Developing an open source simulation model of physician supply and healthcare utilization

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AAMC Workforce Conference

May 3, 2012 | Washington, DC

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HELPING DOCTORS HELP

This two-year project is funded by a grant from the Physicians Foundation.

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Presentation Outline

- Project Goals (briefly)
- Overview of current model
  - Outline key questions
  - Solicit feedback
- Discussion

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Project Goals

- **Main objective**: Create open source physician projection model to be used by policy makers
- **Additional goals**: Promote dialogue among physicians, policy makers, medical societies, state and federal workforce planners, health systems and others about need to:
  - ***Not*** generate a single "right" answer
  - Develop scenarios that allow users to simulate policy effects
  - Engage clinicians in planning for the size, shape and specialty mix of the future workforce

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A schematic view of how the three pieces fit together to produce a projection

- The following slide presents a high level, schematic view of how three key elements of our model fit together –
  - Utilization
  - Supply
  - Linking demand for health services with supply of providers

  – to create estimates of

  A. **Physician supply (by time, location, training, characteristic, e.g.) as a function of contextual elements**
  B. **Relative adequacy of supply for population health needs**

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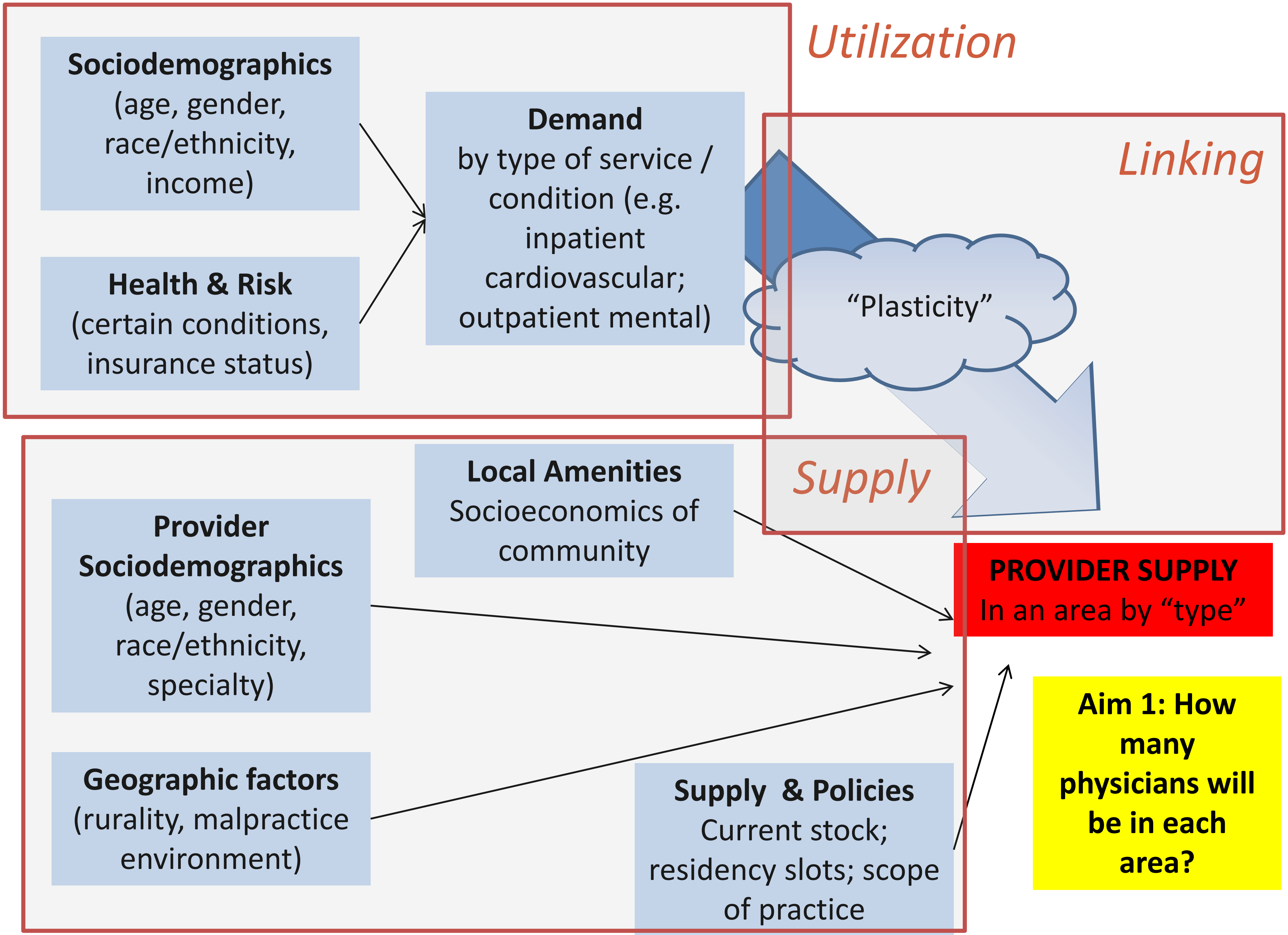
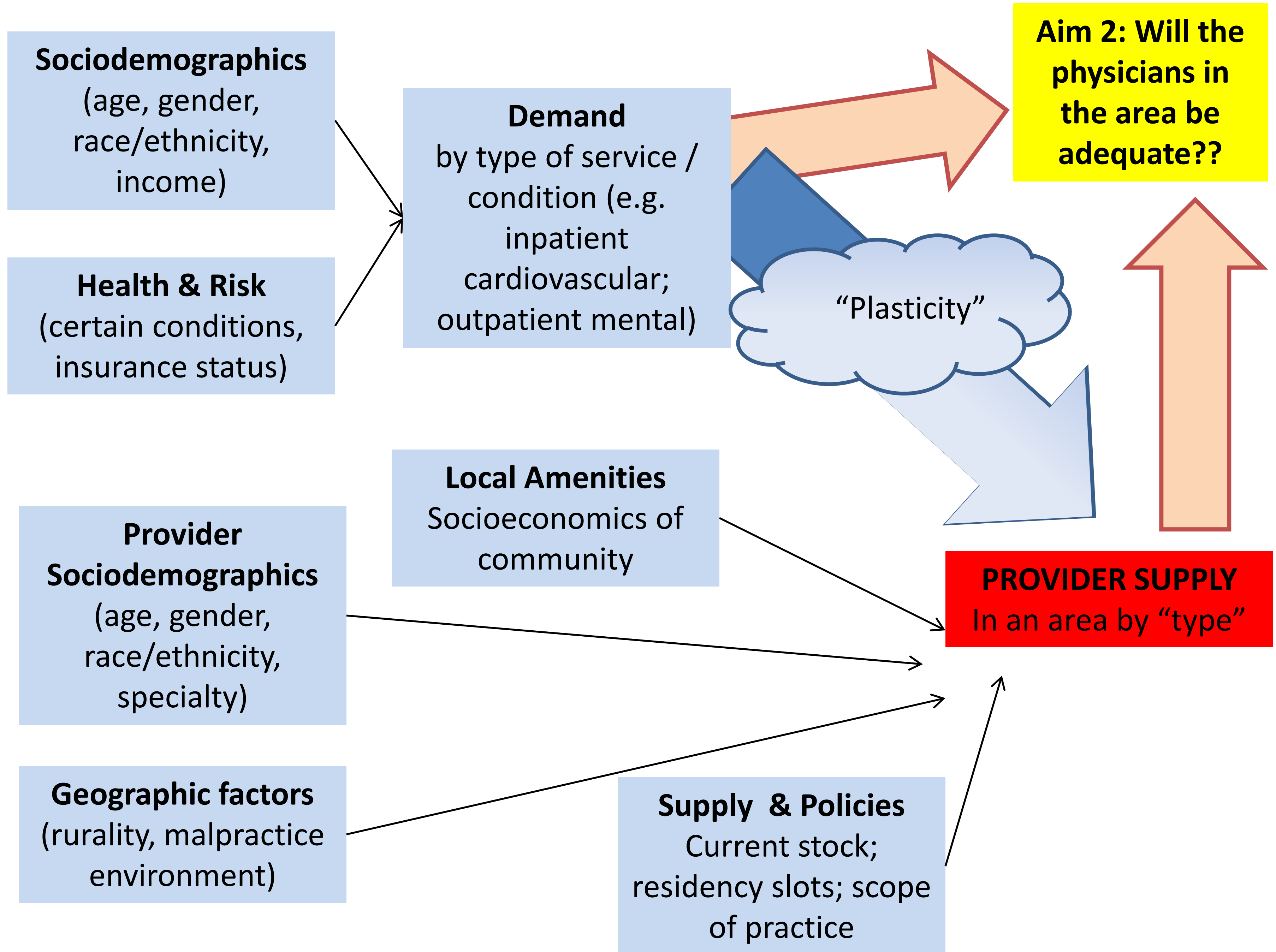

Utilization
Sociodemographics (age, gender, race/ethnicity, income)
Health & Risk (certain conditions, insurance status)
Demand by type of service / condition (e.g. inpatient cardiovascular; outpatient mental)
Linking
"Plasticity"
Supply
Local Amenities Socioeconomics of community
Provider Sociodemographics (age, gender, race/ethnicity, specialty)
Geographic factors (rurality, malpractice environment)
Supply & Policies Current stock; residency slots; scope of practice
PROVIDER SUPPLY In an area by "type"
Aim 1: How many physicians will be in each area?


Sociodemographics
(age, gender, race/ethnicity, income)
Health & Risk
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Aim 2: Will the physicians in the area be adequate??
"Plasticity"
Local Amenities
Socioeconomics of community
Provider Sociodemographics
(age, gender, race/ethnicity, specialty)
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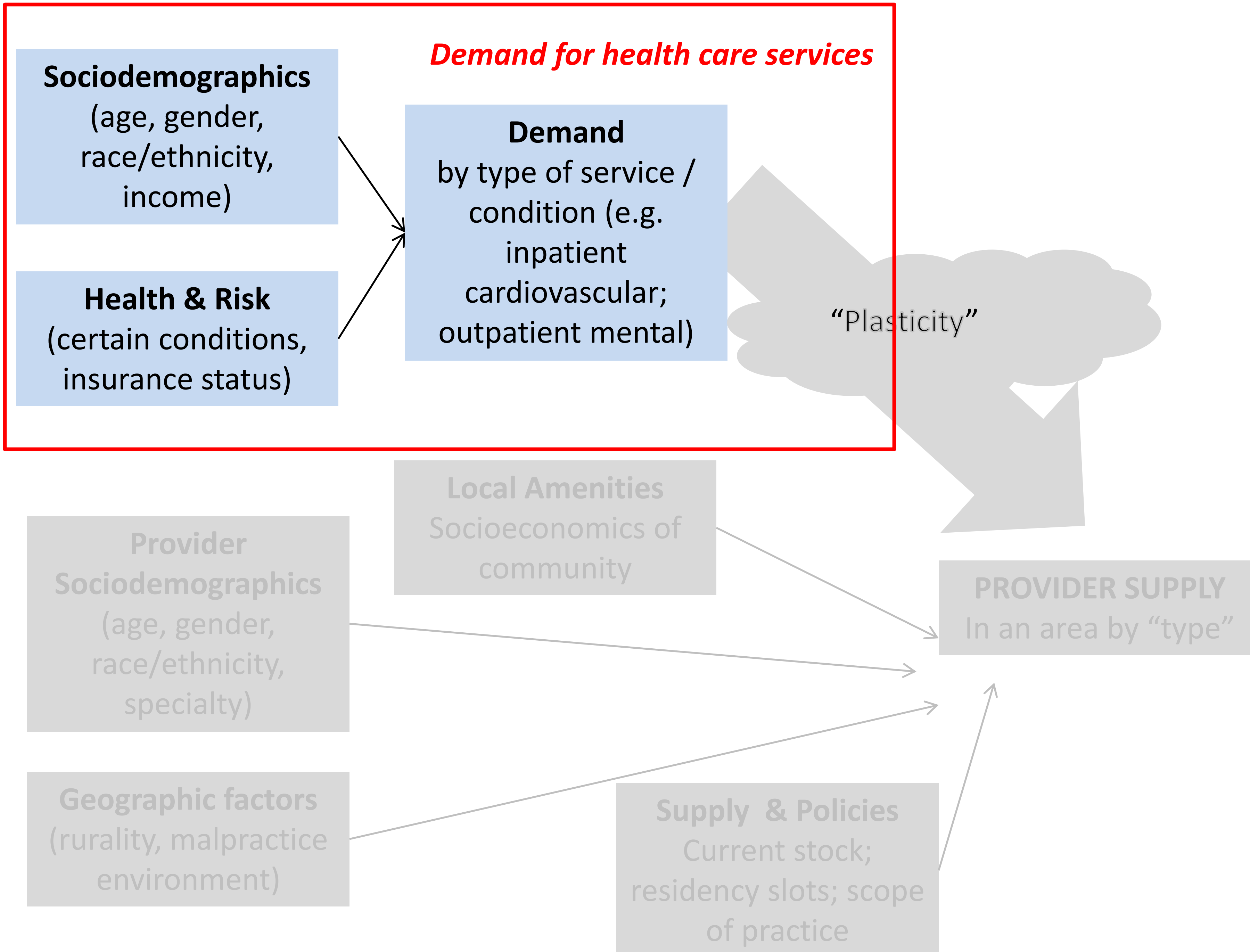

Demand for health care services
Sociodemographics
(age, gender, race/ethnicity, income)
Health & Risk
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Demand
by type of service / condition (e.g. inpatient cardiovascular; outpatient mental)
"Plasticity"
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PROVIDER SUPPLY
In an area by "type"

We are modeling *utilization*, not demand, not need

- What's the difference?
  - Need – "biological"
  - Demand – incorporates ability and willingness to pay
  - Utilization – the demand that is realized – i.e. the number of services consumed
- The population uses thousands of different kinds of health services – can we aggregate these into a manageable number?
- Aggregation method: Clinical Classification System (CCS), AHRQ algorithm, defined by ICD-9 diagnoses

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We are modeling utilization in four settings

- We are using four settings of services
  - Office-based provider
  - Hospital-based care: inpatient and outpatient settings
  - Emergency room

- Combined with the 18 CCS, we have 4 x 18 = 72 different kinds of services utilized

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Sources for data on utilization

- Primary data source is Medical Expenditure Panel Survey (MEPS)
  - Annual survey by AHRQ, contains setting and CCS for approximately 30,000 individuals per year
  - We have combined multiple years
- Allows us to estimate the effect of key factors known to influence utilization, and then develop *areal* rates:
  - **Sociodemographics**: age, income, insurance coverage;
  - **Health & Risk**: obesity, smoking, etc. (e.g. BRFSS)

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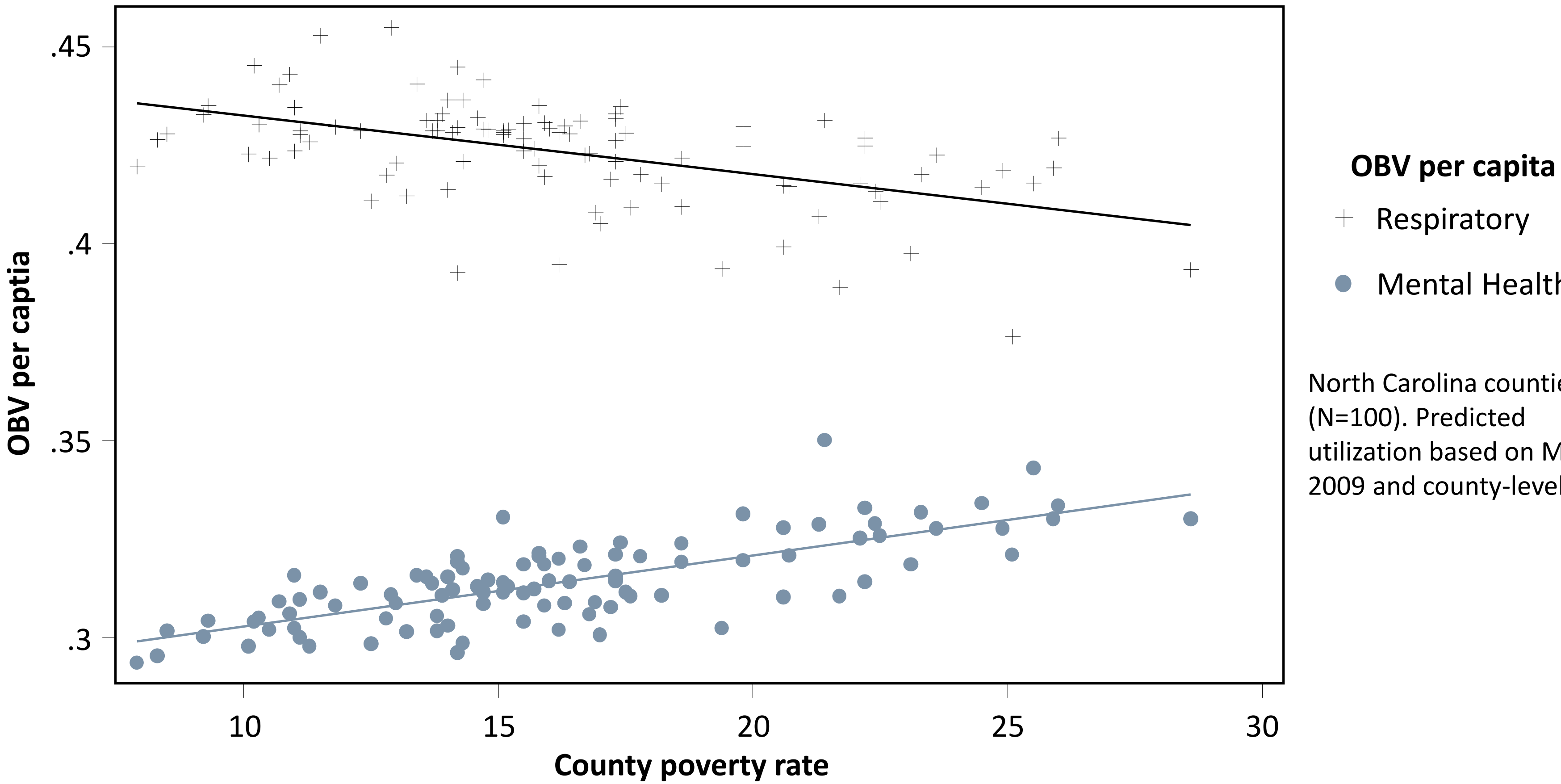
Area contextual data has differing effects across types of services

Predicted Mental Health and Respiratory Office-Based Visits (OBV) Per Capita



North Carolina counties (N=100). Predicted utilization based on MEPS 2009 and county-level data.

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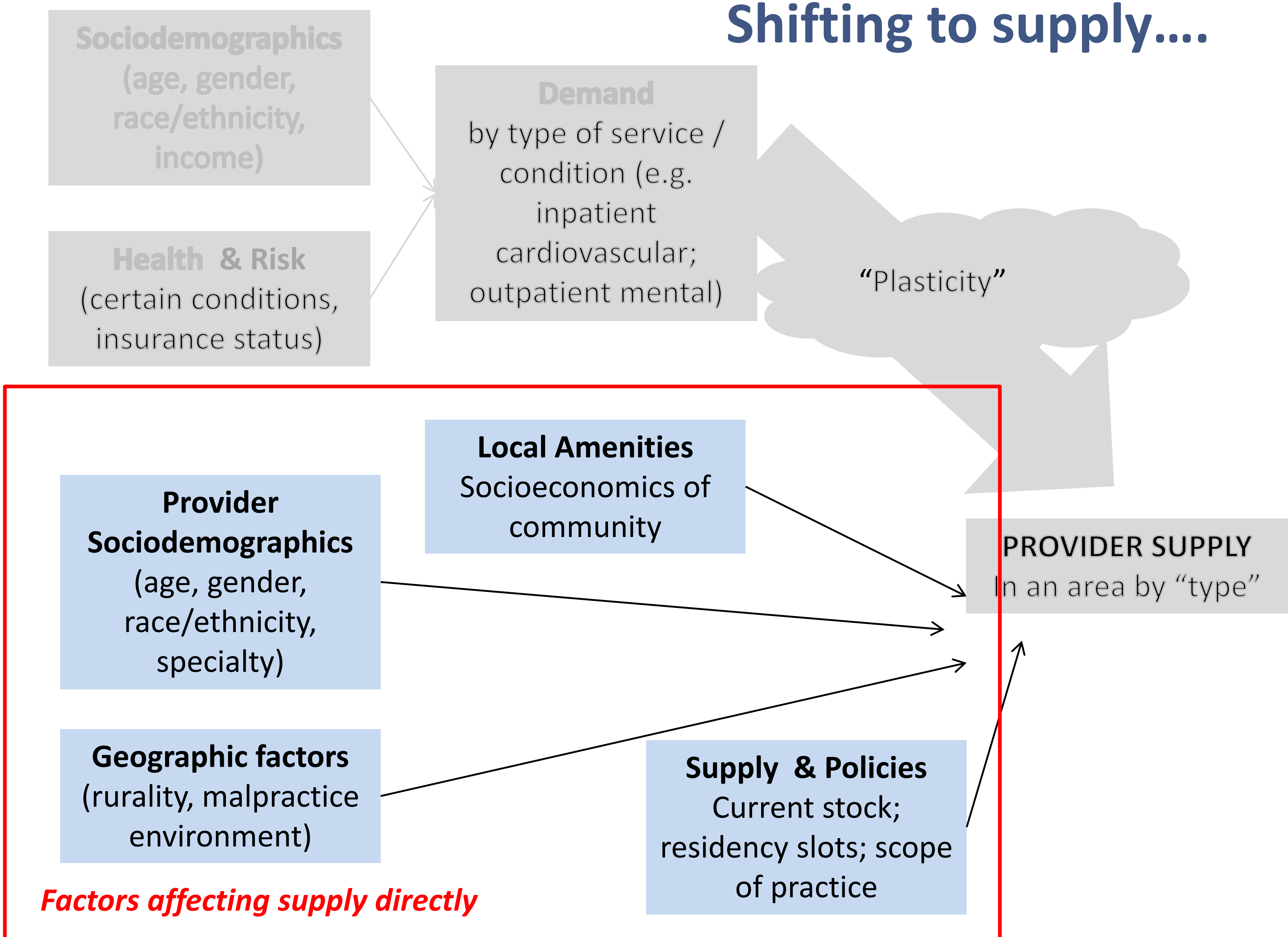
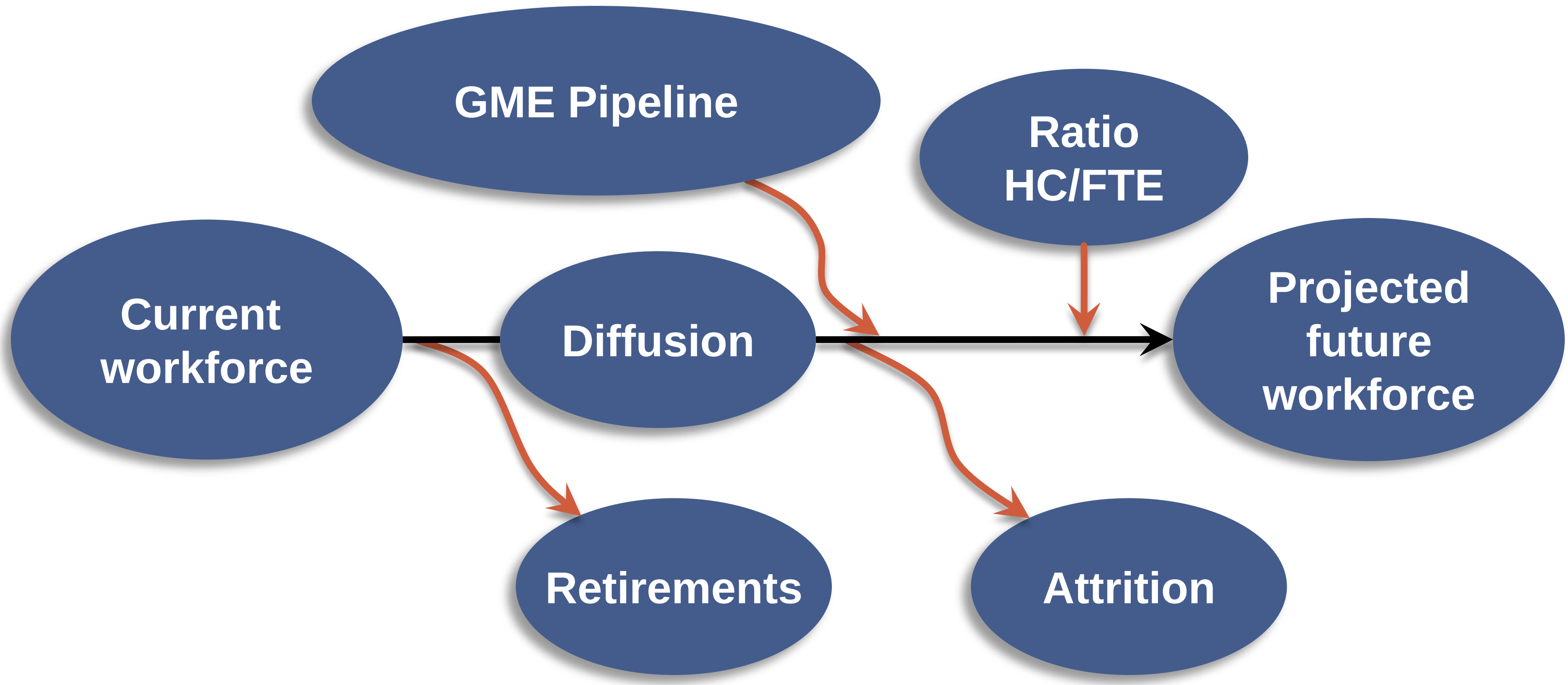
Shifting to supply….



Modeling supply like the real world



Agent-based model for physicians

- Use existing data, literature on physicians and their behavior to simulate the behavior of hundreds of thousands of physicians
  - My decision affects your decision
- Physician assistants and nurse practitioners included in model, but not as an "agent"
  - Quality of data, science on their behavior less well developed

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How can decisions on location choice ("diffusion") be modeled?

Table 4: Conditional Logit Model Results for Physician Location Choice

	OB/GYNs	*Surgeons*	*PCPs*
Malpractice premiums (US$1,000s)	0.0076	– 0.0235	0.0264
	(0.0087)	(0.0073)**	(0.0158)
Damage award cap	0.1482	1.3004	0.0561
	(0.6248)	(0.4051)**	(0.2417)
Health professional shortage area	0.4580	– 0.8410	1.2158
	(1.4424)	(1.0801)	(0.3798)**

Source:
Chou and LoSasso, 2009

Results of the analysis will provide parameters than can be used to determine the probabilities of moving to each county

County	Probability
Autauga County, AL	0.3%
Baldwin County, AL	0.6%
Barbour County, AL	0.4%
Bibb County, AL	1.4%
Blount County, AL	0.8%

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Diffusion

- Model attractiveness of location by
  - Age
  - Gender
  - Specialty
  - Area characteristics

Example: I'm a 45 year old male surgeon with a 25% chance of staying here, 5% chance of going to Charlotte, 1% chance of Nashville, .002% chance of Michigan's Upper Peninsula

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Provider "Clinical Service Areas"

- **Key question**: **How many different types of physicians can we model?**
  - Too few – aggregating dissimilar specialties
  - Too many – model loses precision
- Our target was 8-10
- Current list = 34

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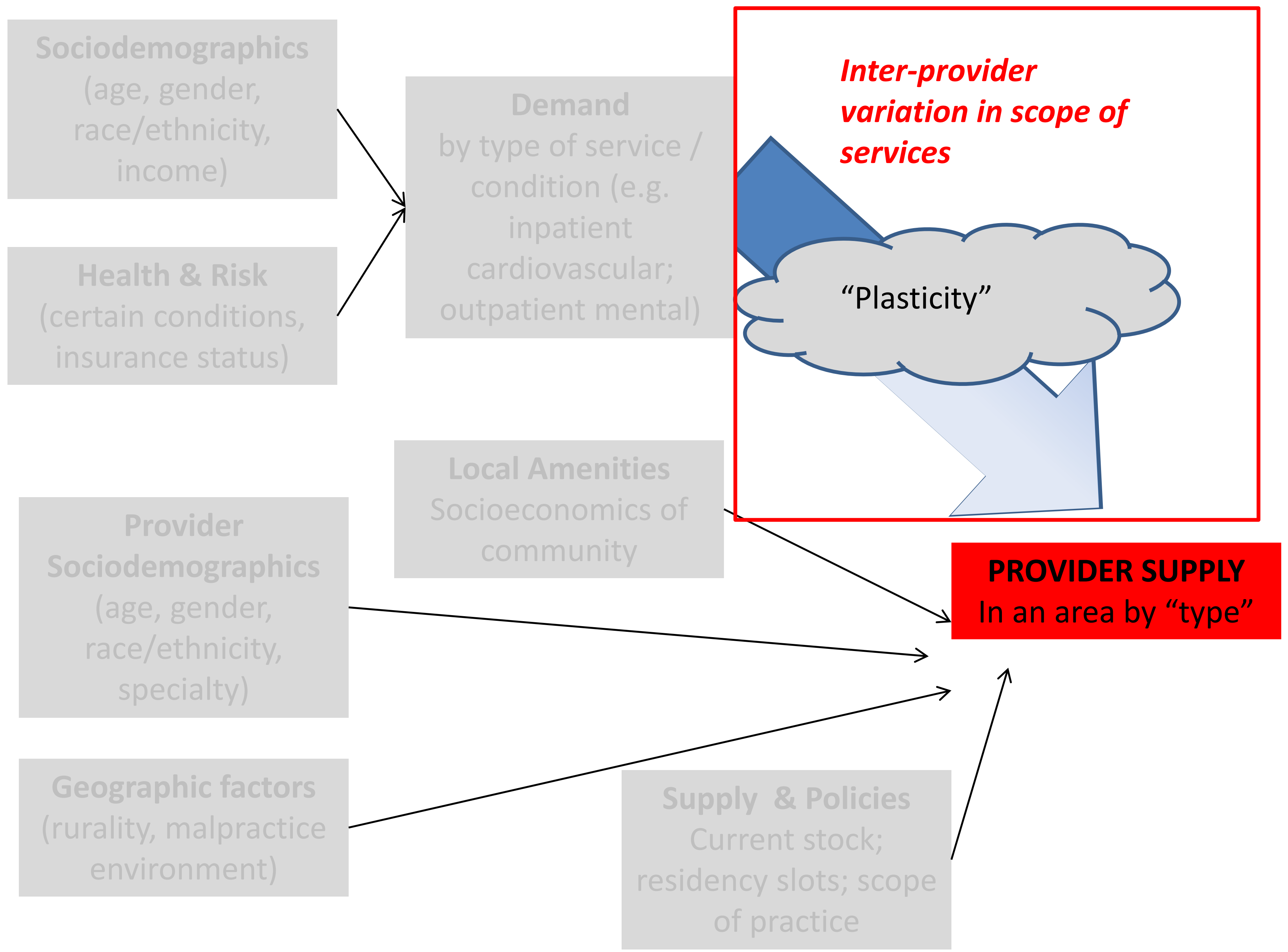

Sociodemographics
(age, gender, race/ethnicity, income)
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Demand
by type of service / condition (e.g. inpatient cardiovascular; outpatient mental)
Inter-provider variation in scope of services
"Plasticity"
Local Amenities
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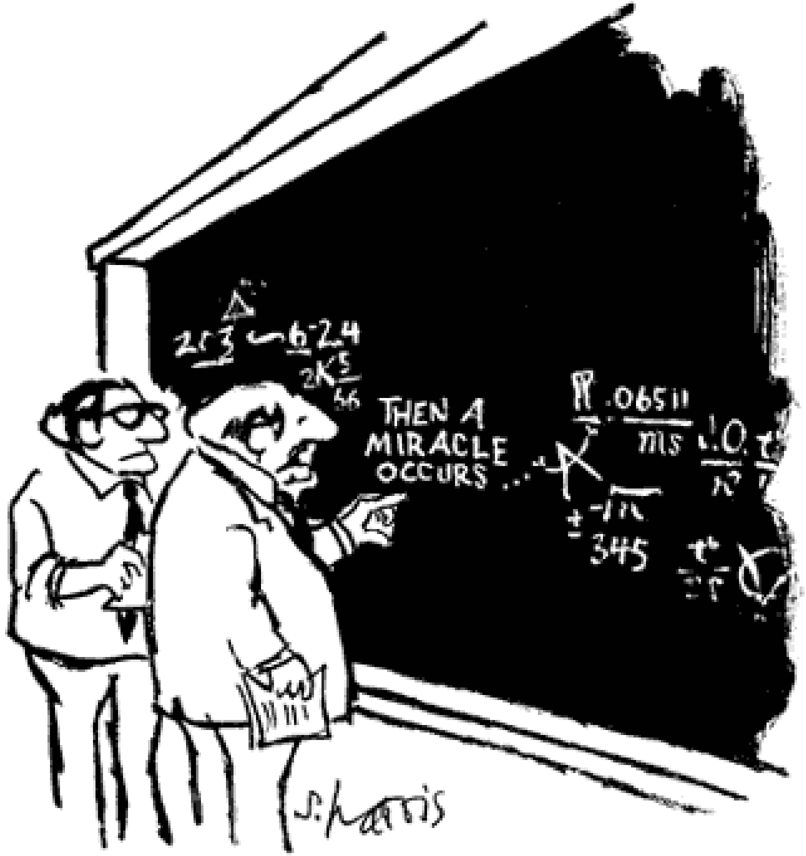
Mapping *services* to *providers*



"I think you should be more explicit here in step two."

- Key decision: no silo-based modeling
  - Recognize the "fungibility" of services across specialties
- How to model a specialist's range of services?

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Translating utilization against supply

- We refer to this concept as the "transmission" or "plasticity"
- For example, family and general practitioners* have considerable heterogeneity in the distribution of visits by CCS…

* We recognize that these specialties are different, but NAMCS groups them.

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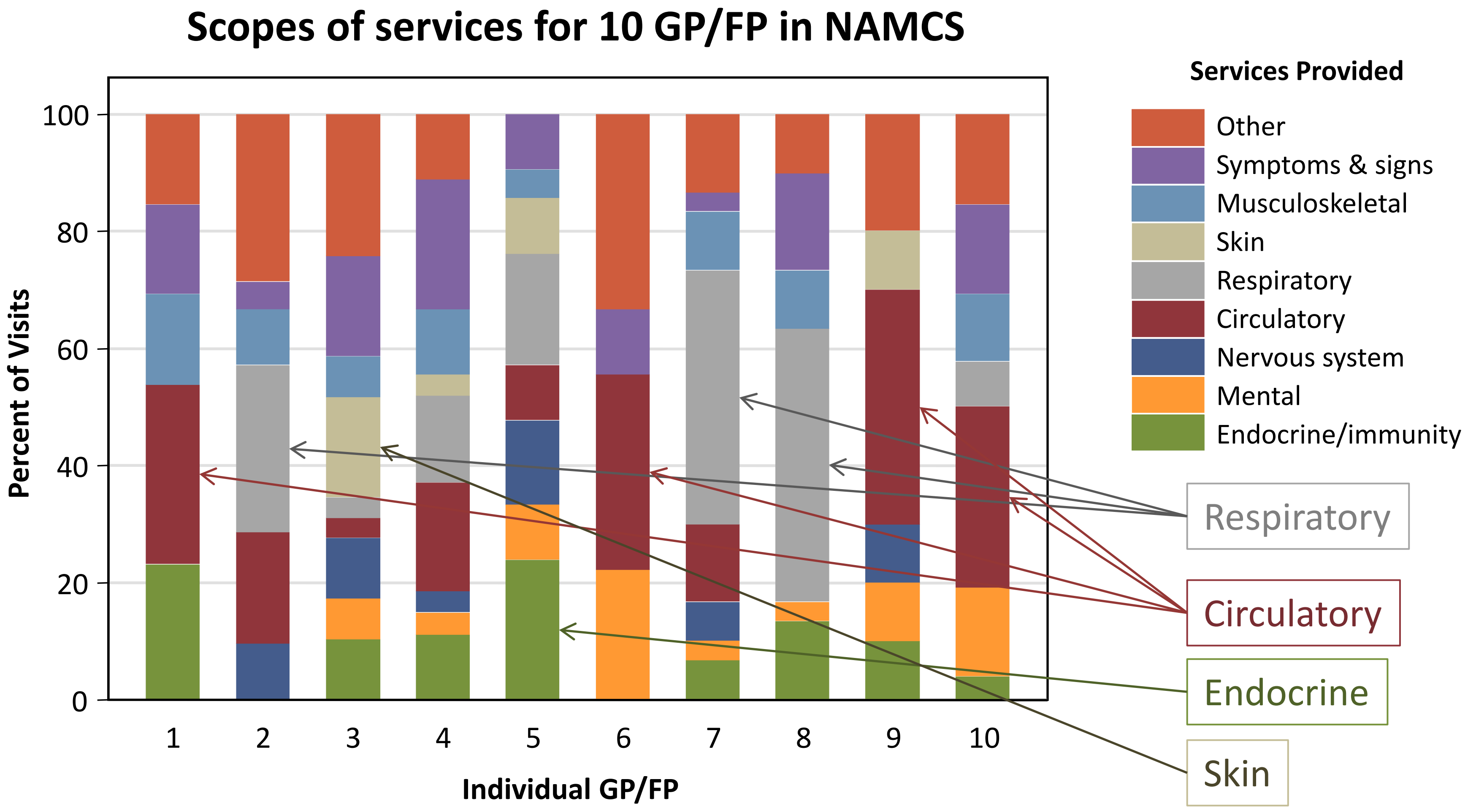
A random sample of ten GPs/FPs has heterogenous scopes of services



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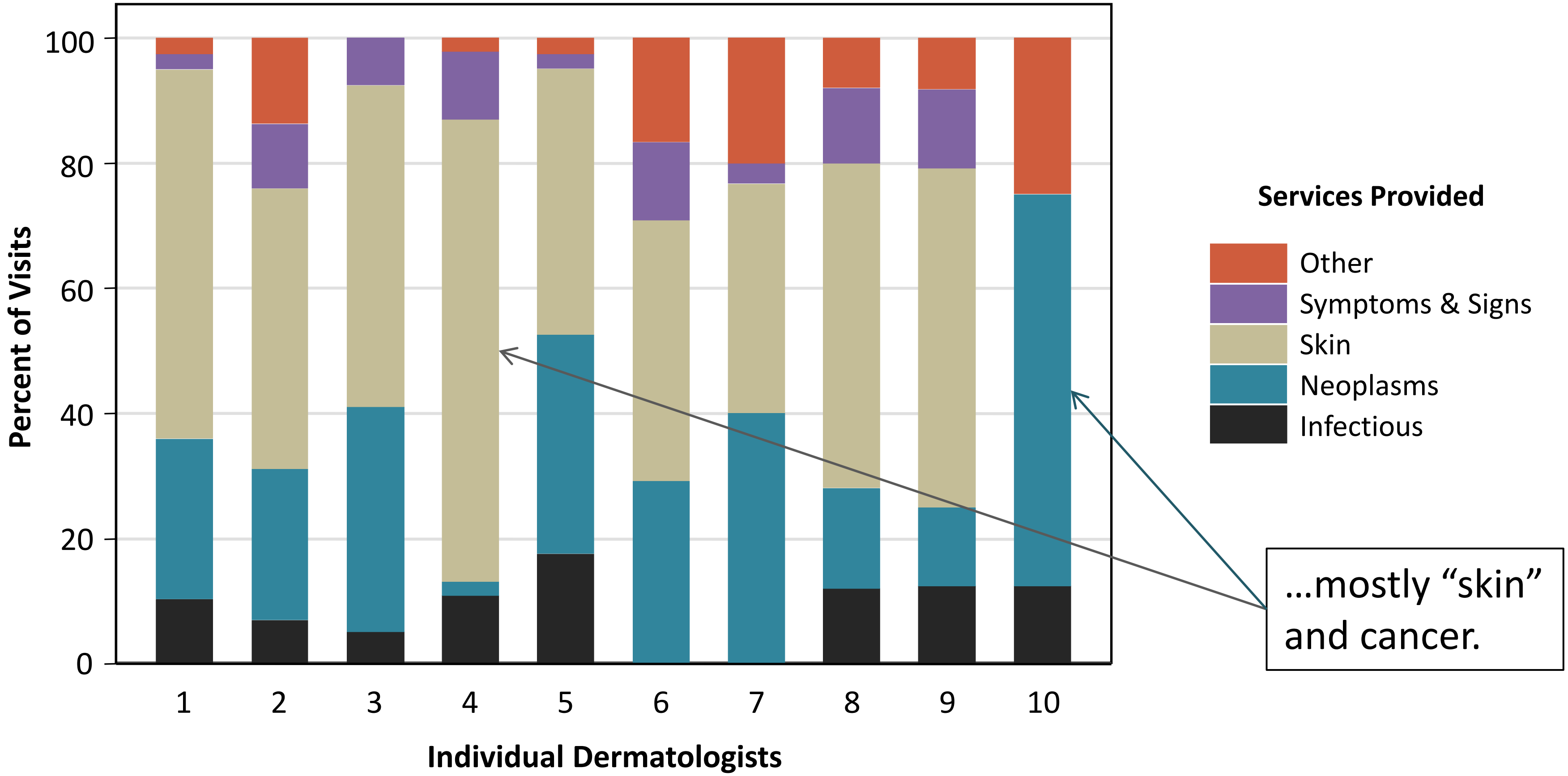
…But dermatologists provide relatively similar scopes of services

Scopes of services for 10 Dermatologists in NAMCS



Takeaway

- Heterogeneity in scope of service varies within specialty (not all doctors have similar scope of service)
- Degree of heterogeneity varies across specialty (some specialties have more similar doctors)
- **Key question: What determines the specific scope of services among physicians with similar training?**
  - *Are they responsive to relative local demands? How much?*
  - *What factors modify a physician's "responsiveness" – e.g., age?*

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Things the model (as we currently envision it) can model

Appeal of this (and all other supply models) is ability to "sandbox" policies and trends:

- **Change in FTEs by cohort**
- **Demand for specific services**
- **Tort reform**
- **Changes in scope of services**
- **GME changes**
- **Increase in retirement age**
- **New payment models**

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Things the model (as we currently envision it) CANNOT do

There are some things the model does not have a “hook” for – cannot bring in:

- **Differences in physician quality**
  (e.g. differential pay for performance)
- **Changes in medical school graduate preferences**
  (e.g. more recruitment from rural communities)
- **Feedback from physicians to area health status**
  (e.g. underserved area with undermanaged diabetes leads to higher rates of complications)

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The appeal of our open source design

- Intentional design and implementation to enable extensions to the model for alternative tasks

Example: You could tailor for surgical workforce focus by disaggregating surgical specialties and utilization (and aggregating non-surgical specialties). Operationally, with new parameters and data, the model could adapt relatively easily.

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Model deployment

- Vision: web-based, but also platform-independent model
  - (eg downloadable Java program calls data stored at central server)
- Temporal, geographic projections
  - Tables, figures, maps(?)
- Computational issues:
  - One year of a physician's life take approx .002 seconds
    - Times 500,000 physicians
    - Times 20 years
    - = 14 hours
    - If we want confidence intervals, * 100? = 8 weeks!!

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Discussion

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