Developing Workforce Models and Data Visualizations that Engage, Educate and Provoke Policy Makers

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In case your office calls, this presentation in one slide

- My frame: objective, “data agitating” workforce researcher and policy wonk
- A brief history of workforce projections—it hasn’t gone so well
- The science of projecting the “right” number of health professionals is still developing
- Better data and methods are needed to account for team-based models of care
- Data visualizations are useful tools to educate, engage and provoke stakeholders
- We’ve got plans with the American Board of Pediatrics to examine the peds workforce

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My lens on workforce research

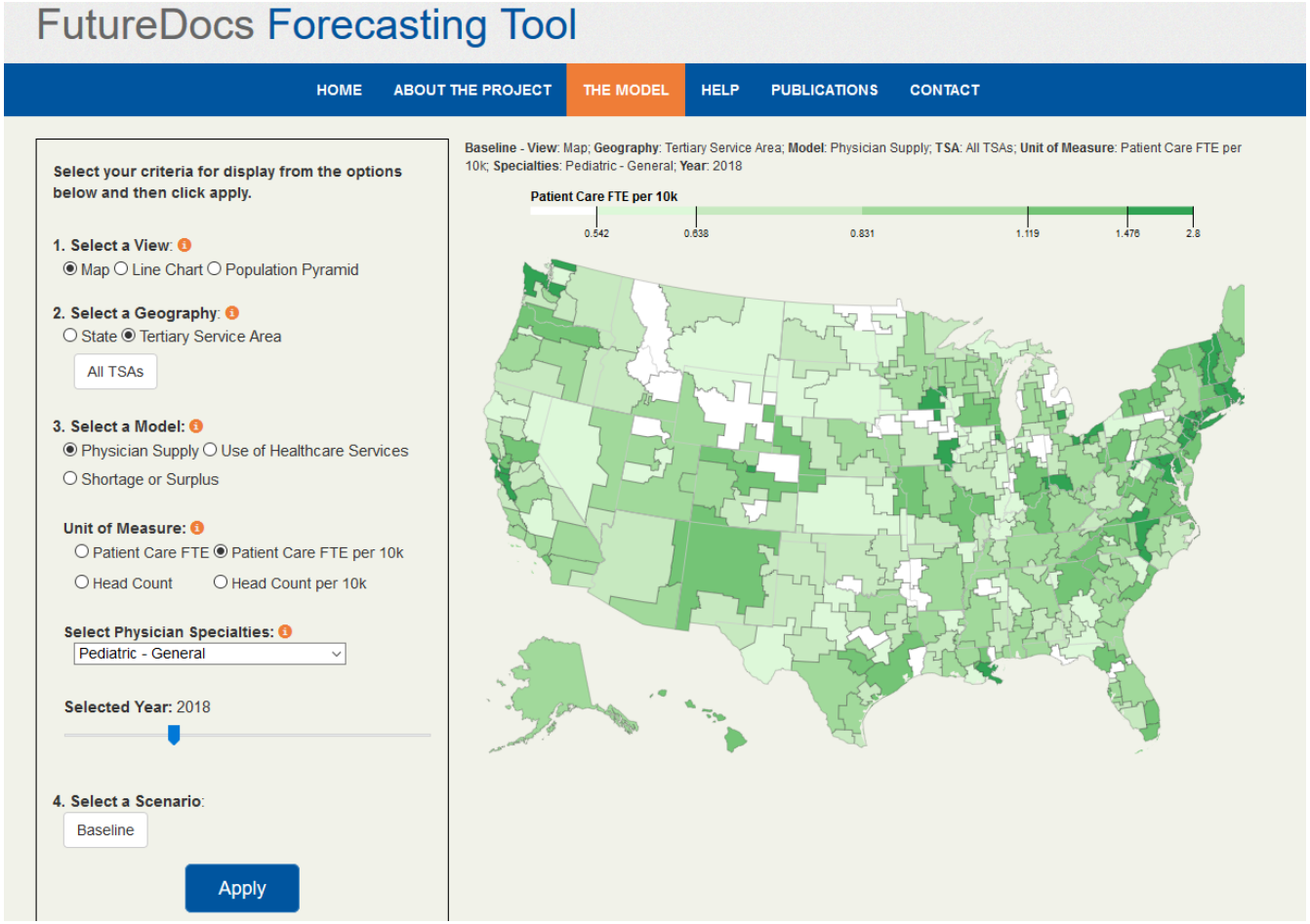
- Privileged to work across specialties and professions. Requires to me to be ethnographer, data geek, policy wonk and diplomat (I'm still working on that last bit)
- 20+ years based at Cecil G. Sheps Center for Health Services Research at UNC-CH where I focus on state, national and international health workforce policy
- Direct HRSA-funded Carolina Health Workforce Research Center which provides timely, objective research to inform national health workforce policy
- Current Chair of COGME, Advisor on CHGME, frequent expert to NAM on workforce topics
- My mission is to infuse data and evidence into what are often contentious turf wars

A brief history of workforce projection models

Most workforce models:

- Aim to answer question of too many or too few health professionals
- Overlook pressing issue of geographic maldistribution
- Produce findings that result in fragmented, advocacy-based reactions:
  - training institutions see opportunities for expansion
  - specialty groups push to expand training programs
- Are proprietary (read: black box) & uncustomizable
- Lack friendly, interactive user interface

We tried to address some of these issues with the FutureDocs Forecasting Tool



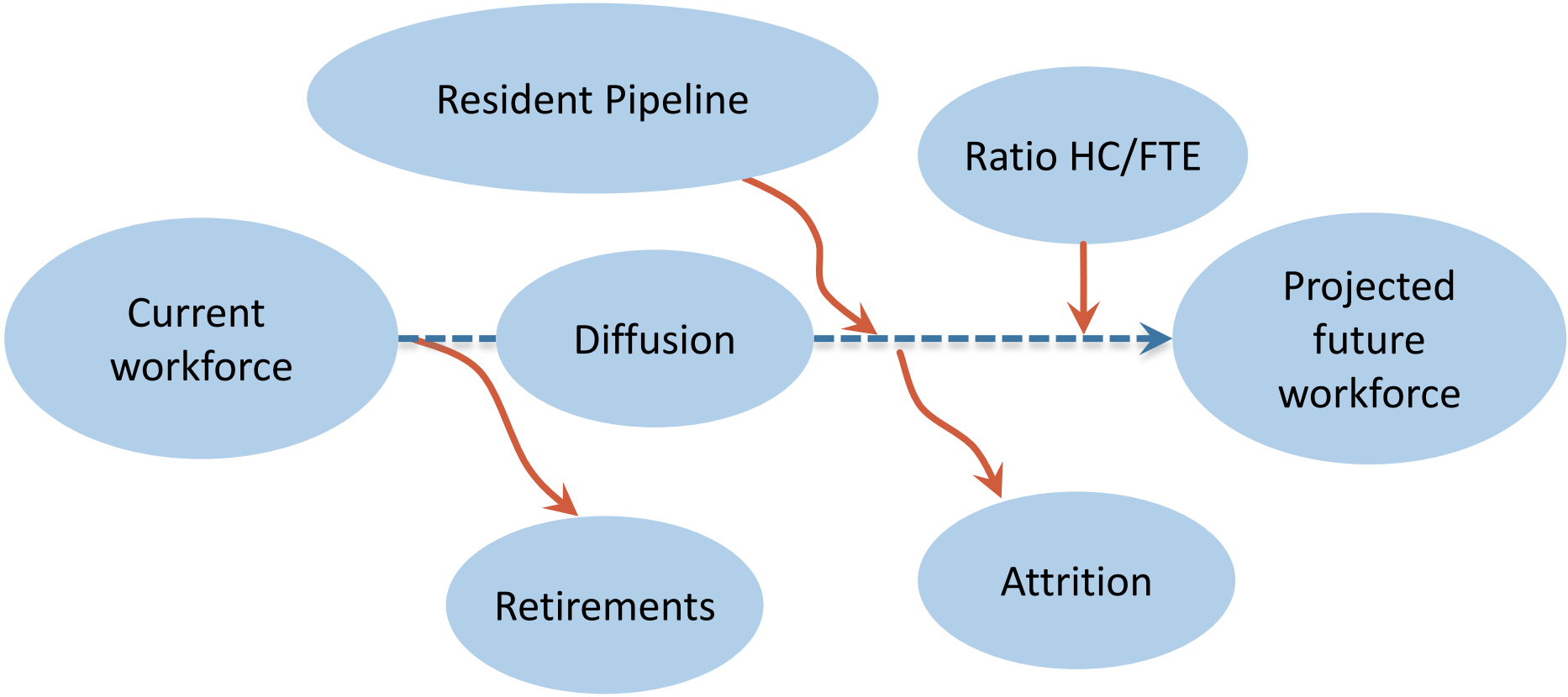
go.unc.edu/FutureDocs

What made FutureDocs different

Released in 2014 and sought to:

- Shift national narrative from focus on overall shortages to pressing issue of geographic maldistribution
- Move away from siloed, profession-based modeling to incorporate “plasticity”– a methodology that recognizes providers have flexible, dynamic and overlapping scopes of practice
- Allow users to model supply and demand under alternate futures — “what if” scenarios
- Engage stakeholders in using data to understand local access problems and develop policies to address them
- Display data in interactive format that enabled users to customize data with 3 types of visualizations — maps, line charts and population pyramids

But it wasn't just a pretty (inter)face. Here's what is behind the supply model



Methods Behind the Supply Model (1)

For 36 physician specialties, we modeled:

- **Current workforce**: Headcount and FTE by age, gender, current practice or training location
- **Retirements and attrition:** based on historical data but simulated effect of earlier or delayed retirement
- **Ratio of Headcount to FTE**: captured variation in hours worked by age, gender and subspecialty

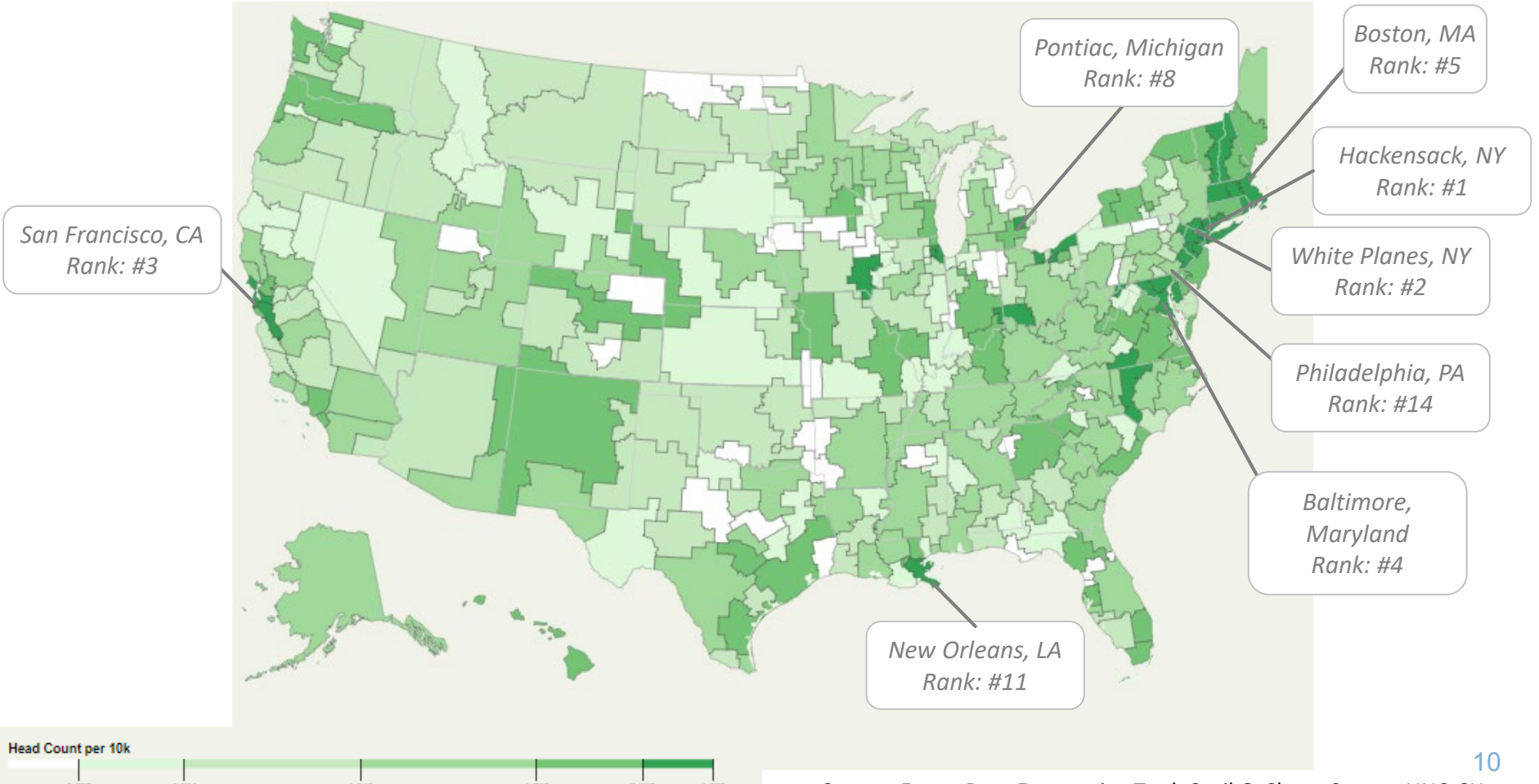
Methods Behind the Supply Model (2)

- **Resident pipeline:** Number of residents entering training and subspecializing—accounting, for example, for the ~40% of peds trainees who exit categorical training and go on to pursue subspecialty training
- **Diffusion:** Geographic diffusion of trainees from residency program to first practice location and geographic moves of actively practicing workforce

We used a microsimulation approach to estimate effect of each of these factors, at individual physician level, to generate forecasts of future supply

Model showed that like many physician specialties, general pediatricians are concentrated around academic health centers in urban areas

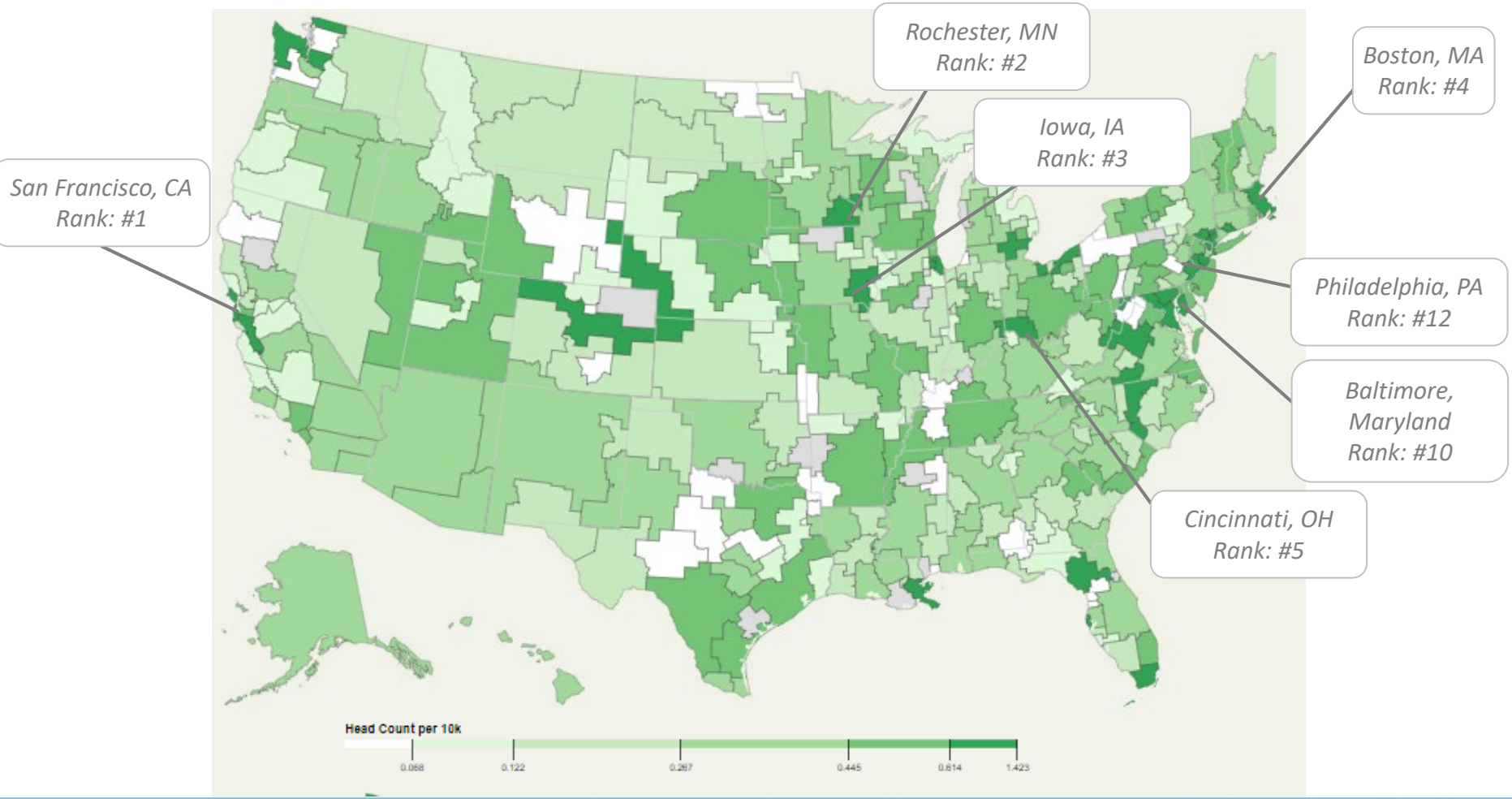
General Pediatricians per 10K pop, 2013, United States



Source: FutureDocs Forecasting Tool, Cecil G. Sheps Center, UNC-CH

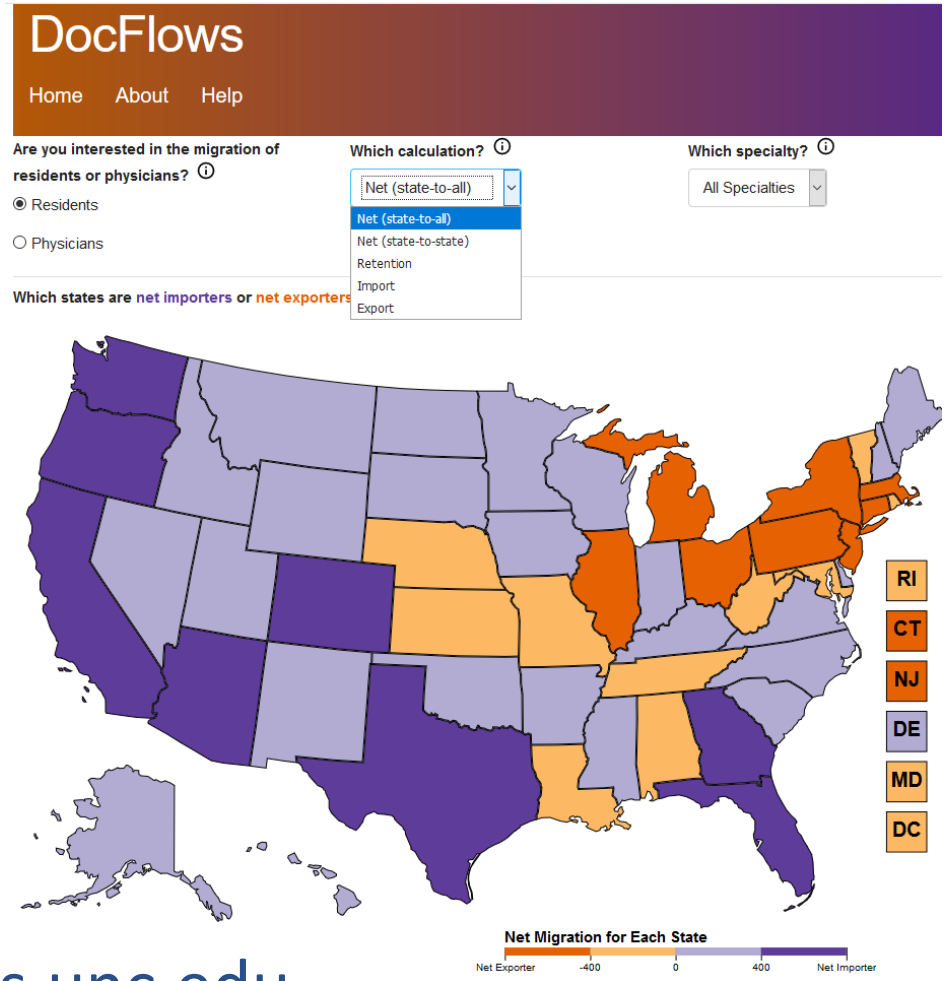
Pediatric Subspecialists are even more geographically concentrated

Pediatric Non-Surgical Specialists, per 10K pop, 2013, United States



Our diffusion methodology led us to develop a new viz tool—DocFlows

- Shows interstate flows of residents and actively practicing physicians between 2009 and 2015
- Goal: help policy makers visualize geographic imbalances between funding of training and workforce needs
- Shows net flows at national level and between states
- Import/export patterns between states for different specialties

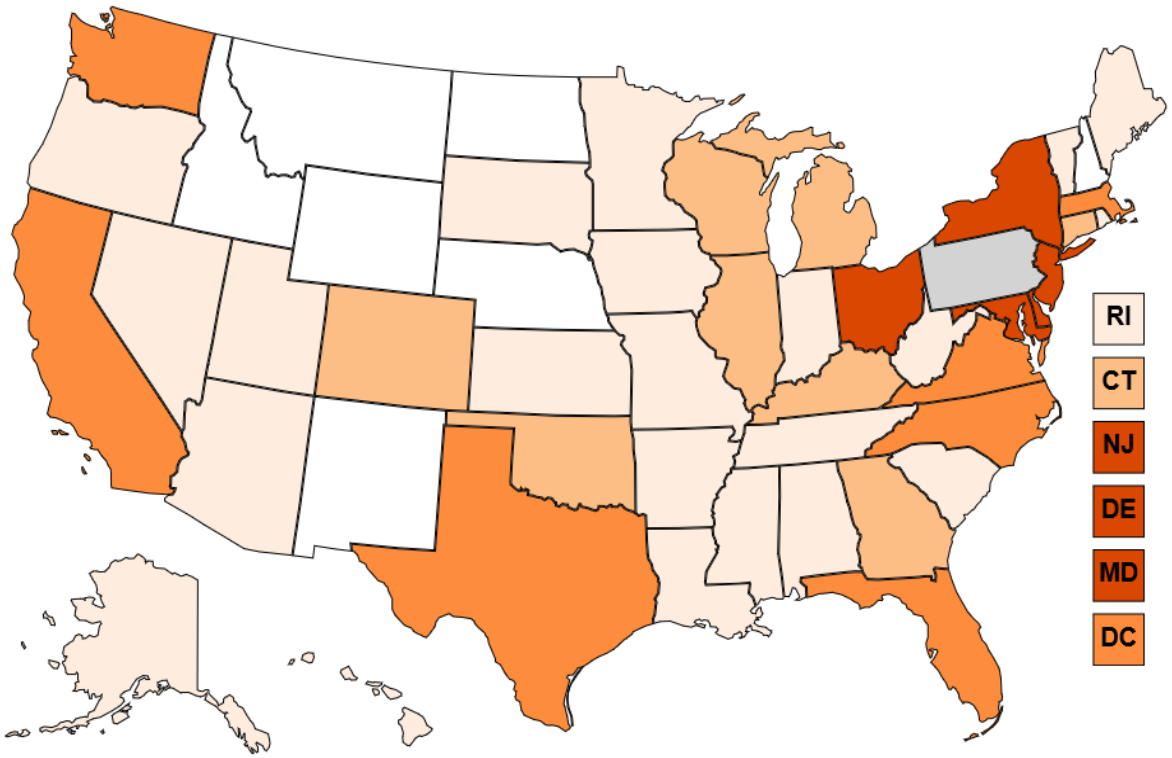


Docflows.unc.edu

To which other states is Pennsylvania *exporting* residents in general pediatrics?

Of gen peds residents in training in 2009 who were in practice in 2015, top states Pennsylvania exported to:

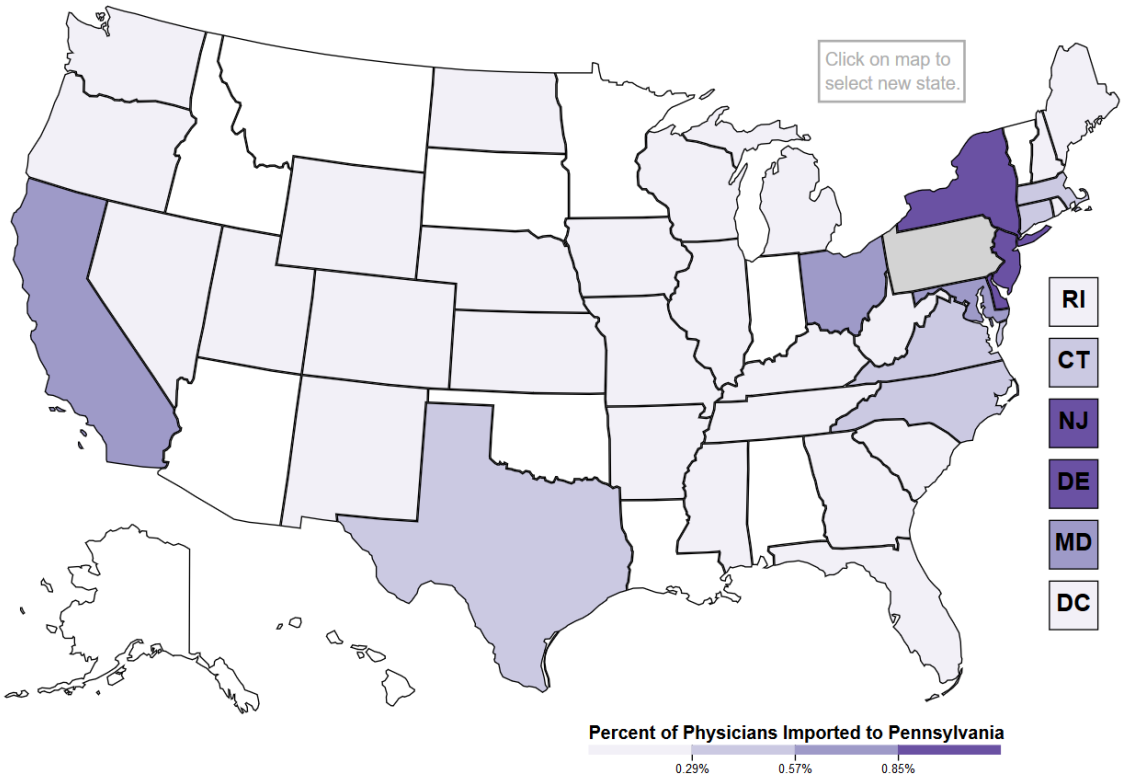
- 5.4% went to Ohio, 4.7% to NY, 4.5% to NJ and 3.7% to MD
- No residents went to ID, MT, NE, NH, NM , ND or WY



From what other states is Pennsylvania *importing* general pediatricians?

Of 1,970 general pediatricians in practice in PA in 2015 (and who were in practice in 2009),

- 48 moved to PA from NJ, 23 from NY, 22 from DE, 15 from CA and the rest from across the country
- None moved to PA from AL, HI, AK, ID, LA, IN, MN, AZ



But back to FutureDocs….The model produced some unexpected results

- Model forecast a doubling of supply of pediatric surgeons
- Why then, is there a sense of shortage?
- Is it related to maldistribution of pediatric surgeons?
- Could it be related to fewer general surgeons, who are better distributed in rural areas, doing pediatric cases?

This finding heightened our interest in the concept of "plasticity" in the health workforce

The term **plasticity** has long been used in neuroscience. Neuroplasticity refers to a brain's ability to change continuously throughout an individual's life.

In the health workforce context, **plasticity** describes a provider's ability to **adjust his/her scope of services to** changing needs in the community, personal preferences, density of other providers with related scopes of practice, and evolving payment and care delivery models.

Related concepts: flexibility, adaptability, generalist practice

A case study of plasticity in practice: pediatric surgeons and general surgeons

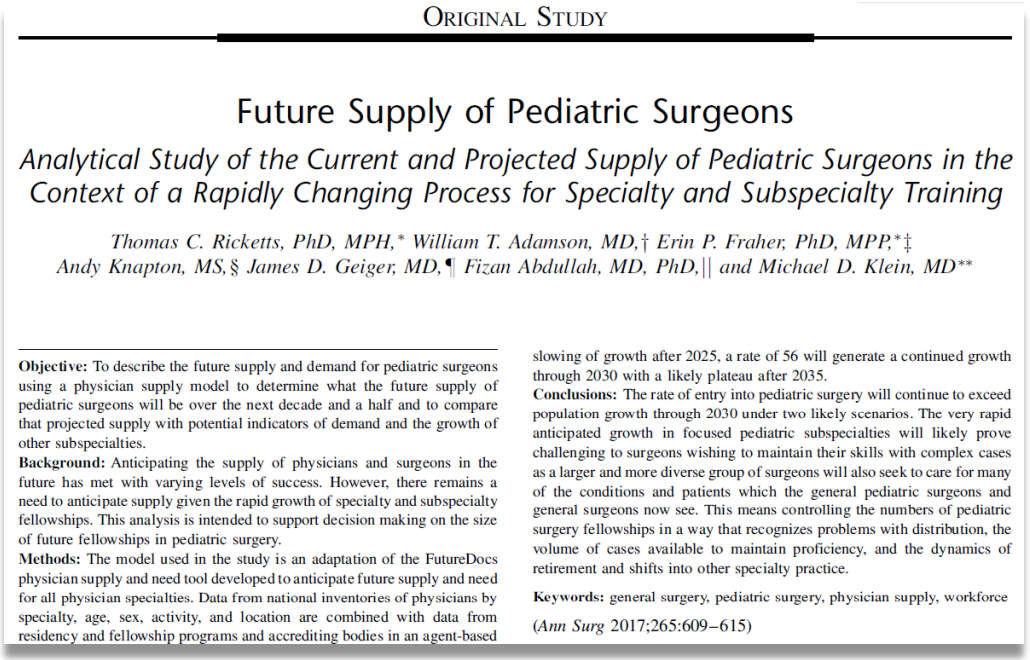
- Plasticity is *dynamic* process. Distribution of work among specialists and generalists changes over time
- As number of pediatric surgeons has increased:
  - Pediatric surgeons have taken on more general surgery cases for pediatric patients
  - Pediatric surgeons in training have "soaked up" pediatric surgery cases, even non-complex ones
  - Fewer general surgeons in training and in practice seeing pediatric cases

Plasticity reframes the issue

- What if perceived shortage of pediatric surgeons is **actually** a shortage of general surgeons doing pediatric cases?
- And what does the likely future oversupply of pediatric surgeons mean to the specialty?
- Worry there will not be volume of cases needed to train new residents and maintain skills of existing pediatric surgeons

Worked with American Pediatric Surgical Association to interpret meaning of findings

- Clinical input has been critical to interpret data in "real world" context and use model findings to implement change
- Recommended decreasing number of pediatric surgery fellowships
- And shifting focus to address geographic imbalances of workforce



ORIGINAL STUDY

Future Supply of Pediatric Surgeons

Analytical Study of the Current and Projected Supply of Pediatric Surgeons in the Context of a Rapidly Changing Process for Specialty and Subspecialty Training

Thomas C. Ricketts, PhD, MPH, William T. Adamson, MD,† Erin P. Fraher, PhD, MPP,*‡ Andy Knapton, MS,§ James D. Geiger, MD,¶ Fizan Abdullah, MD, PhD,|| and Michael D. Klein, MD***

Objective: To describe the future supply and demand for pediatric surgeons using a physician supply model to determine what the future supply of pediatric surgeons will be over the next decade and a half and to compare that projected supply with potential indicators of demand and the growth of other subspecialties.

Background: Anticipating the supply of physicians and surgeons in the future has met with varying levels of success. However, there remains a need to anticipate supply given the rapid growth of specialty and subspecialty fellowships. This analysis is intended to support decision making on the size of future fellowships in pediatric surgery.

Methods: The model used in the study is an adaptation of the FutureDocs physician supply and need tool developed to anticipate future supply and need for all physician specialties. Data from national inventories of physicians by specialty, age, sex, activity, and location are combined with data from residency and fellowship programs and accrediting bodies in an agent-based

slowing of growth after 2025, a rate of 56 will generate a continued growth through 2030 with a likely plateau after 2035.

Conclusions: The rate of entry into pediatric surgery will continue to exceed population growth through 2030 under two likely scenarios. The very rapid anticipated growth in focused pediatric subspecialties will likely prove challenging to surgeons wishing to maintain their skills with complex cases as a larger and more diverse group of surgeons will also seek to care for many of the conditions and patients which the general pediatric surgeons and general surgeons now see. This means controlling the numbers of pediatric surgery fellowships in a way that recognizes problems with distribution, the volume of cases available to maintain proficiency, and the dynamics of retirement and shifts into other specialty practice.

Keywords: general surgery, pediatric surgery, physician supply, workforce

(*Ann Surg* 2017;265:609–615)

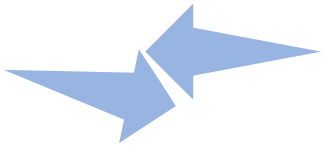
Ricketts TC, Adamson WT, Fraher EP, Knapton A, Geiger JD, Abdullah F, Klein MD. Future Supply of Pediatric Surgeons: Analytical Study of the Current and Projected Supply of Pediatric Surgeons in the Context of a Rapidly Changing Process for Specialty and Subspecialty Training. *Ann Surg*. 2017:265;609-615.

Takeaways from plasticity

- Model currently accounts for plasticity between physician specialties and plasticity between physicians and NPs/PAs
- Developed a plasticity "matrix" that captures these overlaps in practice
- Data in plasticity matrix reflect national practice patterns
- But we know there are local differences due to variation in:
  - local supply and balance of care provided by specialty vs generalist physicians
  - supply and scope of practice of Nurse Practitioners and Physician Assistants
  - institutional/practice-level decisions about deployment of health workforce

Plasticity extensions

Future models could account for between profession plasticity (SWs, RNs, Pharmacists, PTs, CHWs etc)



For different types of health care services (mental health, geriatrics, primary care etc.), how much care and which types of services could be shifted between physicians, NPs, PAs and other professionals?

Can we model this using plasticity matrix?

Would this be useful framework for health systems, practices, and human resource managers to understand how to deploy/retrain/retool existing workforce to meet demand?

Future research needed:
We don't have good data on NP/PA plasticity

How will rapid increase in NP and PA supply affect:

- **NPs and PA plasticity?**
  Will they simply provide more visits for the same types of clinical services or will they widen their scopes of practice?

- **Physician plasticity?**
  Will physicians continue to provide the same type of services, presumably concentrating on more complex cases, or will they alter the types of services they provide?

Future research needed:
The local and dynamic nature of plasticity

- Can we use claims data to better understand factors that drive variations in local plasticity?

- Need to design quantitative and qualitative studies to understand how plasticity changes over time:
  - as ratio of generalists vs specialists changes
  - when new practitioners enter/exit practice in a local area
  - as care delivery and payment models change incentives
  - technology creates new roles and eliminates others
  - rural hospitals and health care services shut down

Future research needed:

How does plasticity vary within specialty/profession?

Individuals within same specialty/profession will have different scopes of services depending on:

- rural/urban location
- demographic characteristics (age, gender) and personal preferences
- length of time since completing training, certifications held
- proximity to other providers with overlapping and/or competing services
- patient population served
- organizational/practice level deployment decisions

Moving from theory to practice: If you build it (a model), will they come?

I've learned the hard way:
the answer is NO!

We built a Mazzerati that no one knew how to drive

- Launched model in 2014
- Lots of hits (by consultants and health systems) but didn't initially reach policy audience
- Realized that we needed to interpret and contextualize findings, not assume people would do this themselves

We got some papers out describing the model's innovative methods

Article

The Contribution of "Plasticity" to Modeling How a Community's Need for Health Care Services Can Be Met by Different Configurations of Physicians

George M. Holmes, PhD, Marisa Morrison, Donald E. Pathman, MD, MPH, and Erin Fraher, PhD, MPP

Abstract

This article introduces the concept of "plasticity" to health care workforce modeling and policy analysis. The authors define plasticity as the notion that individual physicians within the same specialty each provide a different scope of service, while the scope of service of physicians in different specialties may overlap. This notion represents a departure from the current, silo-based conception of physician supply as physician headcounts by specialty; the implication is that multiple configurations of physicians (and, by further application, other health care professionals) can meet a community's utilization of health care services.

Within-specialty plasticity and between-specialty plasticity are two facets of plasticity. Within-specialty plasticity is the idea that individual physicians within the same specialty may each provide a different mix and scope of services, and between-specialty plasticity is the idea that patterns of service provision overlap across specialties. Changes in physician specialty supply in a community affect both the between-specialty and within-specialty plasticity of that community's physicians. Notably, some physician specialties are more "plastic" than others.

The authors demonstrate how to implement a plasticity matrix by assessing the sufficiency of physician supply in a specific community (Wayne County, North Carolina). Additional literature and data can provide further insights into the influences on (and of) plasticity, improving this approach and expanding it to include task-shifting across health care professions.

A common approach in physician workforce modeling and policy analysis is to assess whether there is a physician shortage by considering each individual specialty to be distinct, defined by the different training experienced by and unique scope of services provided by its practitioners.[1-4] This "siloed" conception of specialties ignores the reality that the scope of medical services that physicians of different specialties provide often overlaps. This traditional approach also treats all physicians within a single specialty as identical and therefore interchangeable, even though individuals within a given specialty offer different mixes of services because of their particular training and interests.

An alternative health care workforce modeling approach exists. (In this article, we refer to "physicians" for expositional simplicity, although the model could easily be extended to other clinicians such as physician assistants and advanced practice nurses. We use "providers" or "workforce" for multiple combinations of physician specialties to provide a specified group of medical services but still recognizes that certain specialties are more likely to provide certain types of health care services.

Heterogeneity in the services provided within a specialty also characterizes physician practice. For instance, some internists devote a greater proportion of their visits to respiratory conditions, whereas others focus more on circulatory conditions. Few researchers have conducted scholarly work exploring either within-specialty heterogeneity or between-specialty service overlap, despite the importance of these realities to the solutions that could flow from physician workforce models. We suggest that these related concepts represent two facets of *physician plasticity*. This article's objective is to describe the concept of plasticity

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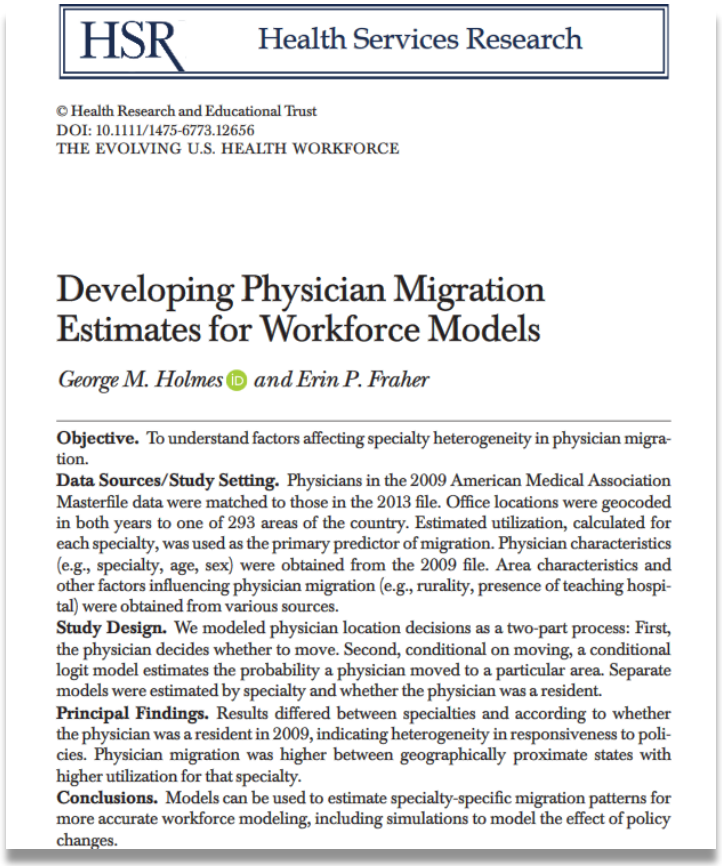
Dr. Fraher is assistant professor, Department of Family Medicine and Department of Surgery, University of North Carolina School of Medicine, and

Holmes GM, Morrison M, Pathman DE, Fraher E. *Academic Medicine*. 2013;88:1877-1882.



HSR Health Services Research

DOI: 10.1111/1475-6773.12656
THE EVOLVING U.S. HEALTH WORKFORCE

Developing Physician Migration Estimates for Workforce Models

George M. Holmes and Erin P. Fraher

Objective. To understand factors affecting specialty heterogeneity in physician migration.

Data Sources/Study Setting. Physicians in the 2009 American Medical Association Masterfile data were matched to those in the 2013 file. Office locations were geocoded in both years to one of 293 areas of the country. Estimated utilization, calculated for each specialty, was used as the primary predictor of migration. Physician characteristics (e.g., specialty, age, sex) were obtained from the 2009 file. Area characteristics and other factors influencing physician migration (e.g., rurality, presence of teaching hospital) were obtained from various sources.

Study Design. We modeled physician location decisions as a two-part process: First, the physician decides whether to move. Second, conditional on moving, a conditional logit model estimates the probability a physician moved to a particular area. Separate models were estimated by specialty and whether the physician was a resident.

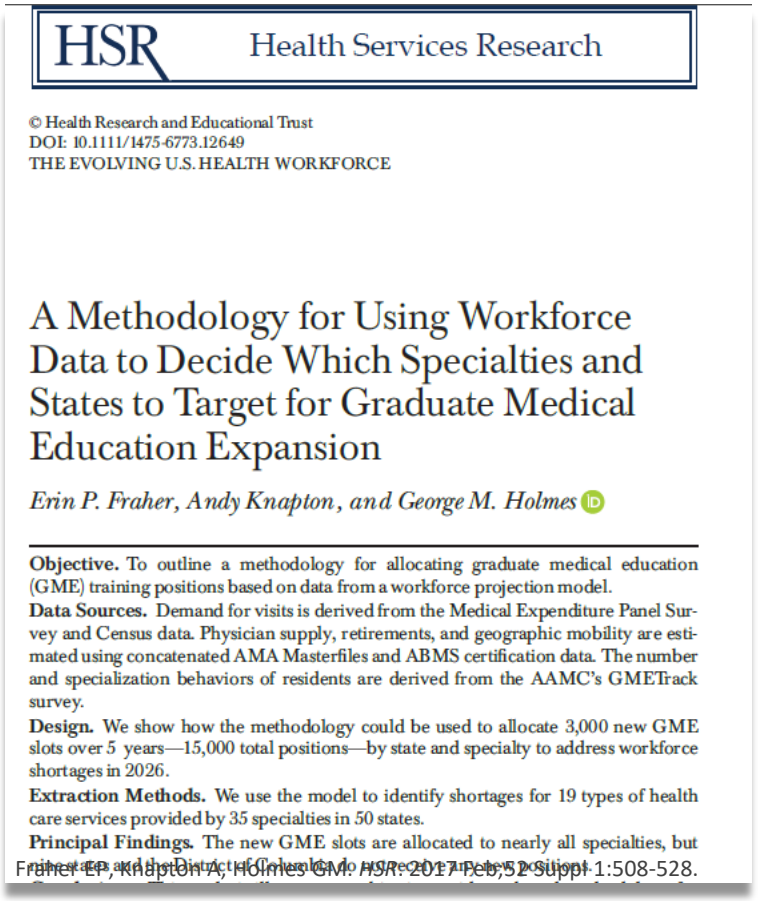
Principal Findings. Results differed between specialties and according to whether the physician was a resident in 2009, indicating heterogeneity in responsiveness to policies. Physician migration was higher between geographically proximate states with higher utilization for that specialty.

Conclusions. Models can be used to estimate specialty-specific migration patterns for more accurate workforce modeling, including simulations to model the effect of policy changes.

Holmes GM, Fraher EP. *HSR*. 2017 Feb;52 Suppl 1:529-545.

And findings that aimed to change policy

- Model findings suggest need to expand GME in states with:
  - Poor health outcomes and high health care utilization (AR, MS, AL)
  - Large, growing populations (TX, CA)
  - Aging populations (FL)
  - Low resident/population numbers (ID, WY, MT, AK, NV)
- "Generalist" specialties and cardiology received largest # of slots
- Wanted to use model to determine how to redistribute GME but that was like touching the 3rd rail



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DOI: 10.1111/1475-6773.12649
THE EVOLVING U.S. HEALTH WORKFORCE

A Methodology for Using Workforce Data to Decide Which Specialties and States to Target for Graduate Medical Education Expansion

Erin P. Fraher, Andy Knapton, and George M. Holmes

Objective. To outline a methodology for allocating graduate medical education (GME) training positions based on data from a workforce projection model.

Data Sources. Demand for visits is derived from the Medical Expenditure Panel Survey and Census data. Physician supply, retirements, and geographic mobility are estimated using concatenated AMA Masterfiles and ABMS certification data. The number and specialization behaviors of residents are derived from the AAMC's GMETrack survey.

Design. We show how the methodology could be used to allocate 3,000 new GME slots over 5 years—15,000 total positions—by state and specialty to address workforce shortages in 2026.

Extraction Methods. We use the model to identify shortages for 19 types of health care services provided by 35 specialties in 50 states.

Principal Findings. The new GME slots are allocated to nearly all specialties, but primary care and the District of Columbia do not receive new positions.

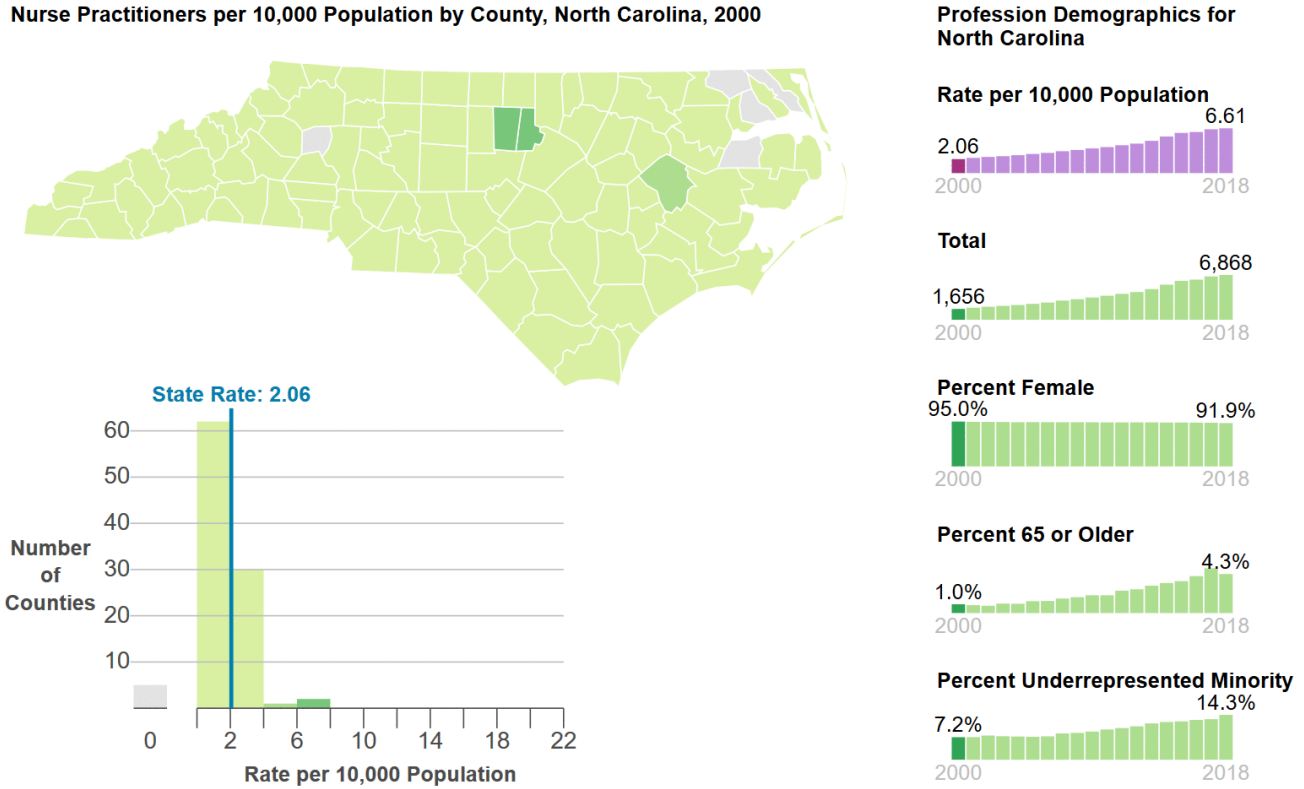
Fraher EP, Knapton A, Holmes GM. HSR. 2017 Feb;52 Suppl 1:508-528.

But manuscripts didn't reach the policy makers we wanted to engage

Realized we needed to change our dissemination strategy on FutureDocs model and other workforce projects

- Began developing data visualizations in 2015 to increase access, interest and engagement with our data
- Encourage policy and decision makers in state to ***use data instead of anecdotes*** in health policy debates
- Wanted to give people quick, easy customizable access to the information most relevant to their profession, specialty or geographic area
- Increase dissemination by enabling users to download line charts, maps and tables

Our NC Health Workforce viz allows users to explore data on 21 health professions in NC from 2000-2018



SHEPS HEALTH WORKFORCE NC

Notes: Data include active, licensed nurse practitioners in practice in North Carolina as of October 31 of each year. Nurse practitioner data are derived from the North Carolina Board of Nursing. Population census data and estimates are downloaded from the North Carolina Office of State Budget and Management via NC LINC and are based on US Census data. Source: North Carolina Health Professions Data System, Program on Health Workforce Research and Policy, Cecil G. Sheps Center for Health Services Research, University of North Carolina at Chapel Hill. Created October 18, 2019 at https://nchealthworkforce.unc.edu/supply/.

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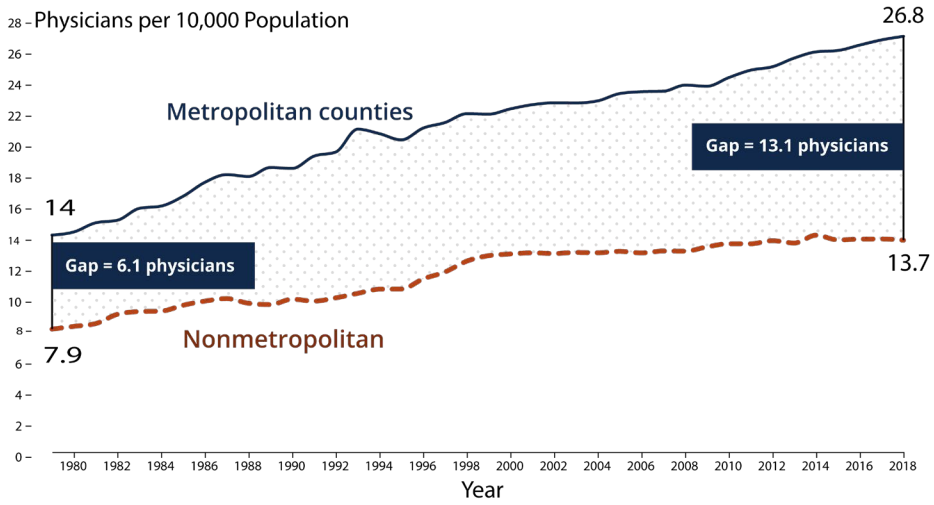
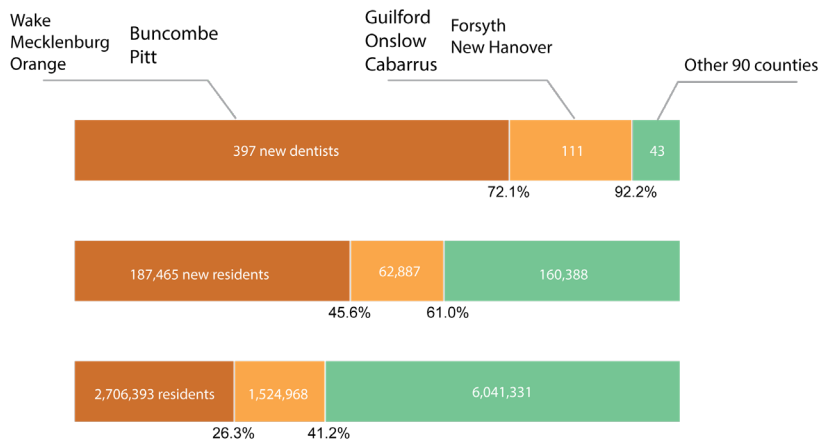
Not everyone wants to play with the data. We created micro-blogs featuring bitesize "story morsels" that not only educate and engage but sometimes provoke

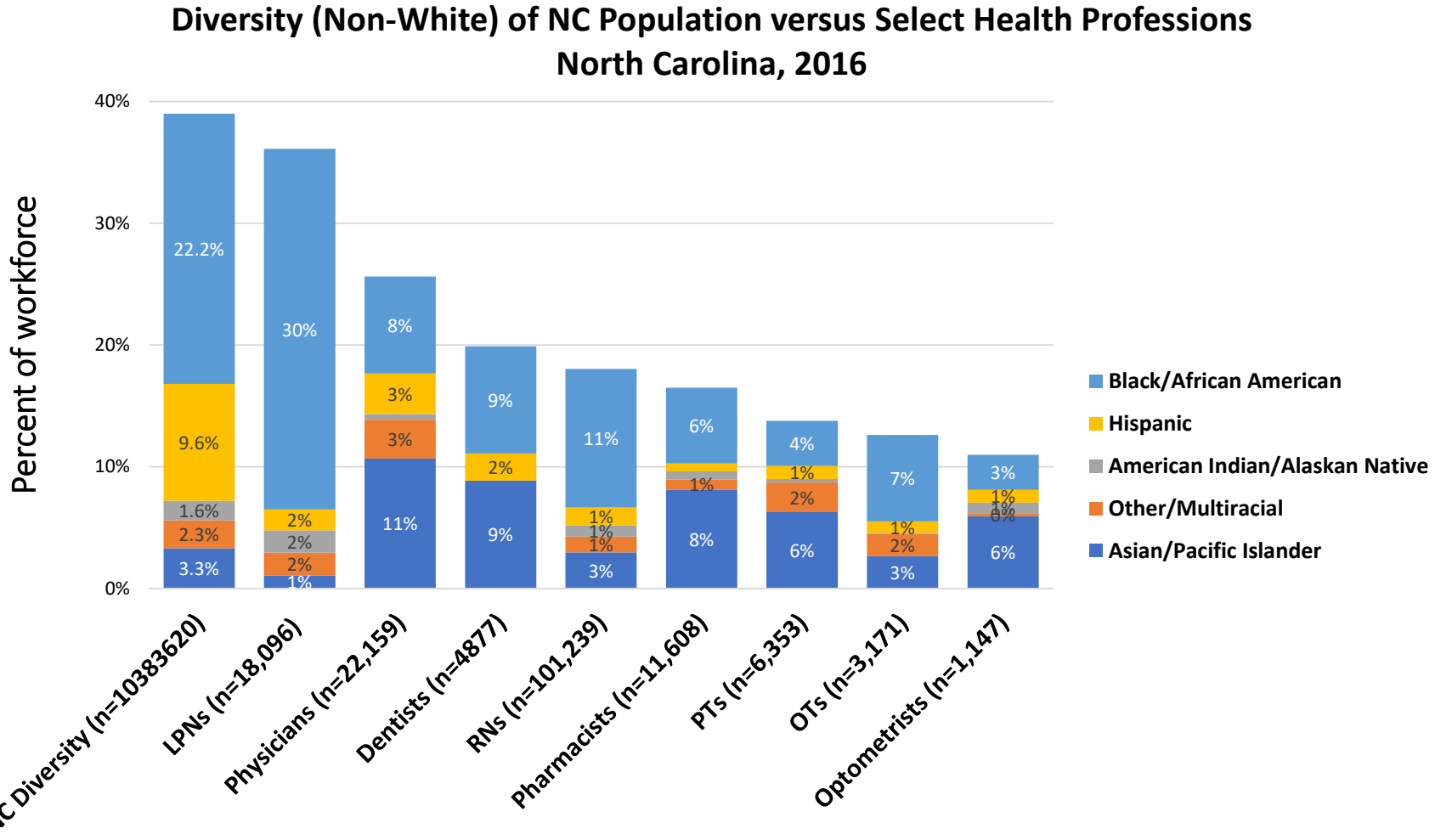
The real issue is not a shortage of physicians. It's a growing disparity between rural and urban areas



And while NC moved up from 47th to 37th in the nation in dentist supply, 72% of NC's dentist workforce growth occurred in 5 counties, 8% went to 90 counties



We take our role as "data agitators" seriously, for example: highlighting racial/ethnic disparities in workforce



We don't just provoke people—we also make them happy

"Powerful! thanks. I work at…a network of community health clinics and we use Sheps' data frequently to describe need for medical and dental clinicians." - **Director, Planning and Strategy, Community Health Center**

"I am on your website to find a contact so we can make a data request to the Health Professions Data System for background data to be used in our HRSA training grant proposal. … Instead, I find your interactive tool so I can download the data myself. Beautiful! Thank you for your service to the state." - **Preventive Medicine clinician and researcher**

"This is exactly what we are looking for." - **Legislative assistant to NC Senator** who called looking for the latest data on the number of primary care physicians per population in NC.

"You are phenomenal! Thank you so much!" - **AHEC Director** who called looking for data during a five-minute break from a meeting. We directed her to the website, and she had data on workforce supply when the meeting resumed.

A faculty member at UNC School of Public Health called the Sheps Center's main line to make a data request. As the call was being transferred, she found the data she needed on the HPDS data visualization website.

A slide for the techies

- Core technology is a JavaScript library called D3, which allows for the development of flexible data visualizations, unconstrained by predefined chart templates.
- Supply visualization also uses the JavaScript framework Vue.js
- All open source
- Code for visualizations on GitHub: github.com/gallowayevan
- Prototype/develop on Observable, a JavaScript notebook environment: observablehq.com

We will apply all this learning in our future work with ABP

- Developing model to forecast headcount and FTE for 14 pediatric subspecialties at national and regional level from 2018-2040
- Developing “what if” scenarios to simulate effect of changes in retirement, GME, and other factors
- Serve as initial step in demand analysis to estimate whether number and distribution of pediatric subspecialists meets needs of pediatric population
- Will disseminate findings through presentations, papers and data visualizations to ensure findings are used by policy makers, program directors and other stakeholders

Subspecialties included in the model

- ✓Adolescent Medicine
- ✓Pediatric Cardiology
- ✓Child Abuse Pediatrics
- ✓Pediatric Critical Care Medicine
- ✓Developmental-Behavioral Pediatrics
- ✓Pediatric Emergency Medicine
- ✓Pediatric Endocrinology
- ✓Pediatric Gastroenterology
- ✓Pediatric Hematology-Oncology
- ✓Ped Infectious Disease
- ✓Neonatal-Perinatal
- ✓Pediatric Nephrology
- ✓Pediatric Pulmonology
- ✓Pediatric Rheumatology

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