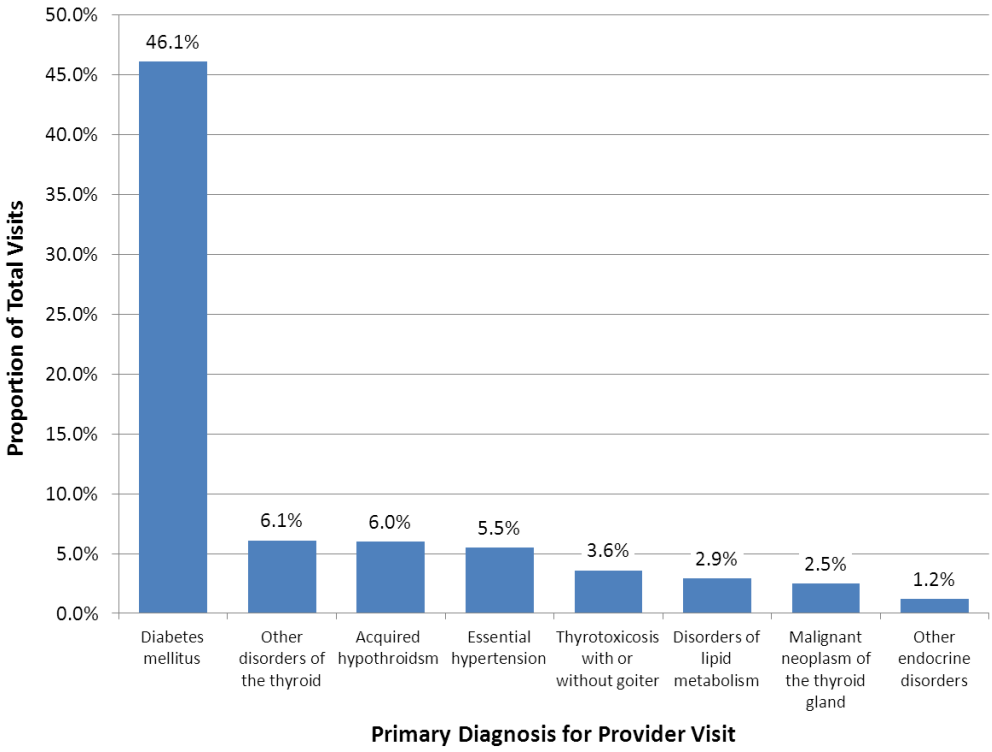
Data from the Medicare program is highly detailed and useful for patterns of care but limited in that it applies only to Medicare beneficiaries-- those ages 65 and over. This is an important population and is expected to grow from 13% of the population in 2000 to 19 percent of the population by 2020. Moreover, it is a group for which detailed and relatively complete claims data is available. Further, as the absolute size of this population increases, it will have an important effect on the demand for the services of endocrinologists.

The MEPS data are more general than the Medicare data in that it is a random sample that includes all patients, not just those who are eligible for Medicare. It is a survey that is based on a sample of providers and captures office visits by provider type and, most importantly, reason for visit. Moreover, it has weights which permit generalization to the U.S. population. A limitation of the data is that there are small numbers of endocrinologists in the database.

A. Current Demand

We examine, first, the distribution of office visits by primary diagnosis. Diabetes, with 46 percent of the visits, is the top diagnosis code among patients seen by endocrinologists (***Exhibit 29***). There is a 5 percent range difference of visits of other primary diagnosis codes to the endocrinologists.

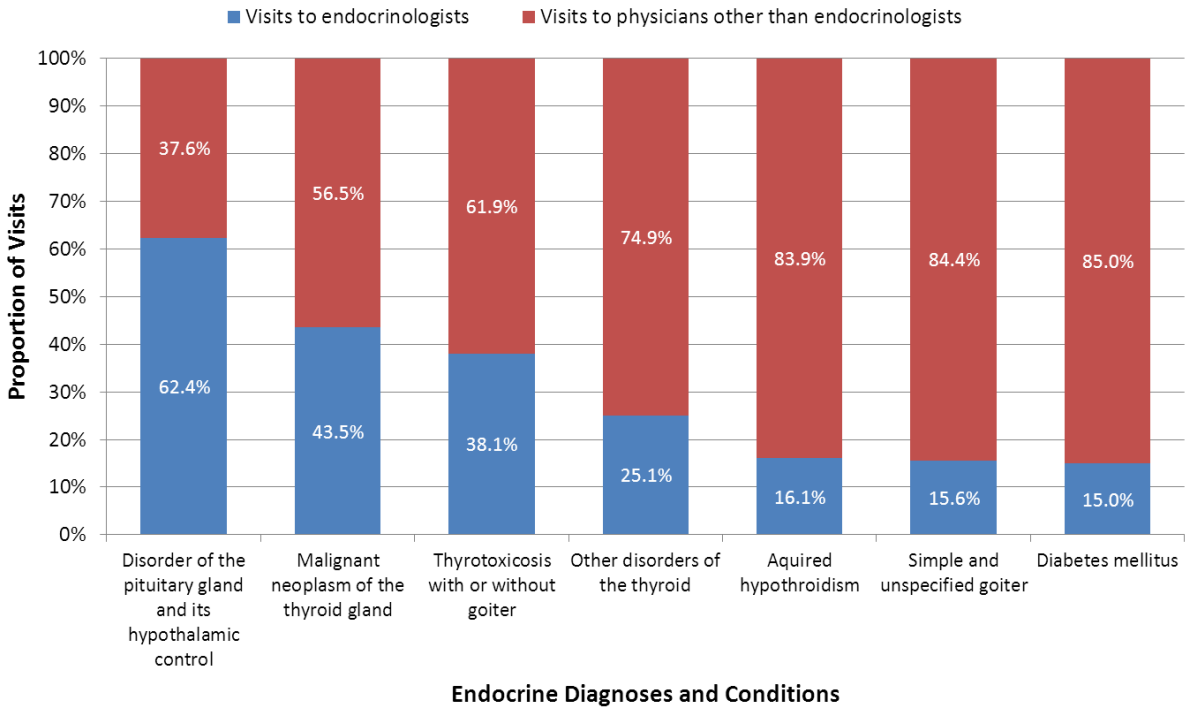
Exhibit 29. Percent of Visits to Endocrinologists by Primary Diagnosis Code



Source: Medical Expenditure Panel Survey (MEPS) 2008

The share of visits for endocrine diagnoses and conditions were compared between those seen by endocrinologists as opposed to those seen by other physicians (***Exhibit 30***). The majority of visits for endocrine diagnoses and conditions are seen by physicians other than endocrinologists, except for disorders of the pituitary gland and its hypothalamus control (62.4 percent seen by endocrinologists). Endocrinologists have the least share of visits (15 percent) for all patients seen for diabetes mellitus.

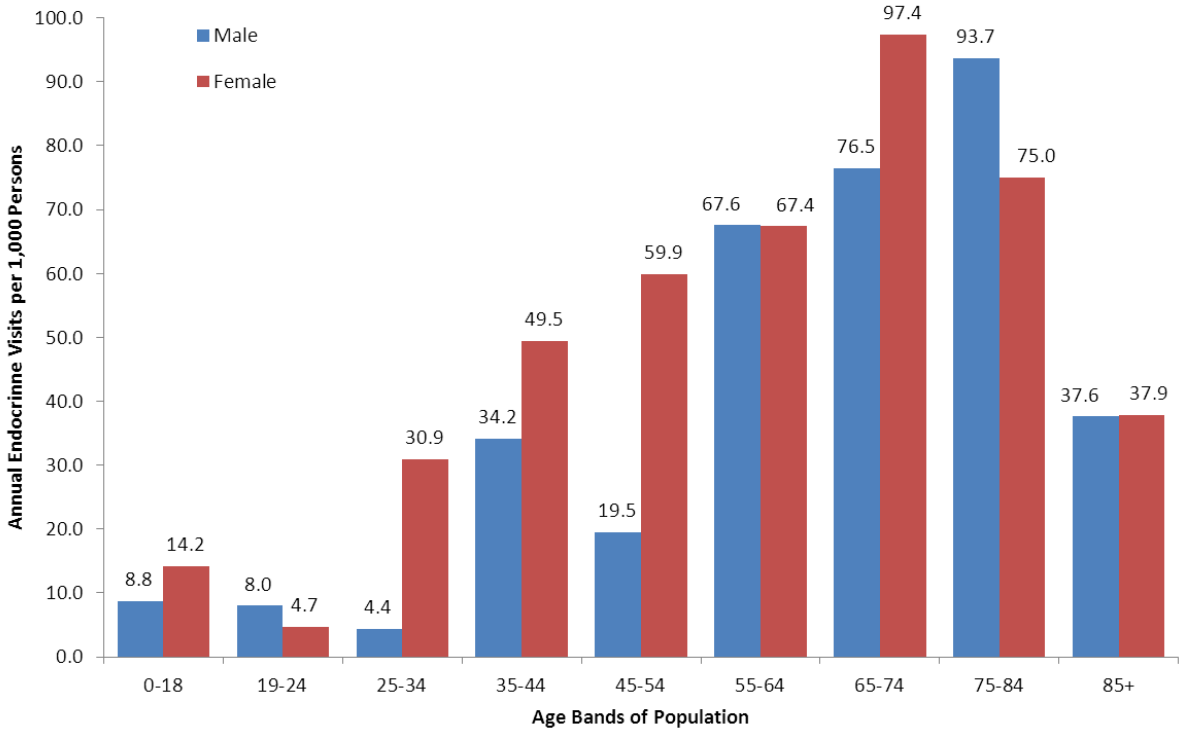
Exhibit 30. Share of Visits to Endocrinologists for Endocrine Diagnoses and Conditions



Source: Medical Expenditure Panel Survey (MEPS) 2008

The computed utilization rates for visits to endocrinologists annually were detailed by age and gender, based on the MEPS analysis (***Exhibit 31***). As expected, utilization rates increase with age, and tend to be higher for females than males. Utilization is highest for females in age band 65 to 74, with 97.4 visits per 1,000 persons.

Exhibit 31. Utilization Rate for Visits to Endocrinologists by Age and Gender



Source: The Lewin Group analysis of three years of Medical Expenditure Panel Survey (MEPS), private insurance claims and Medicare Physician/Supplier Procedure Summary Master File

Note: Low utilization of males 45-54 was rechecked using MEPS data and validated with private insurance claims.

B. Factors Affecting Demand

Socioeconomic and demographic changes in the population will influence demand for endocrinology over the next two decades. These areas include demographic trends, lifestyle changes, economic growth, policy changes related to health insurance, and technological innovation.

- *Demographic Trends*—The U.S. population is projected to increase in all age groups over the next 20 years; however, growth in the number of people between age 65 and 84 and over age 84 is expected to be most rapid. Between 2000 and 2010, the population ages 65 to 84 grew about one percent annually. Between 2010 and 2020, this percent annual increase jumps to 3.3 percent annually as the Baby Boomers turn 65 years, beginning in 2011. Since age is a significant factor in the risk for endocrine conditions, such as Type 2 diabetes, as the population ages the demand for the services of endocrinologists will rise proportionally.
- *Lifestyle Trends*—Trends in prevalence of obesity and Type 2 diabetes in the U.S. population are likely to lead to increased demand for endocrine care. Attention to preventive care such as cholesterol reduction, reduction in obesity and increased physical activity may result in some reduction in demand for endocrine care. In addition, the

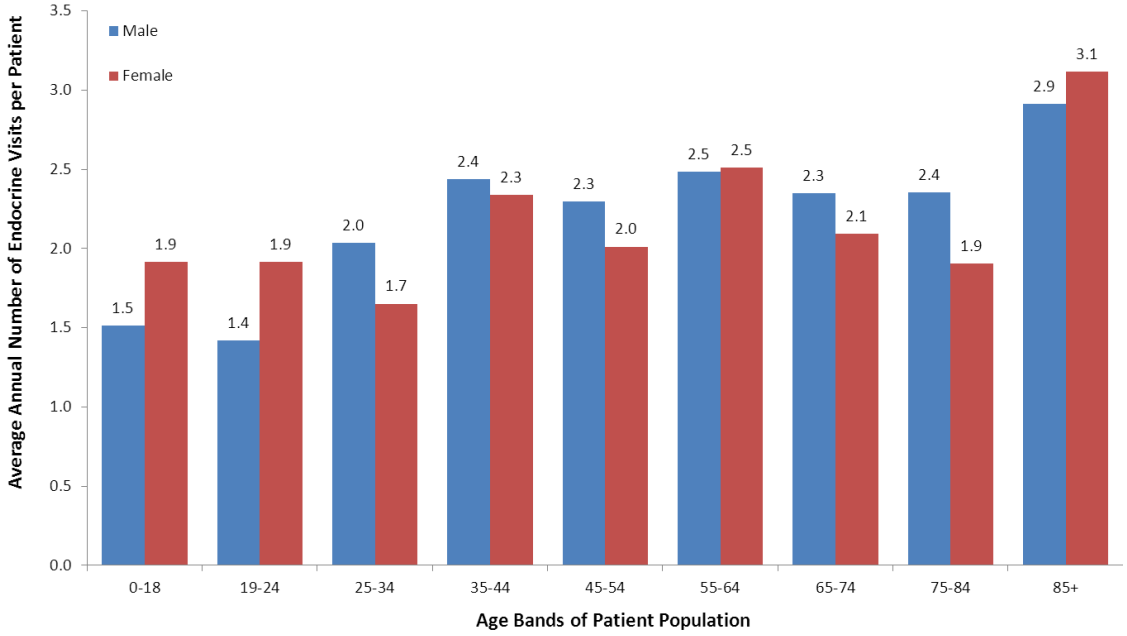
incidence of Type 1 diabetes is increasing, and the incidence of Type 2 diabetes in children is increasing. These factors will affect the demand for pediatric endocrinologists.

- *Insurance Status*—Policymakers continually express concern about the uninsured population in the U.S. Expansion of insurance coverage as part of the PPACA will result in increased demand for services. Estimates range between 25 and 33 million new enrollees, beginning in 2014. This will increase the demand for all physicians, but especially the demand for specialists.
- *Regulatory requirements and guidelines*—A proliferation of "best practice" guidelines, and requirements of payers and hospitals to adhere to these guidelines, encourages the referral to specialists.
- *Complexity and proliferation of optimal medication options*—As the numbers and types of medications for diabetes, metabolic syndrome and other endocrine disorders proliferates, the optimal regimen and combination is difficult to learn, and encourages referral to endocrinologists.
- *Technological Advances*—As new procedures and drugs are developed and prove efficacious, demand for care will change from the projected growth related to demographic trends. Recent examples include continuous glucose monitoring (CGM) and insulin pumps, which will further push treatment of diabetes patients toward the specialist in endocrinology.
- *Achieving Optimal Outcomes* – Current estimates of demand assume that current patient outcomes in diseases such as diabetes and other endocrinopathies are adequate or optimal, and do not factor in the demands required to achieve optimal outcomes. This is particularly relevant to diabetes for which only 15% of patients are seen by an endocrinologist (Exhibit 30). By most estimates, achieving optimal diabetes clinical targets is poor, and additional workforce would enhance diabetes and other outcomes. If clinical outcome expectations were higher, demand can be calculated to be higher as well. The key point is that the baseline demand may underestimate optimal baseline demand and be carried into future year's projections.

Based on the above factors, the projected increase in the demand for endocrinologists may be an underestimate, due to its basis solely on demographic trends. Trends in lifestyle, income, insurance status, complexity, and technological advances are expected to have a substantial positive influence on demand, on net, over the next 20 years. We explore the implications of one observed trend, the increasing prevalence of Type 2 diabetes, in the analysis below.

Currently, the demand for endocrinologist services is broad-based, affecting all age groups, (***Exhibit 32***), but with female patients visiting the endocrinologist more than males (3.1 versus 2.9 visits per year, respectively). The patient population with the lowest visits to the endocrinologist per year is the 19-24 year age group, with 1.4 visits for males and 1.9 visits for females. Not surprisingly, there is an increase in demand in the oldest age groups because of osteoporosis, diabetes, and other endocrine-related diseases associated with aging.

Exhibit 32. Average Annual Number of Endocrine Visits per Patient by Age and Gender (Patients Having at least One Visit)



Source: The Lewin Group analysis of three years of Medical Expenditure Panel Survey (MEPS), private insurance claims and Medicare Physician/Supplier Procedure Summary Master File.

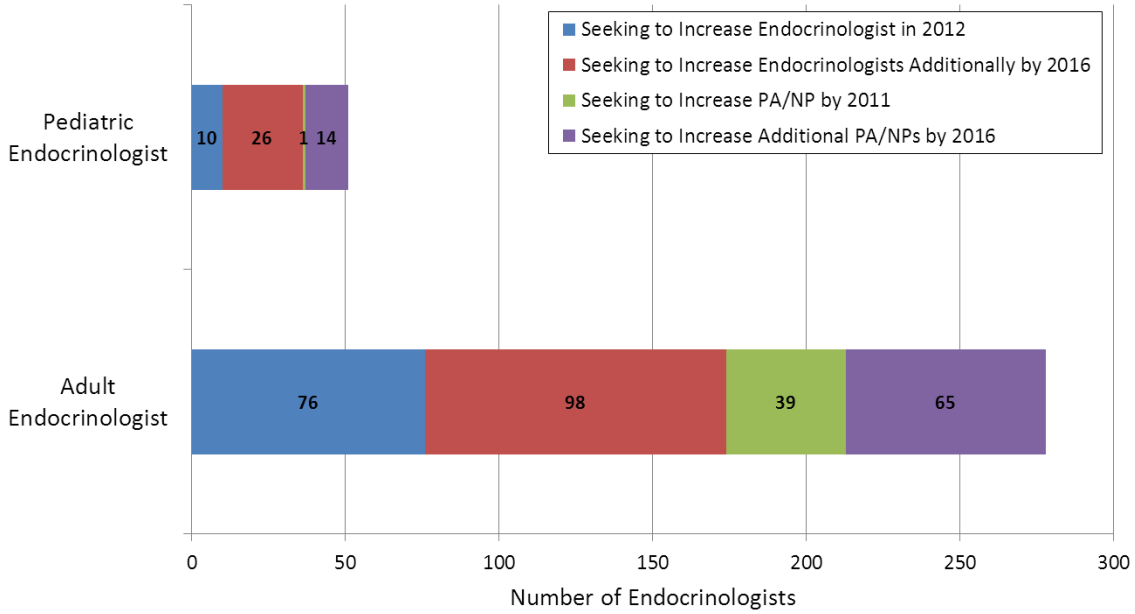
1. Indicators of Excess Demand

Several measures can be used to assess whether there is excess demand for endocrine services. These measures include demand for training, open positions for endocrinologists, and wait time for an appointment. We assess these measures here.

As part of the study survey, we asked respondents to identify the number of positions they had available for the endocrine workforce. Based on the 355 responses, respondents are seeking an additional 76 adult endocrinologists and 10 pediatric endocrinologists. This translates to an additional 24 percent demand for adult clinical endocrinologists and 21 percent demand for pediatric endocrinologists that are currently unmet.

In addition to physicians, endocrine practices are recruiting for non-physician clinicians. Seventy-four percent of private practices and 56 percent of academic practices indicated they had openings for physician assistants and nurse practitioners (***Exhibit 33***).

Exhibit 33. Practices Seeking To Increase Endocrinologists



Source: The Lewin Group analysis of 2012 Endocrinologists Survey responses, n=355

2. Wait Time

Based on the results of the survey, the average waiting time for an initial non-urgent consultation visit with an adult endocrinologist was 37 days. It is likely that this is an underestimate, because it is based on physician self-report. In comparison, the average waiting time for an initial visit with family medicine, cardiology and dermatology specialists is 20, 15 and 22 days respectively.[42] Though the method was different (phone requests for actual appointments compared to physician survey responses), the longer mean waiting time for an appointment with an endocrinologist suggests a greater relative scarcity. It is worth noting that, despite a 23 percent growth in the number of endocrinologists from 1999, the mean waiting time for the initial visit remained at 37 days.[43]

3. Population Projections

A major factor affecting the anticipated demand for health care services is the aging population. In 2010, there were 37.5 million people age 65 or over, constituting about 12.7 percent of the total population. By 2015, the number over age 65 will increase to 46.9 million (14.6 percent of the total population). By 2025, the population age 65 or over will number 62.5 million (17.9 percent of the population). ***Exhibit 34*** shows that the population over age 64 is expected to increase by more than 60 percent over the 20 year period while the population under age 65 is expected to increase by only a little over 10 percent.

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[42] "2009 Survey of Physician Appointment Waiting Time," Merritt Hawkins and Associates, Irving, Texas. This was a phone survey that requested specific types of new patient appointments of selected specialists in 15 metropolitan areas.

[43] *Workforce Study of Endocrinologists,* Paul F. Hogan et al, The Lewin Group, 2001.

Exhibit 34. Population Projections (in millions)

Age Group	2010	2015	2020	2025
<20	83,236	86,062	88,887	91,996
20-64	185,456	188,871	192,285	194,656
65-84	34,120	40,742	47,363	54,607
85+	6,123	6,696	7,269	8,436
Total	**308,935**	**322,371**	**335,804**	**349,695**

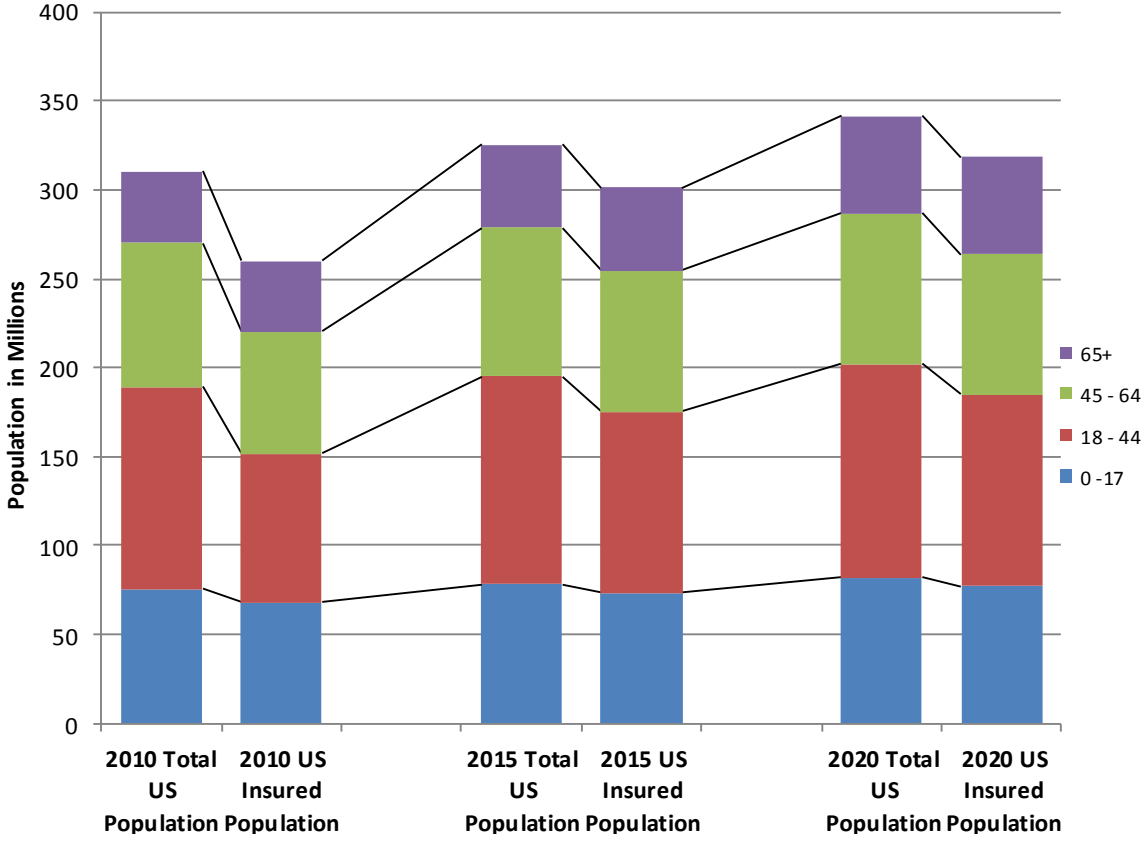
Source: U.S. Census Bureau, 2010

Due to the growth in the prevalence of many of the diseases treated by endocrinologists that increase with age, the increased growth in the population over age 64 will exert a major influence on the demand for endocrine services.

Due to the implementation of the PPACA by 2014, the number of uninsured U.S. population will decline from 50 million to 22 million.[44] However, the largest decline in the number of uninsured will occur in the age cohort 18-24 years of age. Compared to other age cohorts, the 18-24 age-cohorts have a relatively low utilization of endocrine services. ***Exhibit 35*** shows the age distribution of U.S. insured population pre- and post-Health Care Reform Act.

[44] Elmendorf, Douglas W. "The Reconciliation Proposal." Letter to the Honorable Nancy Pelosi, Speaker of the U.S. House of Representatives. *Congressional Budget Office* 20 March 2010.

Exhibit 35. Age Distribution of U.S. Insured Population
Pre and Post Health Care Reform Act



Source: U.S. Census Bureau

C. Demand Projections

Demand for services is dependent on a multitude of factors and influences that include insurance, health status, socioeconomic status, gender, age, epidemiology of morbidities of interest, influences of other morbidities, geographical location, distribution of services and other externalities. The ability to substitute some endocrinology services with other providers, such as primary care clinicians, and with non-physician clinicians such as nurse practitioners and physician assistants, also plays a role. Age composition of the population produces the greatest demand for endocrinology services. Demand for any medical services increases with each decade of life starting around age 15, and is more magnified for the internal medicine subspecialties than other medical services. Generally, as an individual ages he or she requires mores medical services, both in quantity and quality, each year. Inefficiencies in the system also contribute to increased demand.

We consider two cases for projecting the demand for adult and pediatric endocrinologists. The Baseline case assumes that current utilization patterns by age and sex persist into the future, except that we show the effect that the increased insurance coverage resulting from the Patient Protection and Affordable Care Act will have on demand. The second case, Scenario 1, projects the effect of a 1 percent annual increase in diabetes prevalence at each age group.

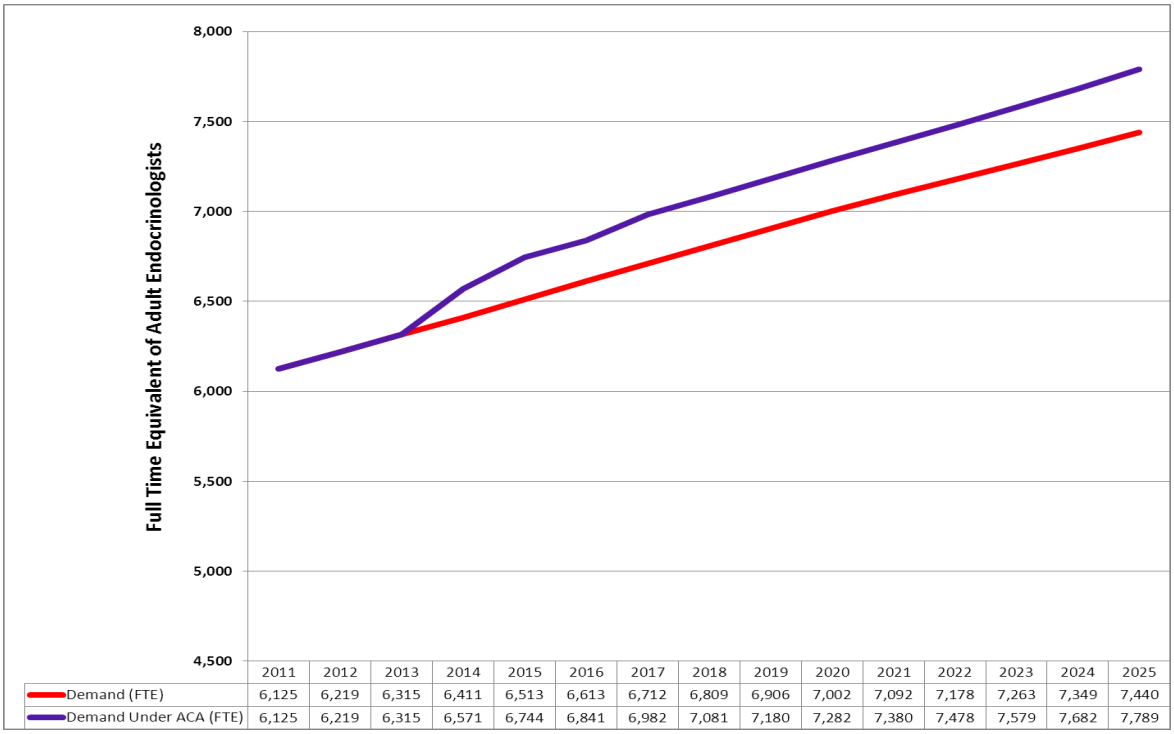
Exhibit 36. Demand Baseline

Scenarios	Adult Endocrinologist	Pediatric Endocrinologist
Baseline	Current utilization patterns are projected into the future driven by population, with a shift in demand due to increased insurance coverage under the PPACA.	Current utilization patterns are projected into the future driven by population, with a shift in demand due to increased insurance coverage under the PPACA.

The baseline demand for adult endocrinologists is shown in ***Exhibit 37***. Note that demand increases over time. This reflects a growing population, but perhaps more importantly, an aging population. Prevalence of chronic disease, most notably Type II diabetes, increases dramatically with age. With it, the demand for the services of adult endocrinologists increases.

The exhibit also depicts the effect of the PPACA on demand. The shift in the curve upward beginning about 2014 reflects the effect of the health insurance mandate under PPACA, and the expansion of affordable ways for the uninsured to meet that mandate. With increased health insurance coverage comes increased demand for health care services.

Exhibit 37. Baseline Demand for Adult Endocrinologist FTE

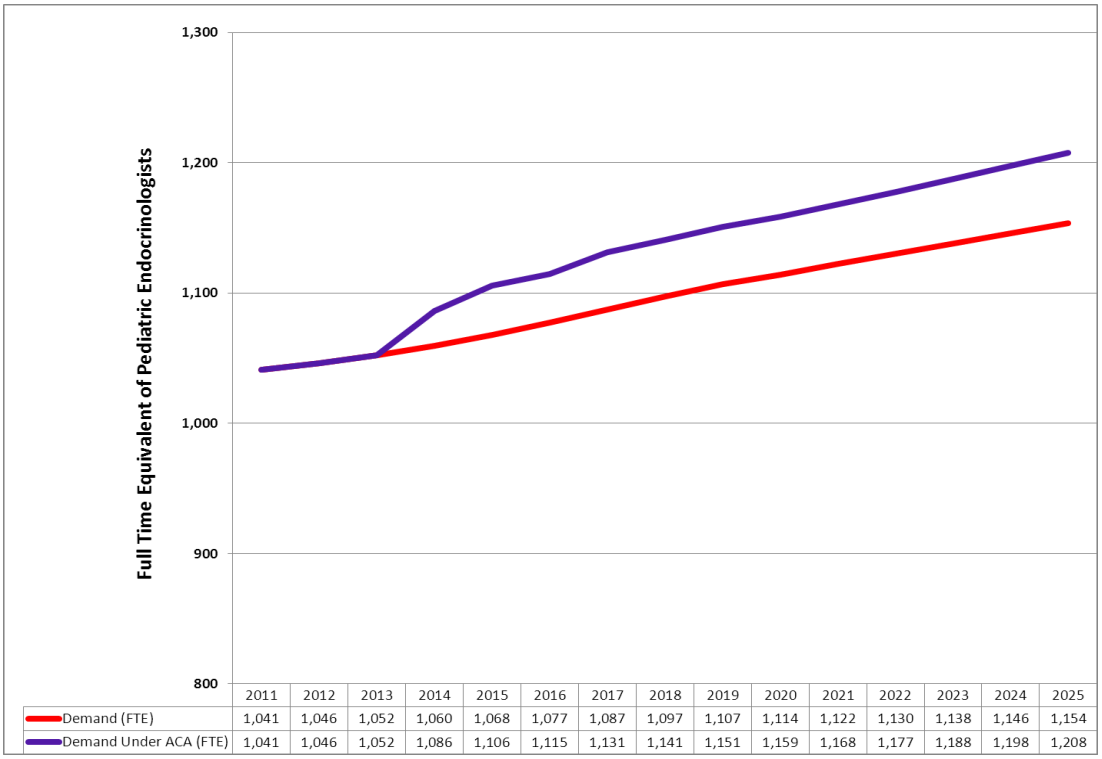


	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025
Demand (FTE)	6,125	6,219	6,315	6,411	6,513	6,613	6,712	6,809	6,906	7,002	7,092	7,178	7,263	7,349	7,440
Demand Under ACA (FTE)	6,125	6,219	6,315	6,571	6,744	6,841	6,982	7,081	7,180	7,282	7,380	7,478	7,579	7,682	7,789

The baseline demand for pediatric endocrinologist services, measure by FTE of pediatric endocrinologists, is shown in ***Exhibit 38***. The chart depicts the upward shift in demand that is expected under PPACA. Note that, though it's not apparent visually, the percentage increase in demand between 2011 and 2025 for pediatric endocrinologists is about half that of adult, 15 percent versus 27 percent. Indeed, what is driving demand for pediatric endocrinologists is largely an increase in the pediatric population. Aging of the population is not an independent

driver of demand for pediatric endocrinologists. The actual share of the population represented by those less than 19 years of age actually declines between 2011 and 2025.

Exhibit 38. Baseline Demand for Pediatric Endocrinologist FTE



	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025
Demand (FTE)	1,041	1,046	1,052	1,060	1,068	1,077	1,087	1,097	1,107	1,114	1,122	1,130	1,138	1,146	1,154
Demand Under ACA (FTE)	1,041	1,046	1,052	1,086	1,106	1,115	1,131	1,141	1,151	1,159	1,168	1,177	1,188	1,198	1,208

V. RESULTS PART III: ENDOCRINOLOGIST SUPPLY AND DEMAND PROJECTIONS

For both adult and pediatric endocrinologists, the **Baseline Scenario** assumes that, on the demand side, current utilization patterns, by age and sex, persist into the future. Demand growth is driven by overall population growth, aging of the population into age groups with higher utilization, and by a modest increase in demand resulting from a higher proportion of the population being covered by health insurance under the Patient Protection and Affordable Care Act.[45] These demand curves may be underestimates for reasons described previously.

On the supply side, the **Baseline Scenario** assumes that the current workforce is projected into the future, with losses due to mortality and retirement, and that annual new entrants are held constant at their 2011 levels, for both adult and pediatric endocrinologists.

Scenario 1 consists of the same demand case as the Baseline. On the supply side, we allow new entrants to grow at their recent historical rate. Adult endocrinologist new entrants grow at 3.4 percent per year, while pediatric new entrants grow at 6.6 percent per year.

Scenario 2 increases demand. We assume that the prevalence of diabetes increases from about 7.4 percent currently to 12 percent by 2025.[46] This increase in prevalence occurs at a constant annual proportional rate for each age group. Both the baseline supply and the supply under Scenario 1 are displayed in Scenario 2.

Scenario 3 solves for the rate of growth in new entrants necessary to close the supply/demand gap for adult endocrinologists in 5 and 10 years, respectively. Note that this scenario applies only to adult endocrinologists. The scenarios are summarized in ***Exhibit 39***.

Exhibit 39. Supply and Demand Scenarios

Scenarios	Supply	Demand
Baseline	Number of annual entrants is projected to remain constant at 2011 levels, which are 280 for adult endocrinologists and 73 for pediatric endocrinologists.	Demand affected only by population growth and changing demographics plus the impact of health care reform for both adult and pediatric endocrinologists.
Scenario 1	Annual increase in fellowship positions by historical growth rate of 3.4 % for adult and 6.6% for pediatric endocrinologists.	Same as baseline.

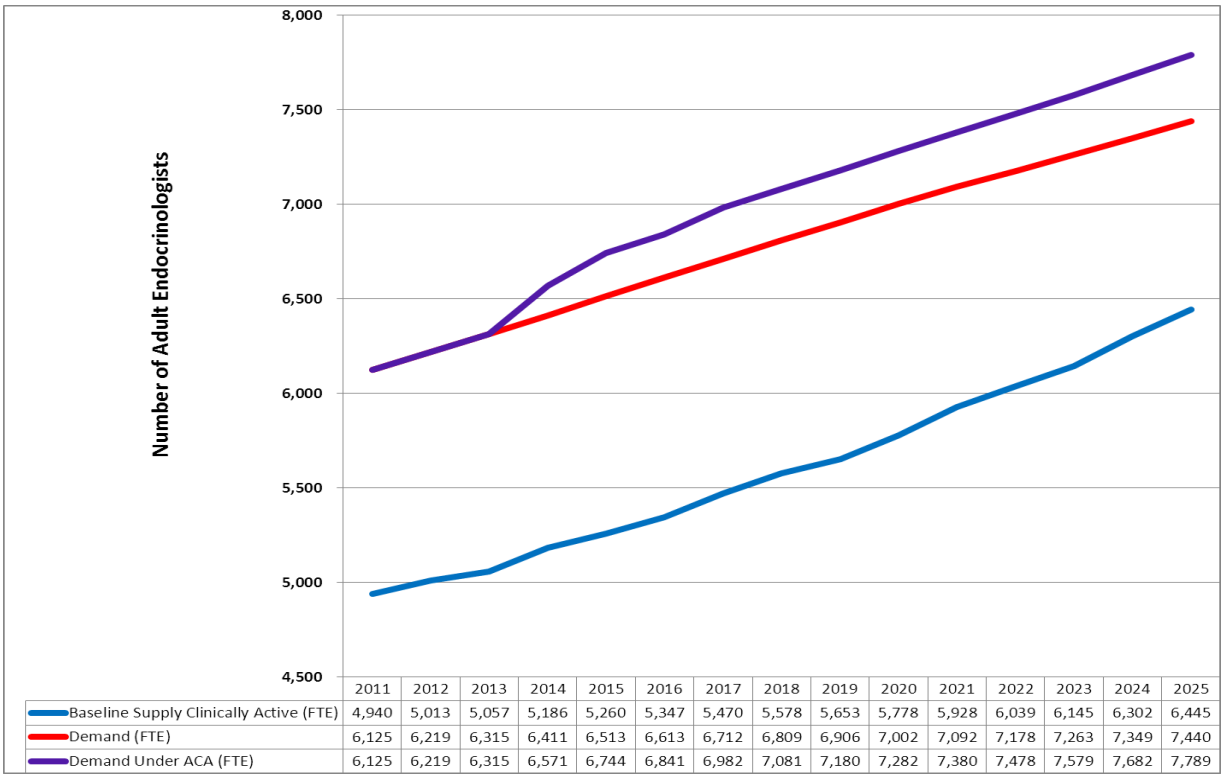
[45] See Sheils, JF and Haught R. "Without the Individual Mandate, The Affordable Care Act Would Still Cover 23 Million; Premiums Would Rise Less Than Predicted." *Health Affairs* 10.1377/hltaff.2011.0708; published ahead of print October 26, 2011; and Congressional Budget Office (2012). "Updated Estimates for the Insurance Coverage Provisions of the Affordable Care Act," March 12, 2012.

[46] This is based on Boyle, James P., Theodore J. Thompson, Edward W. Gregg, Lawrence E. Barker, and David F. Williamson, "Projection of the year 2050 burden of diabetes in the US adult population: dynamic modeling of incidence, mortality, and prediabetes prevalence." *Popul Health Metr* 8, no. 1 (2010): 29.

Scenarios	Supply	Demand
Scenario 2	Both Baseline and Scenario 1 are displayed for both adult and pediatric endocrinologists.	The prevalence of diabetes increases from a current rate of 7.4% to 12% by 2025. Using MEPS data we determined the number of endocrinology visits per diabetic per year, separately for adults and children. We then added the number of visits of additional diabetics due to the prevalence increase to obtain the additional endocrinology visits demanded. This is applied to both the adult and pediatric population.
Scenario 3	Adult: Growth in new entrants to close supply/demand gap in 5 and 10 years, respectively.	Baseline demand

Exhibit 40 presents the baseline supply and demand estimate for adult endocrinologists. Note that, given the assumptions of the baseline—in particular, that new entrants remain constant at their current level through the projection period—there is a significant gap between demand and supply, as measured by FTE endocrinologists that persists over the projection period.

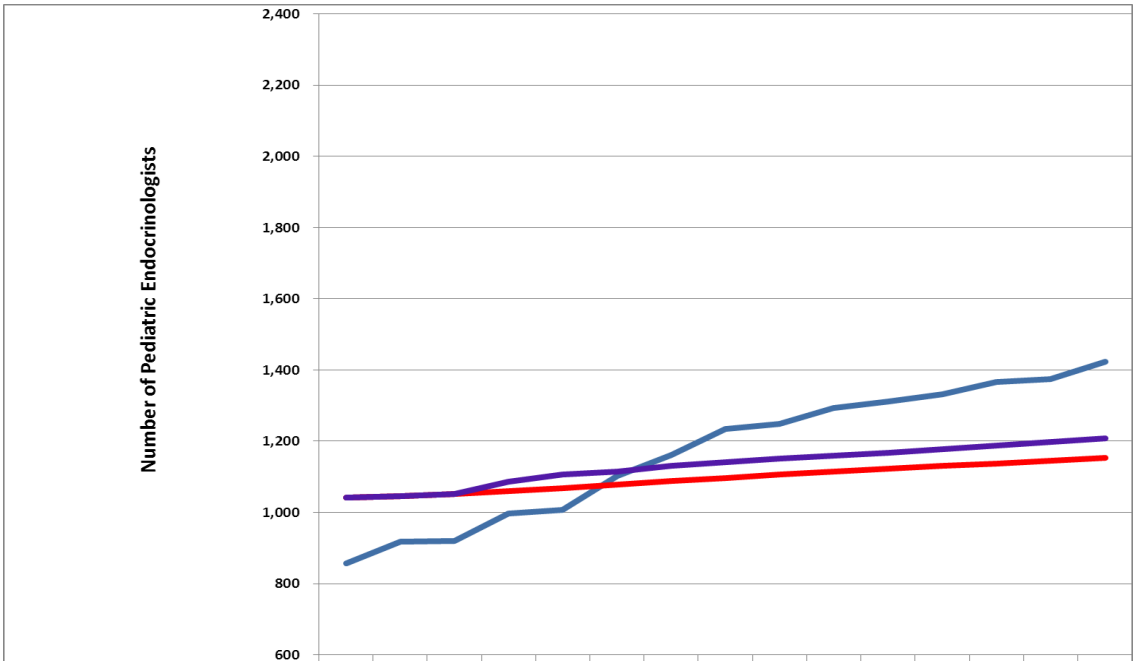
Exhibit 40. Baseline Supply and Demand Estimates for Adult Endocrinologists



	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025
Baseline Supply Clinically Active (FTE)	4,940	5,013	5,057	5,186	5,260	5,347	5,470	5,578	5,653	5,778	5,928	6,039	6,145	6,302	6,445
Demand (FTE)	6,125	6,219	6,315	6,411	6,513	6,613	6,712	6,809	6,906	7,002	7,092	7,178	7,263	7,349	7,440
Demand Under ACA (FTE)	6,125	6,219	6,315	6,571	6,744	6,841	6,982	7,081	7,180	7,282	7,380	7,478	7,579	7,682	7,789

Exhibit 41 presents the baseline supply and demand estimates for pediatric endocrinologists. Unlike the case of adult endocrinologists, there is a modest gap between supply and demand at the beginning of the period. However, with new entrants remaining constant over the projection period, this gap is closed by about 2016.

Exhibit 41. Baseline Supply and Demand Estimates for Pediatric Endocrinologists

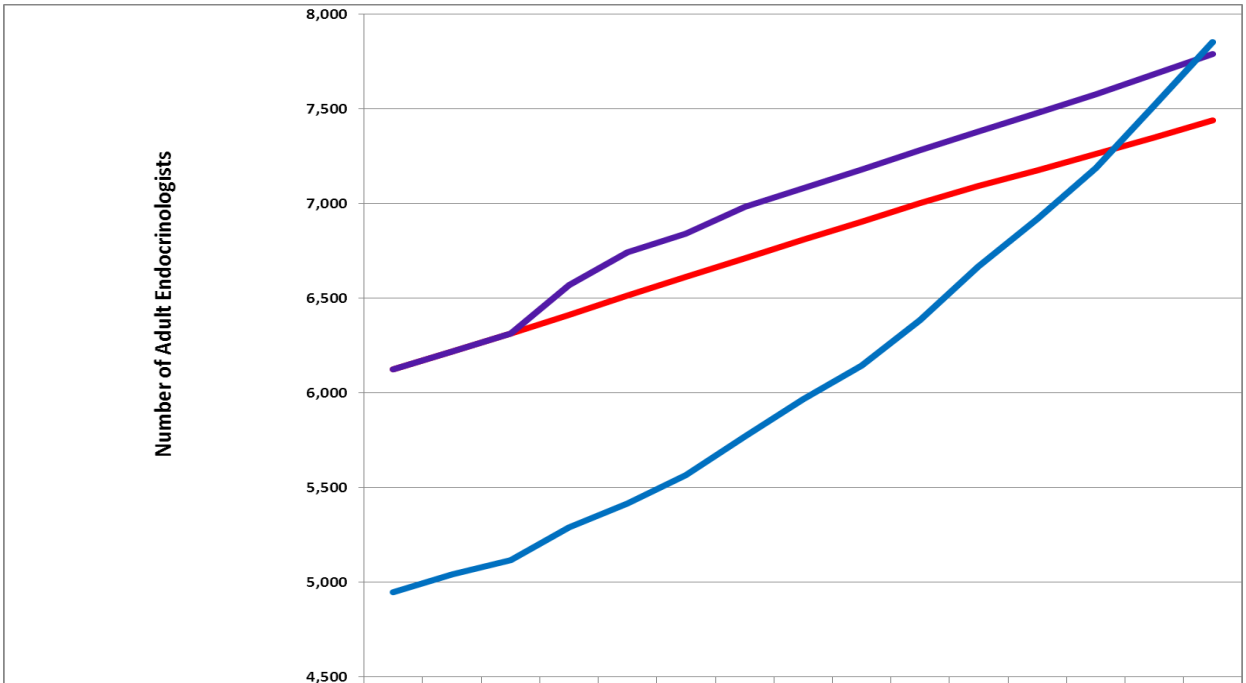


	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025
Baseline Supply Clinically Active (FTE)	858	919	920	998	1,007	1,102	1,162	1,235	1,249	1,293	1,311	1,331	1,366	1,374	1,423
Demand (FTE)	1,041	1,046	1,052	1,060	1,068	1,077	1,087	1,097	1,107	1,114	1,122	1,130	1,138	1,146	1,154
Demand Under ACA (FTE)	1,041	1,046	1,052	1,086	1,106	1,115	1,131	1,141	1,151	1,159	1,168	1,177	1,188	1,198	1,208

The gap in the supply-demand curves is approximately 1000 endocrinologists in every year for the next 14 years. For pediatric endocrinologist, the gap narrows from about 126 in 2012 to about almost 0 in 2017 and thereafter the supply exceeds the demand by up to about 216 by 2025. The primary reason the adult endocrinologist market reflects a persistent excess demand gap while the pediatric case does not is that the aging population adds to demand growth in the case of adult endocrinologists, while this is not the case for pediatric endocrinologists. A secondary reason is that fellowship positions experienced faster growth rates in recent history in pediatric endocrinology compared to adult endocrinology. Hence, though we hold new entrants constant at their current levels for both groups, new entrants are historically larger, relative to the extant workforce, for pediatric endocrinologists compared to adult endocrinologists. This means that the pediatric workforce, other things remaining equal, will grow at a somewhat faster rate.

Exhibit 42 presents the results of Scenario 1 from ***Exhibit 39*** for adult endocrinologists. In this scenario, new entrants grow annually at the recent historical rate of 3.5 percent per year. The result of this new entrant growth is that the excess demand gap is continuously narrowed over the projection years, and closes by 2025.

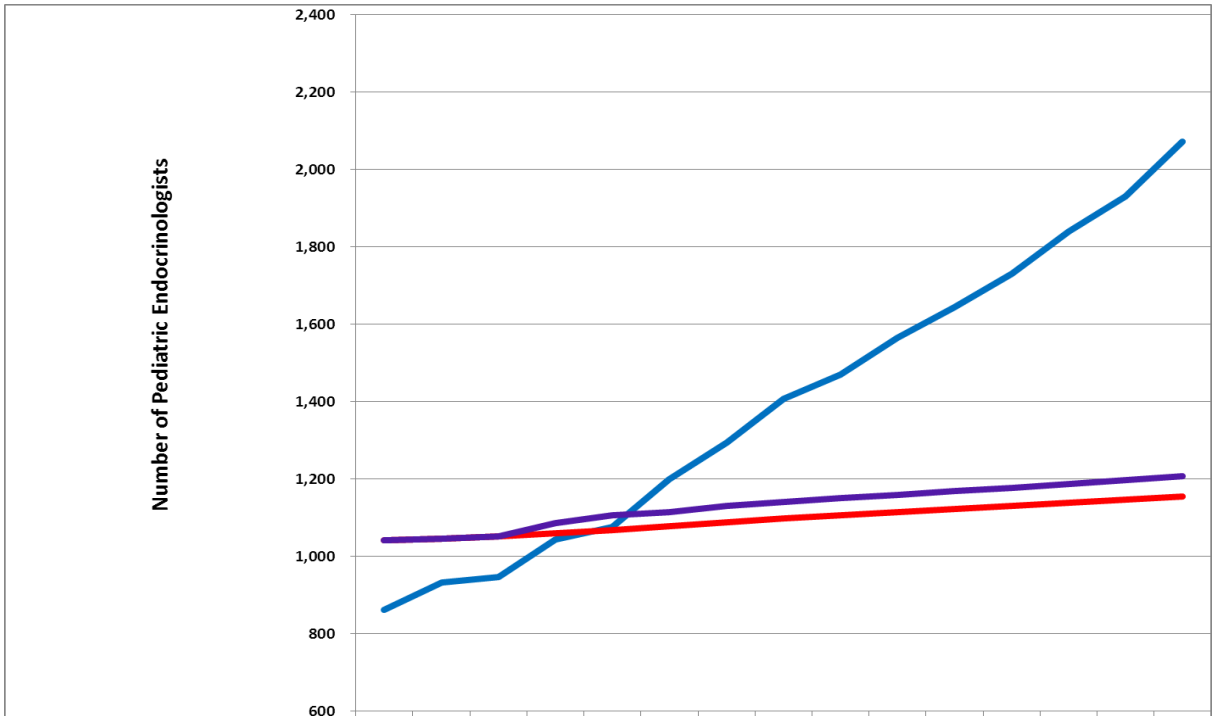
Exhibit 42. Scenario 1: Growth in New Entrants for Adult Endocrinologists



	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
Demand (FTE)	6,125	6,219	6,315	6,411	6,513	6,613	6,712	6,809	6,906	7,002	7,092	7,178	7,263	7,349	7,440
Demand Under ACA (FTE)	6,125	6,219	6,315	6,571	6,744	6,841	6,982	7,081	7,180	7,282	7,380	7,478	7,579	7,682	7,789
Scenario 1 Supply Clinically Active (FTE)	4,948	5,043	5,118	5,290	5,418	5,568	5,770	5,967	6,144	6,386	6,666	6,921	7,187	7,518	7,852

Exhibit 43 presents the results of Scenario 1 for pediatric endocrinologists. New entrants grow at the recent historical rate of 6.6 percent per year. At this growth rate, the small gap between supply and demand is closed within the first three years of the projection period.

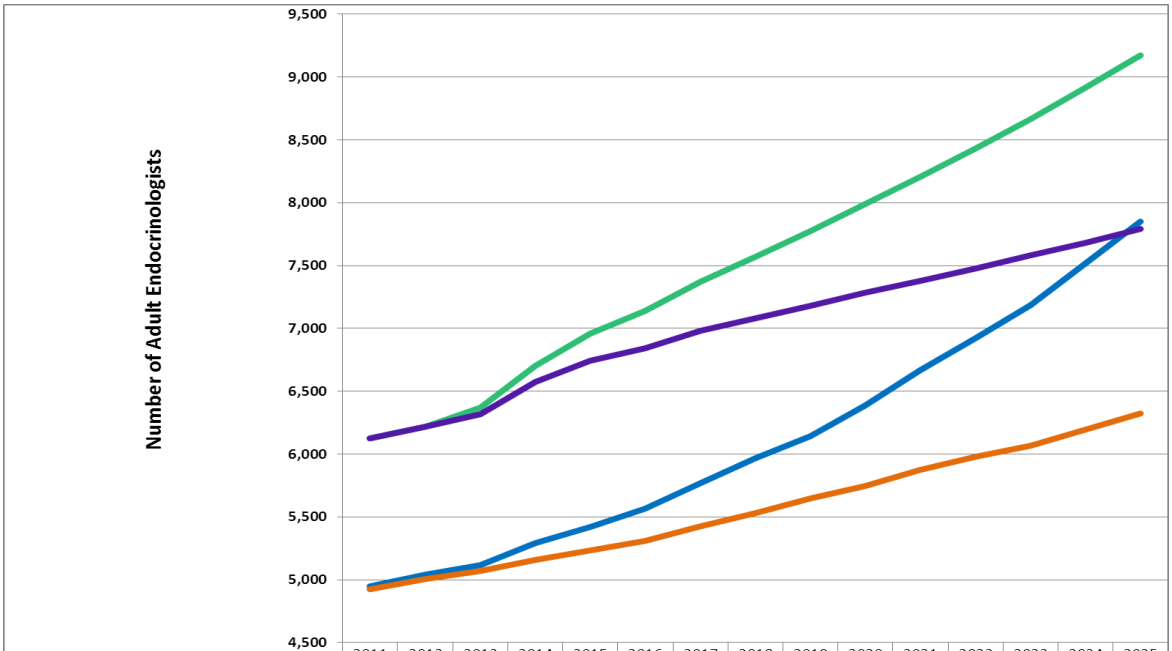
Exhibit 43. Scenario 1: Growth in New Entrants for Pediatric Endocrinologists



	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025
Scenario 1 Supply Clinically Active (FTE)	862	932	947	1,043	1,076	1,199	1,294	1,407	1,469	1,565	1,644	1,730	1,839	1,931	2,071
Demand (FTE)	1,041	1,046	1,052	1,060	1,068	1,077	1,087	1,097	1,107	1,114	1,122	1,130	1,138	1,146	1,154
Demand Under ACA (FTE)	1,041	1,046	1,052	1,086	1,106	1,115	1,131	1,141	1,151	1,159	1,168	1,177	1,188	1,198	1,208

In ***Exhibit 44*** we present the results for Scenario 2 for adult endocrinologists. The demand for adult endocrinologists increases as a result of a higher prevalence of diabetes. We assumed that the prevalence of diabetes increases from a current rate of 7.4 percent to 12 percent by 2025. Using MEPS data on the number of endocrinology we determined the number of endocrinology visits per diabetic per year, separately for adults and children. We then added the number of visits of additional diabetics due to the prevalence increase to obtain the additional endocrinology visits demanded. As can be noted, through the end of our projection period, the supply from Scenario 1 does not catch up with the increased demand under this scenario.

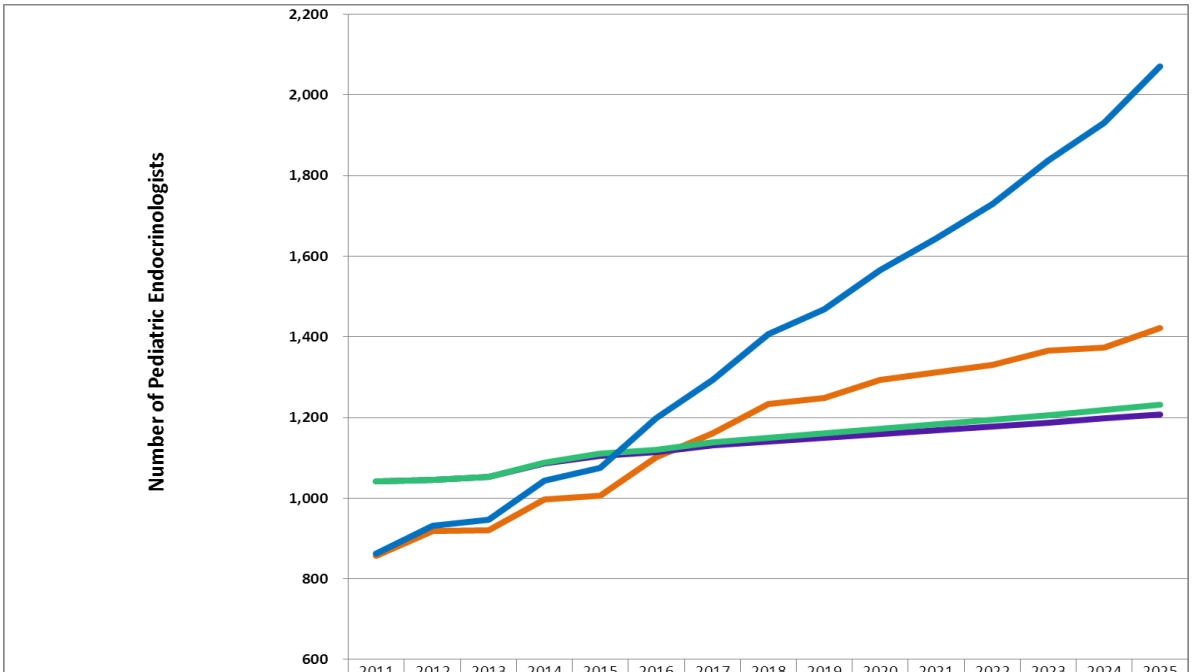
Exhibit 44. Scenario 2: Growth in Number of Entrants and Demand for Adult Endocrinologists



	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025
Demand Adults FTE - diabetes (ACA)	6,125	6,219	6,372	6,703	6,955	7,138	7,371	7,568	7,773	7,987	8,205	8,430	8,668	8,915	9,175
Scenario 1 Supply Clinically Active (FTE)	4,948	5,043	5,118	5,290	5,418	5,568	5,770	5,967	6,144	6,386	6,666	6,921	7,187	7,518	7,852
Demand Under ACA (FTE)	6,125	6,219	6,315	6,571	6,744	6,841	6,982	7,081	7,180	7,282	7,380	7,478	7,579	7,682	7,789
Baseline Supply Clinically Active	4,926	5,009	5,071	5,160	5,234	5,312	5,426	5,530	5,648	5,749	5,872	5,981	6,064	6,193	6,322

Finally, in Scenario 2 for pediatric endocrinologists (***Exhibit 45***), the demand resulting from the increase in the prevalence of diabetes among population aged 0-18 is small, such that the supply from scenario 1 intersects with the new demand at about the same time as it intersects with the original demand curve, in 2015 or 2016.

Exhibit 45. Scenario 2: Growth in Number of Entrants and Demand for Pediatric Endocrinologists



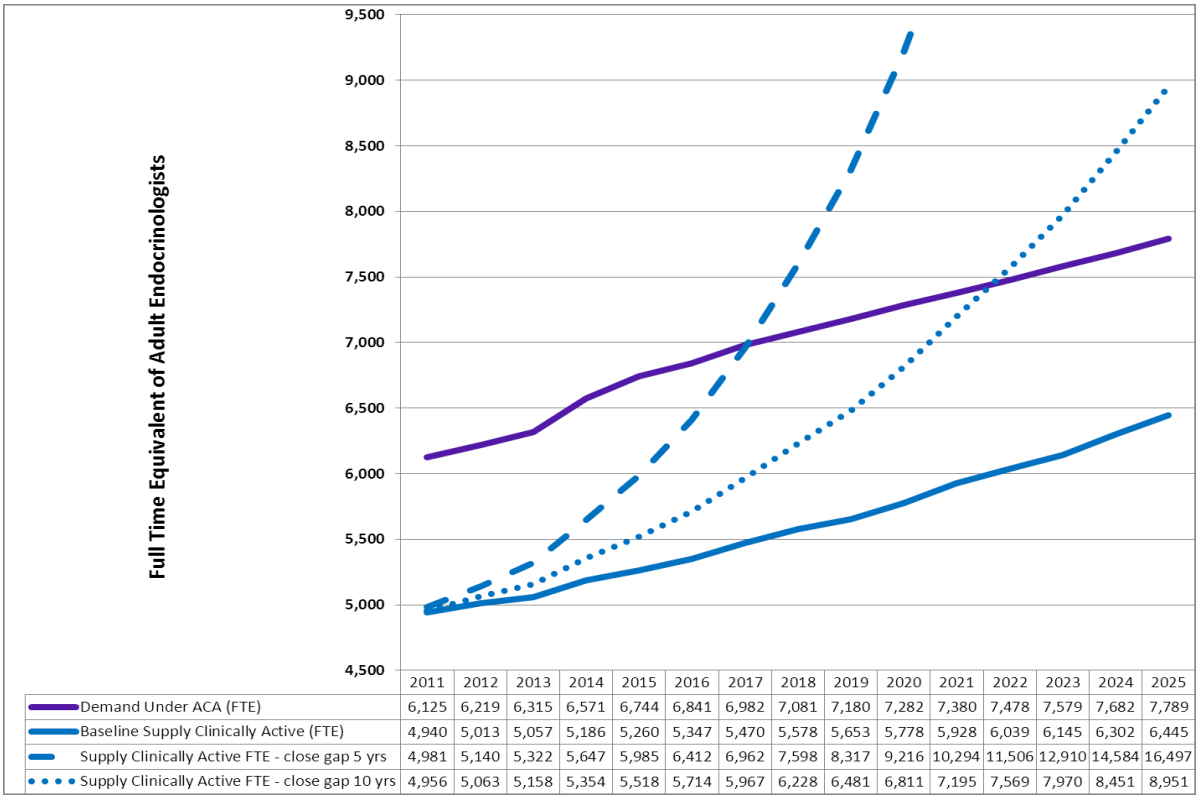
	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025
Baseline Supply Clinically Active (FTE)	858	919	920	998	1,007	1,102	1,162	1,235	1,249	1,293	1,311	1,331	1,366	1,374	1,423
Demand Under ACA (FTE)	1,041	1,046	1,052	1,086	1,106	1,115	1,131	1,141	1,151	1,159	1,168	1,177	1,188	1,198	1,208
Demand Pedi FTE - diabetes (ACA)	1,041	1,046	1,053	1,089	1,110	1,120	1,139	1,150	1,162	1,172	1,183	1,194	1,207	1,219	1,232
Scenario 1 Supply Clinically Active (FTE)	862	932	947	1,043	1,076	1,199	1,294	1,407	1,469	1,565	1,644	1,730	1,839	1,931	2,071

The primary reason that a growth in the prevalence rate for diabetes in the pediatric population has a smaller effect on demand for endocrinology services, compared to a comparable growth rate in the adult population, is that the underlying prevalence rate of diabetes is much lower in the pediatric population. The overall prevalence rate for the population under age 20 is only about 0.26%, while the prevalence rate in the adult population is about 11.3%.[47] Hence, a given percent growth rate will have a much smaller effect on the pediatric population.

Finally, in ***Exhibit 46***, we show the trajectory of supply necessary to close the supply and demand gap for adult endocrinologists in 5 years and in 10 years, respectively. Note that new entrants must grow at an annual rate of 14 percent per year, to close in 5 years, and 5.5 percent per year, to close the gap in 10 years.

[47] CDC National Diabetes Fact Sheet, January 26, 2011.

Exhibit 46. Alternative Supply Scenarios to Close Gap in 5 and 10 Years



	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025
Demand Under ACA (FTE)	6,125	6,219	6,315	6,571	6,744	6,841	6,982	7,081	7,180	7,282	7,380	7,478	7,579	7,682	7,789
Baseline Supply Clinically Active (FTE)	4,940	5,013	5,057	5,186	5,260	5,347	5,470	5,578	5,653	5,778	5,928	6,039	6,145	6,302	6,445
Supply Clinically Active FTE - close gap 5 yrs	4,981	5,140	5,322	5,647	5,985	6,412	6,962	7,598	8,317	9,216	10,294	11,506	12,910	14,584	16,497
Supply Clinically Active FTE - close gap 10 yrs	4,956	5,063	5,158	5,354	5,518	5,714	5,967	6,228	6,481	6,811	7,195	7,569	7,970	8,451	8,951

VI. DISCUSSION

The 2012 Endocrinology Workforce Analysis identifies an increasing demand for the services of adult endocrinologists that exceeds the available supply of full time equivalent clinically active adult endocrinologists. There are several factors at work producing this excess demand. First, the population is both growing and aging. Because the prevalence rate of endocrinopathies tends to be higher for older members of the population, the demand for endocrinologists grows by more than simply the growth in the aggregate population. Second, a significant proportion of the adult endocrinologist workforce is Baby Boomers (born between 1946 and 1964). Those physicians who are over age 60 will leave the workforce or will greatly reduce hours of clinical work, over the next decade. Our model of supply incorporates this attrition and changing hours in the projections. Third, there is emerging evidence that those who replace the older cohort may work fewer hours, on average. The supply model captures the effect of changing demographics on hours of work.

For pediatric endocrinologists, some of the same factors are at work, but the effects are attenuated. First, the effects of the aging population have little or no effect on the pediatric population and, therefore, is not a source of increasing demand as it is in the case of adult endocrinologists. Moreover, the overall proportion of children in the population is actually projected to decline, from about 27 percent in 2010 to 26 percent by 2020, with further declines to 25 percent by 2035.[48] Second, though the prevalence rate of diabetes is increasing in both the adult and pediatric population, the overall prevalence of diabetes in the pediatric population is small. Hence, a given percentage increase in the prevalence rate results in a relatively small increase in demand, compared to an equivalent increase in the prevalence rate in the adult population.

The precise forecasts for both adult and pediatric endocrinologists are subject to uncertainty. In the baseline analysis, we estimate an excess demand gap of about 1,484 full-time equivalent adult endocrinologists in 2015. By 2025, this gap will have fallen slightly to 1,344 FTE. For pediatric endocrinologists, our baseline estimate is that there will be excess demand of about 100 FTE in 2015, but this gap is likely to be approximately closed by 2016. Under the baseline, there may emerge a surplus of pediatric endocrinologists of about 200 FTE by 2025.

We examined the case under which the underlying prevalence of diabetes grows increase from 7.4% today to 12% by 2025. This increases overall demand. However, the qualitative implications of the analysis remain about the same. The qualitative implications are that adult endocrinologists are likely to experience a prolonged period of excess demand. The demand for pediatric endocrinologists is likely to grow less rapidly. This, coupled with a rate of new entrants that is above the historical average, is likely to result in excess supply by about 2017, other factors remaining constant.

There are likely to be adjustments on the supply side related to the excess demand. Basic economics suggest that, in the face of excess demand, earnings in the profession will rise, making it more attractive to enter adult endocrinology. However, the healthcare market must recognize the contributions that endocrinologists make to the control and prevention of diabetes, in

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[48] U.S. Census Bureau. *Statistical Abstract for 2012*, Population Projections by Age and Sex. http://www.census.gov/compendia/statab/cats/population/estimates_and_projections_by_age_sex_raceethnicity.html

particular, and endocrine diseases, in general. If fellowship positions can be expanded, they are likely to be filled. Though the demand for health care services in general declined during the 2008-2012 recession, in the longer run, demand is likely to expand both because of the gaining population and, within age groups, increasing prevalence of diabetes. This increase should result in higher earnings that may encourage some physicians to delay retirement and others to expand clinical hours. All of these factors may work to reduce excess demand by expanding supply.

We considered the question of the rate at which new entrants to the adult endocrinology profession would be required to grow, in order to close the excess demand gap in 5 years and in 10 years, respectively. We found that, under our baseline assumptions for demand, the growth rate for new entrants would be about 14 percent per year to close the gap in 5 years, and about 5.5 percent per year to close the excess demand gap in 10 years.

In addition, excess demand is likely to encourage more practice efficiencies. Because a physician's time will become more valuable, team based care and task shifting will increase. The use of physician assistants and nurse practitioners, leveraging the endocrinologist's time in management of endocrine diseases, especially diabetes, will become more common. Scope of practice laws and reimbursement policies must, of course, adapt to this increase in demand and facilitate these practice efficiencies. To an extent, this is occurring now across both primary care and specialty care, in part in response to shortages.[49] While some market factors may mitigate the level of demand observed over the next decade, the level of excess demand predicted by these models suggests that proactive interventions on the part of the endocrinology community are warranted. These interventions might include:

- Expanding the number of fellowship positions. This is an important first step in almost any strategy to significant reduce the excess demand gap.
- Providing more remunerative E&M codes for diabetes, obesity and metabolic syndrome, as well as for CGM and insulin pump care, for telephone calls to patients, so that these practices have greater incentives to equalize salaries for endocrinologists and proceduralists, so that medical students will choose to enter endocrinology, and practices can recruit endocrinologists and employ efficiencies, as additional fellowship positions become available.
- Generating attractive E&M codes for telemedicine consults, and for ancillary providers at remote sites, so that diabetes, obesity, thyroid disorders and other endocrinopathies can be compensated for these efficient forms of providing care. If meaningful salary increments occur as a result it will be important to provide this information to medical school graduates so that they may more favorably consider a future in endocrinology.
- Truncating the training duration to reach endocrinology board certification status by shortening the internal medicine component from three to two years. This step would speed the rate of entry of endocrinologists, once additional fellowship positions become available and, in the longer run, increase the years of clinical practice provided by endocrinologists over a career.

[49] See, for example, "Nearly Half of Office-Based Physicians Work with NPs and PAs." Victoria S. Elliott, American Medical News, September 12, 2011.

- Disseminating information about practice efficiency methods and providing support to endocrinologists undertaking practice efficiency improvements.
- Disseminating information on best practices, including information on optimal lengths of follow-ups, use of information technology to encourage appropriate follow-up and optima use of PA/NPs to assist with chronic care patients.
- On-line advanced endocrinology courses for PAs and NPs interested in endocrinology management sponsored by the Endocrine Society (modeled after successful programs in other medical specialties).
- Advocating for reimbursement policies that encourage entry into endocrinology, instead of procedure based specialties, and encourage practice efficiency and the use of other health professionals as appropriate (e.g., Diabetes Education Counselors).

Proactively taking steps similar to those suggested above will improve practice efficiency, improve quality of care, and adequately staff practices for the number of patients to be seen.

A. Strengths

This study has several strengths. One is the ability to draw on a suite of refined databases that are increasingly reliable and useful to health workforce researchers. Some of that data was used in combination with other data sets. Agreement across multiple data sets results in more reliable results. Finally, with the benefit of hindsight, the recognition that managed care did not dominate the health care market, arguably reducing the demand for specialty care, results in a greater demand than was anticipated in the earlier study.

B. Limitations

We define an endocrinologist FTE empirically, based on what the typical or average endocrinologist actually does. Empirically, the typical adult endocrinologist provides about 3,038 visits per year, while the typical pediatric endocrinologist provides about 1,964 visits per year. A limitation in the current paradigm is that there is no well-described, broadly accepted definition of "one Endocrinologist FTE." Another limitation is that demand is based on current use measures, and most experts would agree that current use does not achieve the access or benchmark outcome measures most experts would recommend.

Another limitation is that some of the data are generated by self-report, such as salary data and access data. For example, by self-report, physician wait time averages 37 days, but in many areas it is 3-6 months.

An inherent limitation of workforce modeling, including the modeling conducted in support of this report, is that these predictions have the appearance of precision. In fact there are too many variables and assumptions to achieve such precision over long periods of time in modeling. Moreover, the predictions are made without specifying the range of error using statistical methods. Predictive modeling is a statistical estimate or the probability of an outcome given a set amount of input data. Newer and more refined data, and modeling techniques that incorporate uncertainty in a more transparent way, may improve future models.

C. Suggestions for Endocrinology Supply and Demand Data

All professional associations are in need of a method for collecting quantitative information about items in a population. A number of strategies are available to overcome some of the shortcomings in reliable workforce data. With the likelihood of surveys reporting a diminishing rate of return, a set of approaches are suggested.

Creating a small cohort of endocrinology fellows who are asked to commit to internet-based, short but periodic surveys can be less fatiguing than a lengthy survey. Refreshing this cohort with additional cohorts every few years can add to the richness of data. Weighting the individual for statistical purposes can be useful for projecting the workforce as a whole. Adding older members willing to contribute will strengthen the database.

Enlisting a representative sample of endocrinology practices to produce annual administrative data can identify patterns of use, characteristics of patients and staff, diagnoses and treatments rendered. A group of 25 practices will produce a wide range of services that can be measured and compared to other national known data, such as MGMA, MEPS, NAMCS, and others. Agreements can be developed and an administrator's time can be compensated to report this data.

Focus groups of endocrinologists can be undertaken at national meetings. Such focus groups can be exploratory in nature, with or without specific questions. Prearranged questions can prepare the participants. Specific questions about practices, partnerships, procedures, trends in patient characteristics, patterns of referrals, strategies of constraining too many demands, issues of work life and other topics can be explored.

Registration and annual reregistration of members of The Endocrine Society can provide opportunities to ask a series of questions that are useful to workforce planners, if the process is electronic. Not all members would be asked the same questions but instead some small set of questions asked of one portion of registrants and another set of questions to another portion. The cumulative information can be analyzed and that information added to develop the set of questions for the following year. Additional and refined questions can be asked of registrants attending the national meeting.

VII. CONCLUSION

To make useful policy recommendations, physician workforce planners need to have accurate data on current and projected physician supply and a better understanding of how future physician supply will be affected by new entrants and attrition patterns. This study of the endocrinology workforce is central to that mission. An implication of this supply and demand study is that the U.S. endocrinology workforce is undergoing change. Aside from an older generation of specialists being replaced by a younger cadre, it is changing due to a gender shift and retirement patterns. Endocrinologist retirement patterns will be an important factor affecting physician supply during the next 10 years, due to increasing numbers of physicians entering the older age categories. The other is the plateau of fellowship trained endocrinologists entering the workforce. The GME system in this country is largely responsible for the nature of the physician workforce that exists today. Over the years, the system has produced a workforce composed of physicians who are well prepared to enter clinical practice in the specialty of their training, and a physician workforce that has generally been considered appropriate in size and specialty mix to meet the medical needs of the American public. That belief is now being tested.

On the demand side of the equation is a set of trends that have been noted for some time. These include an aging population, a sustainability of chronic diseases, an epidemic of Type II diabetes, new technology for diagnosis and treatment and an expectation from society that care should be readily available. Coupled with this is an inevitable increase of newly insured into the mainstream of society. This increase is due to the PPACA. Expectations about how this will evolve vary, but the general consensus is that more people with insurance means a healthier population, but also an increased demand for health care services, including endocrinology services.

The gap between supply and demand that this study reveals for adult endocrinology is challenging. The economic term "excess demand" is defined as that which exceeds the quantity of the service that can be provided, and usually is the major reason for an increase in price. The demand for adult endocrinology services is not in equilibrium with supply by this analysis and not likely to be for the next decade under the current circumstances.

While this study reveals that there is a gap between demand and supply for pediatric endocrinology services, it is more modest than that for adult endocrinology. Moreover, the baseline analysis suggests that, simply by maintaining a flow of new entrants into pediatric endocrinology at their current level, the gap can be closed by about 2016. After accounting for projected increases in both Type 1 and 2 diabetes for the pediatric population, this basic conclusion still holds. The reason is that the underlying prevalence of diabetes in children is significantly lower than that for adults. Hence, even significant percentage increases in prevalence for this population does not amount to a significant increase in demand in absolute terms. Because estimates provided in this paper are subject to much uncertainty, caution is suggested in interpreting the analysis. The annual demand for adult endocrinology services will likely exceed the supply for some time. That result appears to be robust. Demand and supply are closer together for pediatric endocrinology services. That result also appears to be robust. The exact amount of excess demand and when the gap may be closed is subject to greater uncertainty. Moreover, factors not considered explicitly here—changes in technology, epidemiology, and the organization of care delivery, make any projections beyond four or five years treacherous.

APPENDIX: ENDOCRINOLGIST SURVEY, 2012, CONDUCTED BY THE LEWIN GROUP

1001MC

Endocrinologist Survey

The Endocrine Society is updating their analysis of the endocrine workforce and has developed a survey to help understand the nature and spectrum of clinical practice in Endocrinology, Diabetes, and Metabolism. All responses will be treated with confidence and no individual information will be divulged.

Please answer the questions on this survey by completely filling in the appropriate circle before each response or by writing in the appropriate location provided.

Fill Circles Like This → ● Not Like This → ⊗ ✓

Right Way 2 2 Wrong Way 2 2

Qualifier

1. **Are you currently practicing endocrinology?**
   - ○ Yes
   - ○ No, but I have practiced in the last five years
   - ○ No, I have never practiced - *[Thank you; please quit this survey here if you have never practiced and return the survey in the envelope provided]*
2. **Birth year:** ☐☐☐☐
3. **Are you a US citizen?**
   - ○ Yes ○ No
4. **Gender:**
   - ○ Male ○ Female
5. **Race/Ethnicity:** *(Mark all that Apply)*
   - ○ American Indian or Alaska Native
   - ○ Black or African American
   - ○ Hispanic or Latino
   - ○ Asian
   - ○ Native Hawaiian or Other Pacific Islander
   - ○ White
6. **What is your medical degree?**
   - ○ MD ○ DO ○ MBBS ○ Other _____
7. **What year did you complete your medical degree?**
   ☐☐☐☐
8. **Where did you complete your medical degree?**
   - ○ United States *(specify state)*: ☐☐
   - ○ Another Country *(specify)*: _____
9. **In what state did you do your fellowship?** ☐☐
10. **What is your employment status?** *(Mark all that Apply)*
    - ○ Actively working in a position that requires a medical license
    - ○ Actively working in a field other than medicine
    - ○ Volunteering
    - ○ Not currently working
    - ○ Retired
11. **How many years have you been practicing Endocrinology in the United States (excluding training)?** ☐☐
12. **Training and Certification**

	Completed Accredited Residency Program/ Fellowship	Board Certified
Endocrinology	○ Yes ○ No	○ Yes ○ No
Pediatric Endocrinology	○ Yes ○ No	○ Yes ○ No
Female Reproductive Endocrinology	○ Yes ○ No	○ Yes ○ No
Internal Medicine	○ Yes ○ No	○ Yes ○ No
Other Specialty (write in) _____	○ Yes ○ No	○ Yes ○ No

Practice Characteristics

13. **For all positions held, indicate the average number of hours spent per week (excluding call) on each major activity:**
    [If Direct Patient Care hours is "0", skip to Academic Setting Section after Q41.]
    - _____ Direct Patient Care
    - _____ Research
    - _____ Teaching
    - _____ Administration
    - _____ Other
    - _____ **Total Hours**
14. **Direct Patient Care: Practice Locations**
    Principal practice site
    Zip Code of practice site: ☐☐☐☐☐
    Direct Care hours at site*: _____
    Secondary Practice Site *(if applicable)*
    Zip Code of practice site: ☐☐☐☐☐
    Direct Care hours at site*: _____
    *Number of direct care hours should match total in item #13.
15. **Please indicate your primary employment setting.**
    - ○ Solo Practice
    - ○ Partnership Practice
    - ○ Group Model HMO
    - ○ Government (e.g., VA, military, public health)
    - ○ Faculty, University
    - ○ Industry
    - ○ Endocrinology Group Practice
    - ○ Multi-Specialty Group Practice
    - ○ Hospital Based
    - ○ Retired
    - ○ Other *(specify)*_____

PLEASE CONTINUE TO THE NEXT PAGE →

Clinical Practice Characteristics

The next set of questions relate to patients you treat and clinical practice characteristics.

16. Do you currently treat patients 4 or more hours per week?

- ○ Yes
- ○ No *[Please skip to the 'Future Employment Plans' Section after Q30]*

17. Please indicate the percentage of your clinical care work hours spent providing the following types of care in a typical work week.

% of Clinical Care Hours	Type of Care
_____	Adult Endocrinology
_____	Pediatric Endocrinology
_____	Female Reproductive Endocrinology
_____	General internal medicine (Primary Care)
_____	General pediatrics
_____	Other *(specify)* _____
_____	**Total (please total to 100%)**

18. On average, how many initial (i.e., new patient or consultation) and follow-up outpatient and inpatient visits do you conduct per month in a typical month?

_____ Initial outpatient visits per month
_____ Follow-up outpatient visits per month
_____ Initial inpatient visits per month
_____ Follow-up inpatient visits per month

19. If you are board certified or fellowship trained in Pediatric Endocrinology, what is the age of the:

☐☐ Oldest patient you would be willing to see
☐☐ Youngest patient you would be willing to see

20. Approximately, what percentages of your patients are in each of the following age groups?

% of all Patients	Age Group
_____	Less than 18 years old
_____	18 - 64 years old
_____	65 or older
_____	**Total (please total to 100%)**

21. Are you accepting new patients?

○ Yes ○ No

22. Do you require new patients to have a referral?

○ Yes ○ No

23. How many days (on average) does a non-urgent new patient typically have to wait for an appointment?

_____ days

24. On an average week, how many patients do you see?

☐☐☐

25. Please indicate the number and FTEs of Endocrinologists and PAs and NPs (directed by the endocrinologists) who work in your main clinical practice setting. For example, if you have two NPs who each work 20 hours per week, you would indicate two for the number of professionals and one for the number of FTEs represented by these professionals.

# of professionals practicing in main clinical practice setting	# of FTEs represented by professionals indicated at left	Type of Medical Professional
_____	_____	Endocrinologist
_____	_____	Pediatric Endocrinologist
_____	_____	Female Reproductive Endocrinologist
_____	_____	Physician Assistants (PAs)
_____	_____	Nurse Practitioners (NPs)
_____	_____	Other Physicians
_____	_____	Other _____

26. Do you "job share" (i.e. work less than 30 hours per week and share responsibility for your patients with another full-time or part-time professional)?

○ Yes ○ No

27. Please indicate if your practice or academic division is actively seeking to increase the number of each of the following types of professionals on staff. Beyond your current active recruiting efforts, please also indicate if you expect your practice or academic division to increase the number of each of the following types of professionals on staff within the next five years.

Actively Seeking to Increase	Expect to Increase by 2016	Type of Professional
○	○	Endocrinologist
○	○	Pediatric Endocrinologist
○	○	Physician Assistant / Nurse Practitioner

28. Please indicate the technologies currently available at your medical practice or within your academic division or planned within the next five years. *(Please include only technologies that are under the direct fiscal control of your practice or academic division.)*

Available in 2011	Plan to Acquire by 2016	Technology
○	○	Infusion Unit
○	○	Ultrasound/Sonography
○	○	Densitometry
○	○	MRI
○	○	X-ray
○	○	Laboratory
○	○	Thyroid Biopsy Capability
○	○	Other _____

PLEASE CONTINUE TO THE NEXT PAGE ➡

29. **Please indicate the top six primary diagnoses among your new and follow-up patients over the last six months. Please use 1 to indicate the condition with the greatest share of visits and 6 to indicate the condition with the 6th greatest share. Under "Other" please write-in any condition in your top six which is not listed. (If possible, please refer to your billing records to inform your response.)**

Rank Top 6 Diagnoses for New Patients	Rank Top 6 Diagnoses for Follow-up Patients	Primary Diagnosis for Visit
☐	☐	Diabetes - Type I
☐	☐	Diabetes - Type II
☐	☐	Nodule(s) or Cancer
☐	☐	Other Thyroid Disorders
☐	☐	Parathyroid Disorders
☐	☐	Other Metabolic Bone Disorders
☐	☐	Pituitary Disorders
☐	☐	Reproductive Endocrinology - Male
☐	☐	Reproductive Endocrinology - Female
☐	☐	Obesity
☐	☐	Lipid Disorders
☐	☐	Adrenal Disorders
☐	☐	Other Endocrine Neoplasms
☐	☐	Growth Disorders
☐	☐	Other *(specify)* _____
☐	☐	Other *(specify)* _____

30. **What percentage of your patients have the following primary sources of payment?**

% of Patients	Sources of Payment
_____	HMO, Commercial
_____	PPO, Indemnity
_____	Other Private Insurance
_____	Medicare
_____	Medicaid
_____	Worker's Compensation
_____	Self-Pay
_____	No Charge
_____	Other *(specify)* _____
_____	**Total (please total to 100%)**

Future Employment Plans

The next two questions are related to your future plans.

31. **What are your employment plans for 2012?** ***(Mark only One)***

- ○ Continue as you are
- ○ Increase hours. If so, by how much? ☐☐ hours/week
- ○ Decrease hours. If so, by how much? ☐☐ hours/week
- ○ Seek job in non-clinical setting
- ○ Retire
- ○ Other *(specify)*:_____

32. **At what age do you plan to substantially reduce your direct patient care hours (i.e., partially retire)?**

_____ Age when you expect to reduce substantially patient care hours

_____ No plan to reduce hours before retirement

33. **At what age do you plan to completely retire from patient care?**

_____ Age expected at full retirement from patient care

Professional Experiences

34. **Approximately how many weeks did you work in 2011?**

_____ weeks

35. **In a typical work week in 2011, how many clinical half days did you schedule per week?**

_____ half days scheduled per week (typically there are 10 clinical half days per week)

36. **<u>In 2016</u>, approximately how many total hours do you expect to work in a typical work week?**

_____ hours worked per week

37. **In a typical work week in 2011, what percentage of your work hours was spent on the following activities?**

% of Work Hours	Professional Activity
_____	Clinical care provided in an office setting
_____	Clinical care provided in a hospital
_____	Administration in support of patient care (e.g., insurance/billing, practice staff management)
_____	Administration that does not support patient care (e.g., non-clinical responsibilities at a teaching institution)
_____	Medical teaching
_____	Basic/bench research
_____	Clinical epidemiology or health services research
_____	Translational research
_____	Practice improvement activities
_____	Other *(specify)* _____
_____	**Total (please total to 100%)**

38. **Did you participate in clinical drug trials in 2011?**

- ○ Yes
- ○ No

PLEASE CONTINUE TO THE NEXT PAGE ➡

Current Job Satisfaction

	Extremely Dissatisfied					Extremely Satisfied
39. Overall how satisfied are you with your current practice of Endocrinology?	○	○	○	○	○	○

40. Overall how satisfied are you with the following job attributes:	Extremely Dissatisfied					Extremely Satisfied
Career options/professional growth	○	○	○	○	○	○
Geographic location	○	○	○	○	○	○
Income	○	○	○	○	○	○
Job security	○	○	○	○	○	○
Reimbursement rates	○	○	○	○	○	○

41. Would you like to see the following attributes of your professional workload increase, decrease or remain unchanged?	Decrease more than 10%	Decrease 1 - 10%	Stay Same	Increase 1 - 10%	Increase more than 10%
Number of hours per week in direct patient care	○	○	○	○	○
Number of hours per week on administrative activities supporting patient care	○	○	○	○	○
Number of hours per week on administrative activities that do not support patient care	○	○	○	○	○

Academic Setting

The next set of questions relate to professional experiences in an academic setting.

[If you are not working in an academic setting, please skip to end of survey.]

If you are working in an academic setting, please respond to the next set of questions.

42. What is your academic rank? (Full time, part time, or adjunct) *[Mark only One]*

- ○ Instructor
- ○ Assistant Professor
- ○ Associate Professor
- ○ Professor
- ○ Other *(specify)* _____

43. Are you eligible for tenure or already in a tenured position?

- ○ Already have tenure
- ○ Eligible for tenure
- ○ Not eligible for tenure

44. What percent of your total salary in 2011 was from the following sources?

% of Total Salary	Funding Source
_____	Federal Grant
_____	Industry Grant
_____	Non-Federal, Non-Industry Grant
_____	Departmental/Institutional/ Endowment Support
_____	Practice/Clinical Income
_____	Other *(specify)* _____
_____	**Total (please total to 100%)**

45. Did you supplement your 2011 salary with income from any of the following sources: *(Mark all that Apply)*

- ○ Consulting regarding drugs and/or medical devices
- ○ Consulting, medical-legal
- ○ Consulting other
- ○ Editorial Stipends
- ○ Speaking fees/honoraria
- ○ Inventions/Royalties
- ○ Research Grant Salary Support
- ○ Other, medical
- ○ Other, non-medical
- ○ Not allowed to supplement salary

Income

46. What was your own net income (i.e. salary not including fringe but before taxes) from medical practice in 2011? Please include all income from clinical practice, speaking/consultation, clinical trials and medical legal work in the form of fees, salaries retainers, bonuses deferred compensation and other forms of monetary compensation. Do NOT include investment income from medical related enterprises. Do NOT add the estimated value of any fringe benefits you may have.

- ○ Less than $100,000
- ○ $100,000-$149,999
- ○ $150,000-$199,999
- ○ $200,000-$249,999
- ○ $250,000-$299,999
- ○ $300,000-$349,999
- ○ $350,000-$399,999
- ○ $400,000-$449,999
- ○ $450,000-$499,999
- ○ $500,000 or more

Thank you for taking the time to complete this survey.

Please return your completed survey in the self-addressed, stamped envelope to the address below:

The Lewin Group
PO Box 1662
Hickory, NC 28603

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