Local Area Physician Workforce Planning Model Pilot

Michael Dill, M.S.[1]; Gary Hirsch, S.M.[2]; Emily Yunker, M.P.A.[1]

[1]Association of American Medical Colleges
655 K Street NW, Suite 100
Washington, DC, 20002
202-828-0963
eyunker@aamc.org

[2]Independent Consultant
7 Highgate Road
Wayland, MA 01778
508-202-2990
GBHirsch@comcast.net

Abstract

Physician workforce planning tools are needed to address the adequacy of the nation's physician workforce to meet its health needs. Since health care is an inherently local phenomenon, physician supply and demand need to be understood in the local area context. Therefore, we seek to build a Local Area Physician Workforce Planning Model that emphasizes a local perspective. To that end, we are developing a process to improve physician workforce planning to better align workforce capacity with community needs. The cornerstone of this effort is the extensive use of an iterative series of group model building processes that engage local system stakeholders in creating a system dynamics-based model of physician workforce capacity and need that facilitates planning and the evaluation of potential policy changes. We are approaching the conclusion of our work in our pilot site, the U.S. metropolitan area of Cleveland, Ohio. The model and development process have generated important lessons, including: the importance of advance preparation for group model building sessions; how a combination of group model building and data analysis can verify shared mental models and highlight key policy levers; the difficulties associated with modeling complex supply chains; and the limitations imposed by a dearth of suitable data.

Overview

We are in the early stages of a long term system dynamics modeling project that seeks to address the question of how the physician workforce can be configured to best meet a local population's health needs. Complicating this task is a dynamic environment where payment and care delivery models are evolving, significant changes are occurring in federal and state level policies, and physician work patterns are shifting dramatically. Our goal is to create a model-based tool to support policy decision-making. This requires an enhanced understanding of how supply and demand forces dynamically shape how well an area's physician workforce capacity meets its health care needs.

Past physician workforce projections that we published were based on linear models which could not be applied at the local area level, where most physician workforce decisions are made and where physician services are provided, in a way that reflects that area's unique circumstances. We have therefore moved to a community-based group model building approach, grounded in local stakeholder input and centered on a systems-based workforce projection model and policy evaluation tool designed explicitly to help localities design effective policy interventions.

Local decision-makers have a number of policy and programmatic "levers" available to them as they try to adjust the health workforce to meet the population's health care needs. These levers include the size and mix of local training programs, incentives to retain people completing training and those who might migrate in from other areas, and the numbers and kinds of positions offered and compensation and other conditions that go with those positions. The problem faced by local decision makers is that there is no framework for understanding how their decisions affect each other and the size and makeup of the health care workforce. Without such a framework, it is difficult for them to come together and create a set of workforce programs and policies in a coherent manner. This model is designed to meet that need by integrating the various aspects of physician workforce supply and demand.

We are approaching the conclusion of our work in our pilot site, the U.S. metropolitan area of Cleveland, Ohio. The model and model development process we have established thus far have generated some important lessons for us as model builders, including: the importance of advance preparation for group model building sessions; how a combination of group model building and data analysis can verify shared mental models and highlight key policy levers; the difficulties associated with modeling inherently complex supply chains; and the limitations imposed upon modeling by a dearth of suitable data. This paper will describe the process of model development including group model building, the structure of the pilot model and some simulations it produced, data dilemmas we faced, and plans for future development.

Background

Physician workforce planning tools are needed to address the adequacy of the nation's physician workforce to meet its health needs, including alarm over insufficient absolute numbers and specialty mix, capacity to adapt to new models of care and payment, and chronic geographic maldistribution (IHS, 2015; Dill & Salsberg, 2008; Colwill et al, 2008; Peterson et al, 2012; Phillips et al, 2009). Key issues in this context include: a rise in overall utilization of health care services (CDC, 2014); the increasing need for management of multiple chronic conditions (IOM, 2001); changes in physician work hours, efficiency and retirement patterns; an aging population and workforce (IHS, 2015; Dill & Salsberg, 2008); and pressures to change the way both Medicaid and Medicare pay for health care, such as the Bundled Payments for Care Improvement (BPCI) Initiative (CMS, 2014).

In 2008, the AAMC released *The Complexities of Physician Supply and Demand: Projections Through 2025*; and in 2015, IHS prepared *The Complexities of Physician Supply and Demand: Projections from 2013 to 2025* for AAMC (IHS, 2015). These reports – major resources for policy advocacy, research, and analysis on the physician workforce – contain series of scenario-based physician workforce projections for the U.S. However, the models used could not be applied at local area level, where a great deal of variation can occur.

Indeed, while national numbers are important, health care is an inherently local phenomenon, needed, sought, and provided at the local area level. Relative supply, demand, and access levels vary greatly by geographic area. Thus, physician supply and demand need to be understood in the local area context in order to inform both local and national level physician workforce planning discussions. We therefore seek to illuminate the nuances of physician workforce planning that require insights into the local dynamics of supply and demand, specialty mix, socioeconomic challenges with seeking and accessing health care, and challenges posed by state and local policy environments. Even more significantly for our purposes, physician workforce planning happens

largely within local health systems, where most physicians are employed and provide their services.

We set out to build a Local Area Physician Workforce Planning Model that emphasized a local perspective. We are developing a process for helping localities and their health systems to improve their physician workforce planning to better align their workforce capacity with community health care needs. The cornerstone of this effort is a system dynamics-based computer simulation model of physician workforce capacity and need that facilitates workforce planning and the evaluation of potential policy changes, especially those related to physician workforce recruitment and training.

Methodology

Models should be based on our best understanding of how the underlying system works and evolves. A systems-based methodology is most appropriate for this modeling work, as it tends to suit the dynamic complexity of problems within health systems (Homer & Hirsch, 2006). Moreover, a system dynamics model focuses on endogenous explanations for changes over time in key variables (Richardson, 2011). This endogenous focus enables users to identify leverage points for achieving change, making system dynamics models particularly well-suited to local area workforce planning needs, as they provide stakeholders options for action, rather than merely reaction. The endogenous focus is also crucial for capturing the effects of interactions between workforce supply and demand.

The modeling work described in this paper also draws on extensive experience in applying system dynamics methods to modeling health care systems, care delivery, and population health, both for general populations and people facing particular health problems such as chronic illnesses (Homer et al, 2004; Milstein et al, 2010; Hirsch et al, 2012; Hirsch et al, 2014). This work has been important for identifying the structures that affect the health of populations and the nature of the health care that they receive.

We are drawing upon the direct involvement of local system stakeholders in model conceptualization and development, employing an iterative group model building process. Building the model in this fashion has led to a better understanding of local health care systems and the effects that policy changes are likely to have on them, because the model is informed and validated by those with firsthand knowledge of those systems. Thus, the group model building process lies at the heart of our modeling strategy, bringing together stakeholders from across the health care landscape as a type of learning collaborative with a shared interest in a common problem.

Well established in the field of system dynamics (e.g., Richardson & Andersen, 1995), group model building allows stakeholders with diverse perspectives, and even diverse problem definitions, to share their views and critically examine them in a collaborative environment to collectively create a better overall understanding of the problem (Vennix, 1996). The strength of group modeling building lies in the engagement of stakeholders, the explicit sharing of mental models, the use of simulation to test hypotheses, and ultimately moving participants toward a shared confidence in the new mental models that emerge from their collaboration (Richardson & Anderson in Kilgour & Eden, 2010).

The process is conducted through facilitated face-to-face meetings with stakeholders to elicit model structure in an inductive fashion and engage participants directly in the process of model conceptualization and formulation. Facilitators employ a set of “scripts” intended to elicit the

desired types of input from participants (Andersen et al, 2007; Luna-Reyes et al, 2006). Groups unfamiliar with technical modeling methods are introduced to their language and symbols through a set of small concept models constructed specifically for this purpose, using simple pictures labeled in the group's lexicon to draw them into this approach (Richardson, 2006).

Inspired by work done on the ReThink Health project (Rippel Foundation, 2015), we opted for a strategy of working with a series of local area sites in order to develop a general Local Area Physician Workforce Planning Model, and a process for adapting and implementing the model. We will be working with one site after another, modifying and improving our model and our process for working with local area stakeholders at each site. We will keep calibrating the model and fine-tuning the process in each specific place, until we have a model and process that are polished enough that they can be implemented in any area with engaged stakeholders. Not having done anything like this before, we needed a pilot site, where we could begin with a deep dive into the local health care landscape, learning its contours: the pressing health, health care, and physician workforce issues; and getting to know the key stakeholders.

Process

Given its focus on developing a local area health workforce that meets local community needs, and its potential for generating initial local area contacts, we opted to select one of the sites involved in another AAMC cooperative endeavor, Urban Universities for HEALTH (Urban Universities for HEALTH, 2015). After a preliminary review of basic demographic and health systems data on four of the five main Urban Universities for HEALTH sites (Cincinnati, Cleveland, Kansas City and Albuquerque – having discounted Brooklyn as inappropriate for a pilot site), we decided to focus on Cleveland. It is a largely urban area, leaving the complexity of rural-urban disparities for later sites; it is the site of some significant innovation initiatives, such as Aligning Forces for Quality (Robert Wood Johnson Foundation, 2015) and Centers for Medicare and Medicaid Innovation initiatives (CMS, 2015); there are medical schools and other health professions schools present; and it appeared to offer good relevant data at the state, if not metropolitan area, level.

Beginning with our initial local contacts, who represented Urban Universities for HEALTH partners at Northeast Ohio Medical University and Cleveland State University, we eventually established comprehensive Cleveland area stakeholder contacts through extensive networking, including site visits to Cleveland, as well as phone calls and e-mails to establish, develop, and maintain connections. Our current stakeholder network now comprises representatives of all the area's major health systems, local and state government, area medical schools, practitioners, consumer advocacy groups, non-profit health services research organizations, Federally-qualified Health Centers, private insurance, the local Veterans Administration medical center, the city school district, and the state boards of medicine and nursing. What we are trying to do appears to resonate with actors across Cleveland's health care landscape as a necessary and highly valued endeavor.

Bringing the group together

After a series of telephone and e-mail communications, as well as a site visit and tour of the Cleveland area that focused on the geospatial arrangement of its neighborhoods and major health care facilities, we began to plan our first group model building session. We wanted to ensure that participants in our group model building process were of a sufficient seniority level to have a system-wide perspective, but still connected enough to daily operations to have a good sense of

the specific issues faced by practitioners and their patients. We also needed to achieve an appropriate mix of system leaders, practitioners, trainers, trainees, analysts, and patient advocates. We were able to draw on our network of contacts to recruit them directly, or those they recommended based on who would be best suited to the intensive, technical, and creative work we planned to undertake.

GMB I

The first group model building session was held on June 11, 2014, at Cleveland State University. We chose a neutral site – one with no affiliation with the major health systems – in order to put everyone on an equal footing and thwart potential competitive posturing which we had been cautioned about in the course of our information gathering. For our first group model building session, participants included executive suite leaders in the two largest health systems, physicians, experts in healthcare economics, innovators in health care education, and a leading patient advocate. All participants had been primed on our work through prior communications that included structured and semi-structured interviews, but none had a background in system dynamics modeling.

Prior to the first group model building session, AAMC contracted with Gary Hirsch, a leading system dynamics modeler in the field of health care who helped to develop the HealthBound and the ReThink Health models (Rippel Foundation, 2015; Hirsch et al, 2012; Milstein, Homer and Hirsch, 2010; CDC, 2008), to lead the technical model building, and with David Andersen and George Richardson to facilitate the group model building session itself. Drs. Andersen and Richardson developed a detailed agenda and accompanying scripts, a list of which plus one example can be found in Appendix A. These scripts were used to guide participants through a primer on the technical aspects of model building, as well as a series of group activities aimed at illuminating and elaborating on mental models of the way that the local health system works and the problems it faces, and to begin the process of mapping out the model and the stories it should tell (Richardson and Andersen, 2010). The first session involved 9 participants (see Appendix C) in an eight hour day that started with a brief description of the purpose of the gathering, with AAMC as convener and listener, and an overview of the day. Next, we began to use the scripts, as participants described their hopes and fears for the day, for their community, and for the model and modeling process. This activity was particularly beneficial as there was considerable consensus in both the hopes and fears described. Cleveland health care is a particularly competitive environment, and this activity helped break down preconceived notions of the big issues concerning the various players. A “small but wrong” model was then used to introduce modeling terminology and processes. Participants were next asked to graph key variables the model should display, and the behavior of those variables over time. This was followed by a discussion of the policy levers that might influence change in those variables. The variables focused primarily on factors related to the of training physicians, public health service utilization, and overall health, while the policy levers emphasized provider education and organizational policies, expanded services, and patient education campaigns.

Participants honed in on key policy gaps in primary care and public health, specifically service gaps faced by the area’s vulnerable poor and minority populations in the inner city, as well as the training needed to meet these needs. We asked participants to develop “system policy stories” (another script) to show what causes and impacts these issues. Three groups developed the following ideal scenarios:

- "Access for All", which focused on providing appropriate care and encouraging service in underserved areas.
- "Public Health as Though the Public Matters", which focused on building a healthy community infrastructure and connecting patients with community resources.
- "Enhancing Connectivity between the Health Care System and Local Community Health", which focused on building bridges between resources and providers.

During the development of system stories, participants identified the most important stakeholders in implementing the policies that were an integral part of those stories. These stakeholders were plotted on a "power and interest" grid, shown in Appendix B, allowing us to identify several key constituencies who were missing from the group of stakeholders we had brought together for the group model building and broader project: trainees (medical students and residents); specialty care providers; community health centers; and the other prominent health systems in the area.

The day concluded with Mr. Hirsch showing the participants a simple model that he had developed during the session to demonstrate how their day's work translated into the icons and language of a system dynamics model. This effectively demonstrated that the key variables and policy levers they had identified translated effectively into a system dynamics model that could be used to tell the types of system stories they wanted told.

Initial model building

This initiated an iterative process where each succeeding session provided feedback on the modeling team's interpretation of the last session and shifted into next steps for further model improvement. Thus, we used the model from the conclusion of our first group model building session as the basis of the actual system dynamics model we subsequently built. In the months following that initial group model building session, the modeling team built and refined model structures identified and defined by the group. We then identified various data that could be used in the model, employing a series of "fall back" positions. Where we could find data specific to the actual study area (the Cleveland-Elyria-Mentor Ohio Metropolitan Statistical Area), we used those. If the parameters we sought to populate could not rely on local area data, then we looked for data at the state level (Ohio). Failing that, we sought out national level data. Where no data were available, we relied on the literature for estimates.

GMB II

The second group model building session was held in the same location on November 20, 2014, for another eight hours. This session focused on eliciting stakeholder feedback on the model building that had occurred as a result of the first session. We were able to secure a panel of 17 participants (see Appendix C), with the only absence being an administrator for the county-owned safety net hospital, though practitioners from that system were represented.

After a brief catch-up on methodology for new participants, we reviewed the model and the outputs it could display, talking through the points where we knew there were gaps. The participants divided into groups to go through each portion of the model, discussing what needed to be changed, added, and removed, and where each participant might help us fill in data gaps. This took the majority of the day, as participants discussed supply for both primary care and specialty care, and demand for the same. The group benefited from the inclusion of a health economist who understood the labor market flows, and the leaders of a pipeline program who could illuminate key issues with the way we had designed training structures.

In the concluding activity, we asked participants to prioritize the variables that should be manipulated and the outputs they want to see, as they are the ultimate end users of the model. We received fascinating feedback, particularly on when workforce recruiting and planning begin (with high school students at the least and elementary school students at the ideal), the complexity of the path through medical training, and the degree to which the health system relies upon Advanced Practice Registered Nurses (APRNs) and Physician Assistants (PAs) despite sometimes restrictive scope of practice regulations. These items constituted the primary focus for the next revision of the model.

Revising the model

In the months following the second group model building session, we attempted to make the requested revisions to the model. Primary among them was building out the training pipeline. Because of the complex process for entering and completing training, as well as the variety of ways that people can change their path, this proved particularly challenging. The number of possible education pathways a physician can follow, especially if we extend the pipeline back to where they attended high school, numbers in the thousands. Moreover, because the medical school through residency education timeline is so long, typically taking from 8 to 14 years depending on the specialty, and this pipeline can be exited and re-entered multiple times, the data available to trace the pathways cannot always be assumed to be complete. Data collection for the earliest point in which our stakeholders are interested, location of high school, only began in 2002. Given the three-year lag in updating the primary database on practicing physicians, the American Medical Association's Masterfile, we encounter a data window of 9 years: less than that required for most physicians to complete their training.

Nonetheless, we were able to perform some important analyses on data related to physicians' pathways through the educational pipeline. In particular, group model building participants had emphasized policy levers related to "growing their own", i.e., recruiting and training future physicians from within the local population. Originally highlighted during a group model building script that focused specifically on policy levers available and important to our stakeholder participants, this concept lent itself to quantitative investigation in two different ways: creation and analysis of original survey data on physicians practicing in the area; and analysis of existing data on where practicing physicians attended high school. In conjunction with our pilot modeling work in Cleveland, we fielded a survey of physicians practicing in Cuyahoga County, the core county within the Cleveland MSA (2,500 surveys mailed, with 40% response rate prior to third mailing which is currently in field). Based on group model building participants' expressed interest in "growing their own", we included a question on that survey about where physicians attended high school. Our results showed that more than a third of practicing physicians in that County had attended high school in the Cleveland metropolitan area, and half within the state of Ohio, where Cleveland is located. Moreover, for the subset of practicing physicians nationwide for whom AAMC has data on high school location, and who matriculated to medical school during the 2002-2005 period (the first years we collected high school location data), we found that those who attended high school in Cleveland were 26 times as likely to practice there when compared with those who attended high school anywhere else in the U.S. We hope to follow up on that finding with further analyses.

GMB III

The third all-day group model building session was held on March 18, 2015, at Cleveland State University. This session had 7 attendees (see Appendix C), though many who could not attend

expressed interest in continuing to participate. We are currently completing a series of web-based conferences with them in order to elicit their input, as well. The content for this session focused on key model structures which we had not been able to develop satisfactorily, and validating data we had collected and analyzed. The group had particular interest in the physician pipeline and the use of APRNs and PAs. We were able to flesh out some key policy levers for training decisions made by programs and students, and where the decision points fit in the system.

We also devoted considerable time to reviewing some detailed data we had developed for the pipeline parameters, paying particular attention to concerns we had over their veracity. In compiling them for the most recent version of the model, we had discovered some crucial problems with core data on physician supply and retention rates at different stages of the educational pipeline. Stakeholders were able to help us understand what we were seeing in the data, confirm our suspicions that some of the data were in error (though they were also able to help us validate many of the data points we shared), and even provide us with more accurate data through their own access to the sources of those data points. Informed by our participants' feedback and data, we are now conducting analyses to improve the pipeline retention rates; and we have initiated a longer term project to develop a method for improving our physician supply estimates.

We are have not yet learned all the lessons and built all the structures necessary to call the model complete. We do need to move on to a new site in order to expand key aspects of the model, such as the need for a rural component, and to improve the process through replication. However, we established a plan for maintaining our contact with pilot site participants as we move forward. The group showed interest in participating in ongoing conversations, both with the modeling team and with other sites, through telephone and web conference. The main focus of these sessions will be to discuss potentially major changes to the model structure and identify data needs that they may be able to resolve for their own site. We will follow up with our Cleveland contacts at the conclusion of the multi-site local model development project to deliver a final model that can be used for the purpose of ongoing, locality-wide workforce planning.

The model

The model is still in development, as we are still just completing work at the pilot site. Nonetheless, the basic structure of the model is fairly well developed (Figure 1). It includes supply chains for physicians and the complementary professions of PAs and APRNs, whose participation in care delivery directly affects the capacity of care physicians can provide, and demand driven by population health, age, and income.

Figure 1. Overview of Pilot Local Area Physician Workforce Model

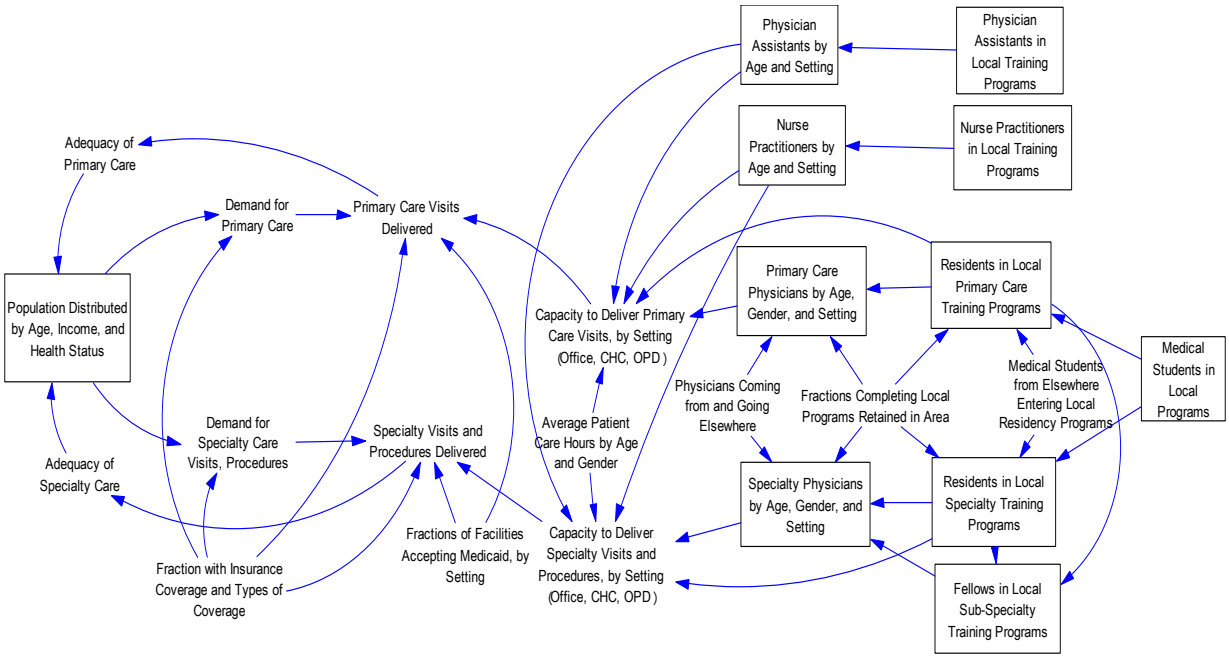
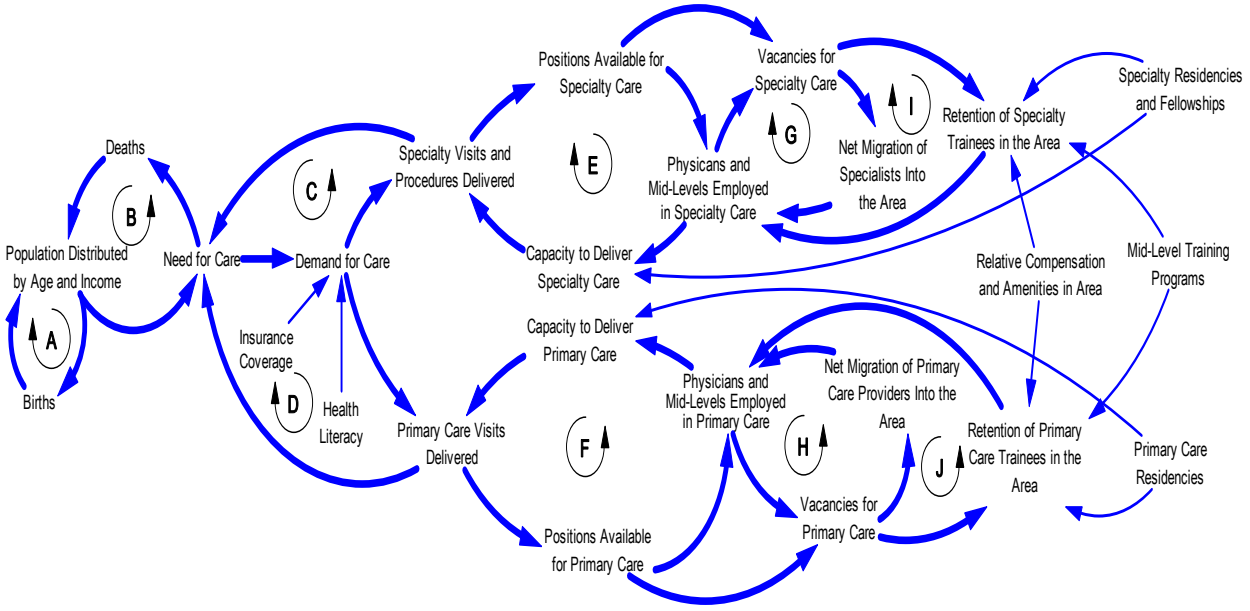


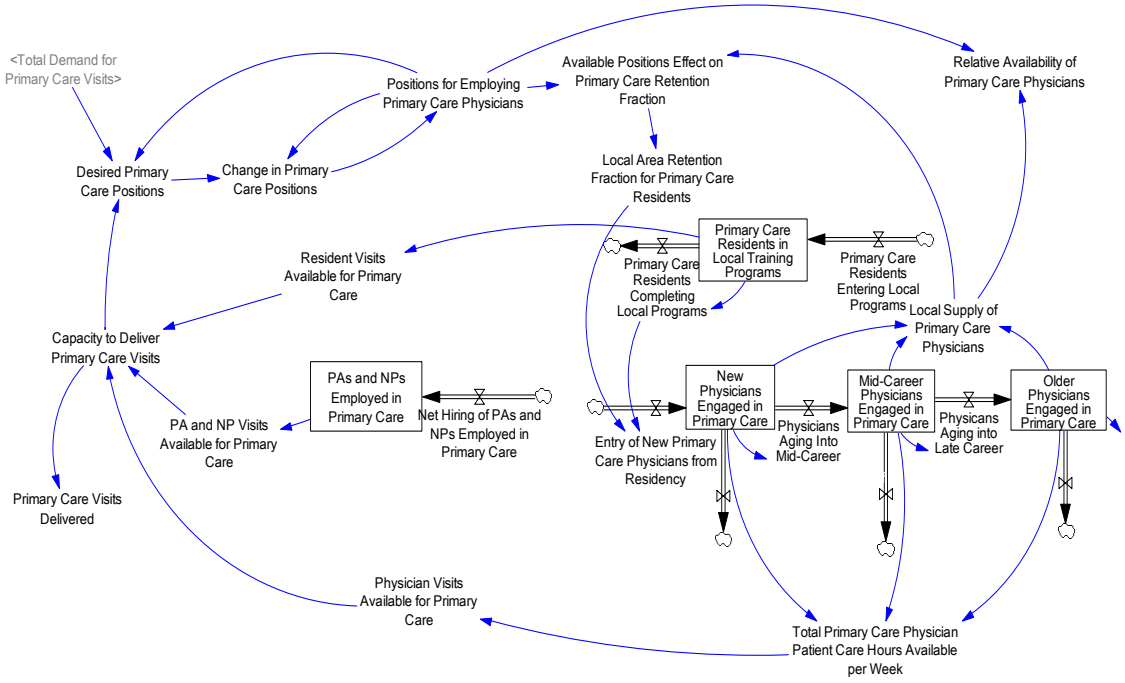
Figure 2 highlights the feedback loops inherent in the system. Loops A and B adjust the local area population based on births and deaths. Loops C and D are balancing loops in which greater needs for care ideally result in the greater demand for care, utilization of more care, improving health, and limiting future needs for care. However, the delivery of care is constrained by the capacity to provide both primary and specialty care. Capacity depends on the number of physicians and mid-levels employed for primary and specialty care plus residents and fellows who can also provide care. Loops E and F adjust employment to accommodate utilization plus provide some percentage of slack capacity by increasing or decreasing positions available. Employment also depends on the willingness of people to fill vacant positions. Loops G and H embody the response of physicians, PAs and APRNs who may migrate from other parts of the country to fill vacancies and loops I and J affect the willingness of people trained in local programs to remain in the area depending on the job opportunities available.

Figure 2: Feedback Loops in the Pilot Local Area Physician Workforce Model



The supply of practicing physicians is modeled in two parallel sections for primary care and specialty care (Figure 3 – structure for specialty care not shown). The structures are identical but built separately as each performs somewhat separate functions within the larger system, addressing different types of demands for care, and each also affects the other.

Figure 3. Pilot Basic Model Structure for Primary Care Physician Supply



Demand for primary care physicians is built around three stocks that divide the population by health status, with people in each health status needing and using different levels of service (Figure 4). Insurance coverage is also built into this part of the model, as it is a crucial driver of access to health care in the U.S. It generates numbers of visits needed and used. Specialty care demand is also built around the same three population health status stocks, but along with generating visits it also includes additional model structures for hospital admissions, stays and procedures (Figure 5).

Figure 4. Pilot Basic Model Structure for Primary Care Demand

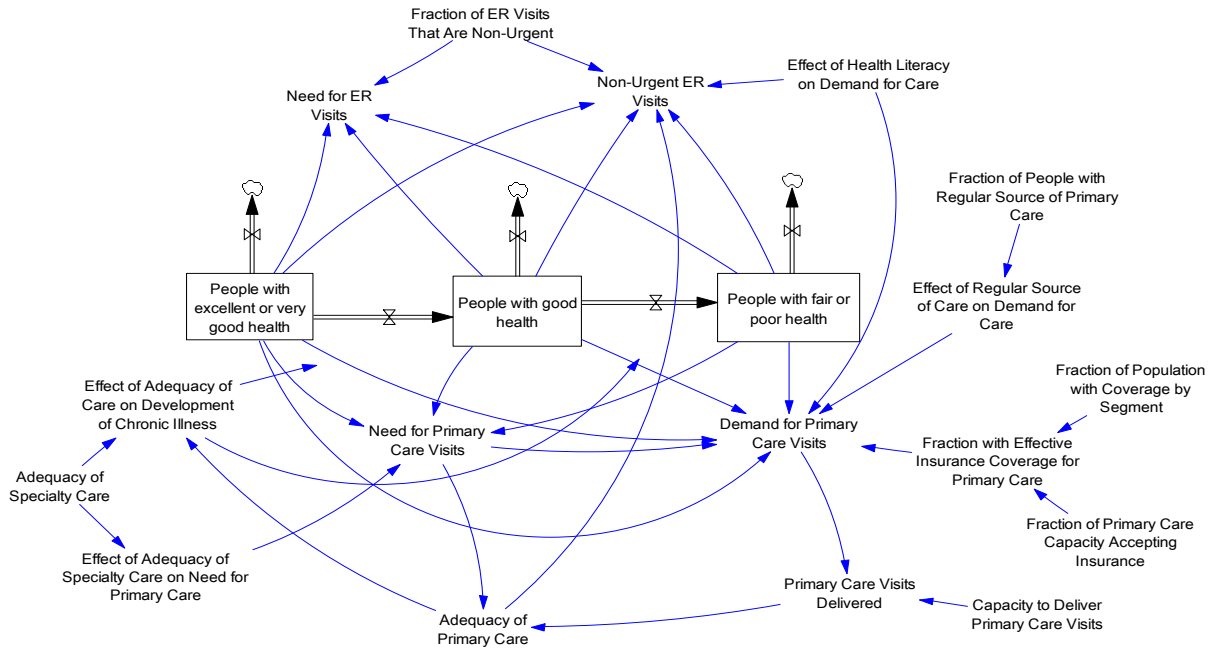
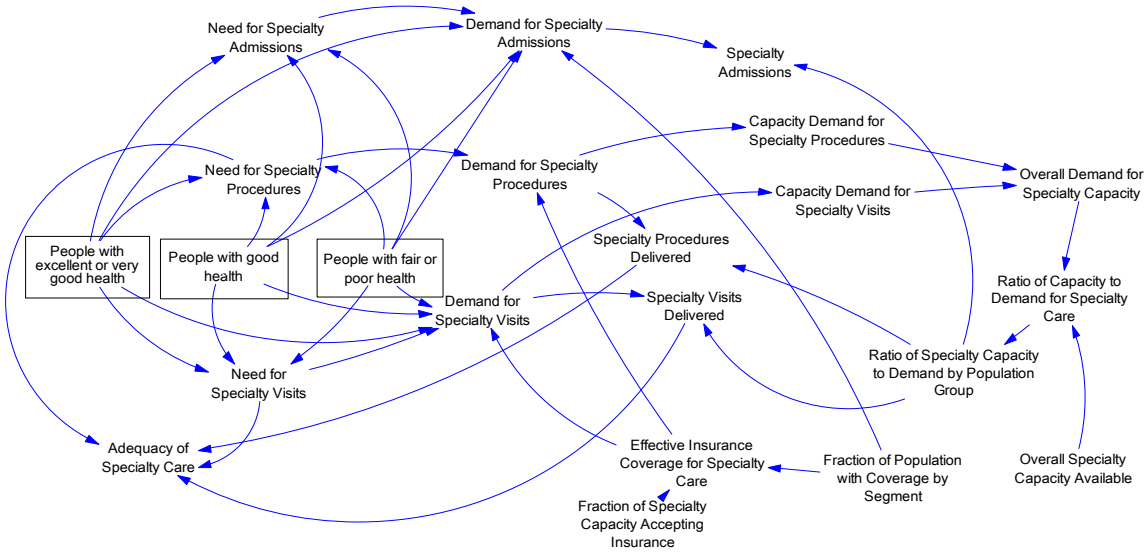


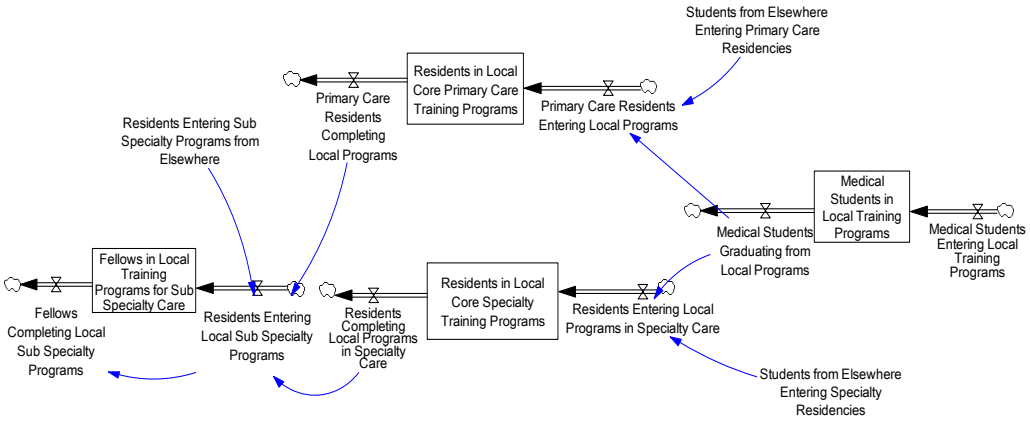
Figure 5. Pilot Basic Model Structure for Specialty Care Demand



Since the second group model building session, we have been focused on building out two of the supply chains that our participant stakeholders told us needed more elaboration, especially since they included key policy decision points. One of these is the educational pipeline for physicians, which our stakeholders said needed to be extended back to include medical school, and preferably even information on where physicians attended high school. The other is the local educational pipeline for producing PAs and APRNs.

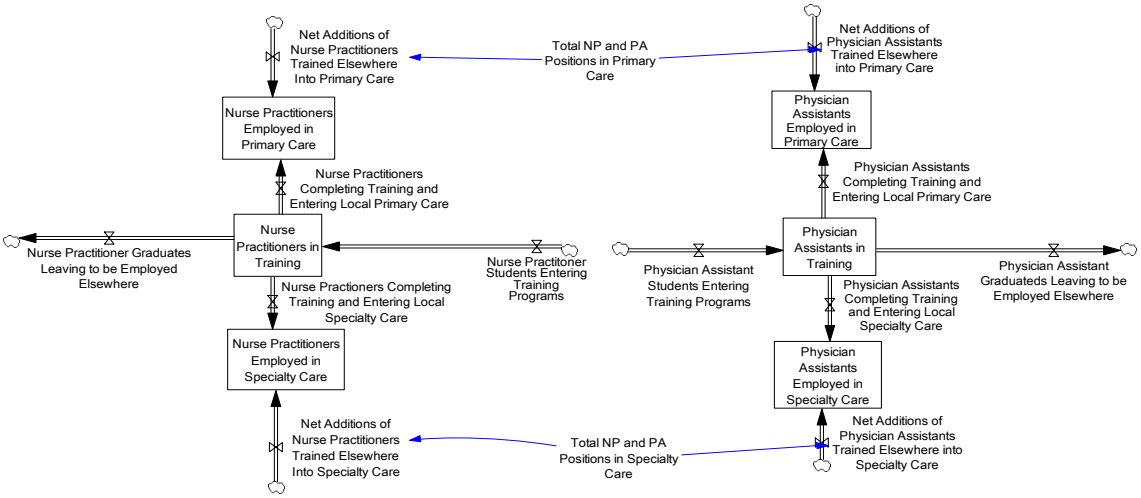
The physician supply chain (Figure 6) now includes medical school and different residency tracks (also known as graduate medical education, or GME). Data on high school attended have not been collected long enough for us to include that variable in the model, though we have separately analyzed some relevant data on that topic for our stakeholders.

Figure 6. Pilot Basic Model Structure for Physician Education Pipeline



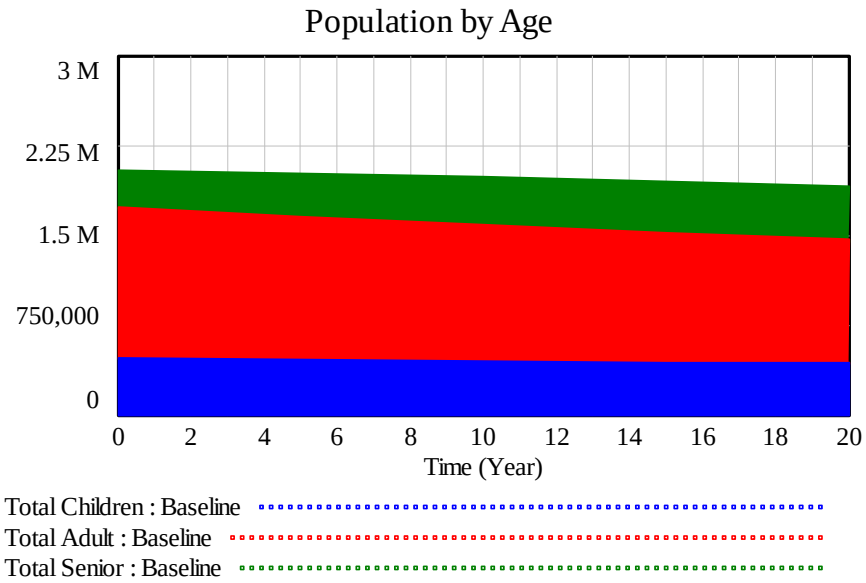
The supply chains for PAs and APRNs (Figure 7) are more rudimentary but allow us to explicitly model local contributions to these key factors in overall system capacity.

Figure 7. Pilot Basic Model Structure for Physician Assistant and Advanced Practice Registered Nurse Pipelines



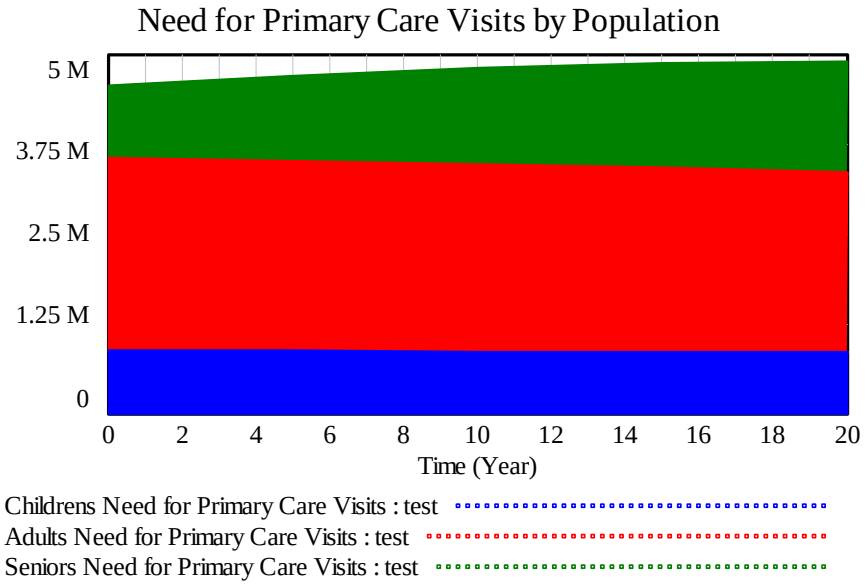
At the second group model building session, we presented some preliminary output from the model in order to demonstrate the types of output we could generate at that time, but also to check the face validity of that output. A few examples are presented here, all of which constitute very preliminary output, beginning with basic output on projected population size by age (Figure 8) showing a slow decline. This is consistent with the long-term trend in the area.

Figure 8. Preliminary Projections of Population by Age, Cleveland MSA



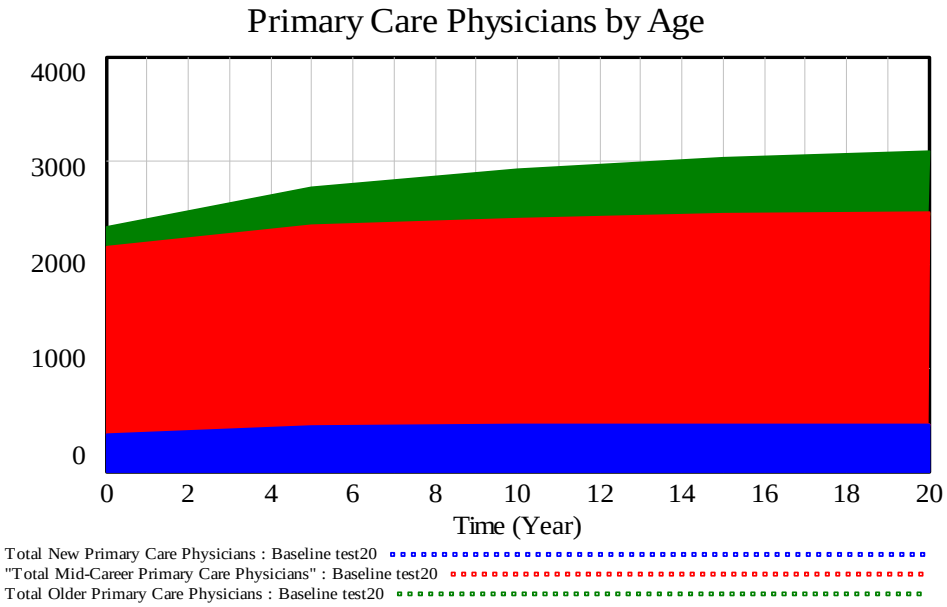
We also presented projections of the need for visits by population age, in part to emphasize that even if overall population is declining, it is also aging, and that implies growing need (Figure 9).

Figure 9. Preliminary Projections of Need for Primary Care Visits by Age, Cleveland MSA



In preparation for the third group model building session, we prepared some model outputs that focused on physician supply, reflecting our focus on the pipeline structures within the larger model. These included the supply of physicians by age (Figure 10 – only primary care shown) since the aging of physician supply is a key concern.

Figure 10. Projected Supply of Primary Care Physicians by Age, Cleveland MSA



Key lessons learned

We have learned some important lessons at our pilot site, both substantive and methodological. We knew going in that in the field of health workforce modeling we were breaking new ground with our community-based approach and focus on local area dynamics, where the social determinants of health meet care-seeking and care-delivering decisions in the context of place. We believed this was a crucial perspective to introduce because health care is largely a localized phenomenon: it is needed, used, and provided at a local area level. Indeed, neighborhood level factors affect health in multiple ways: direct effects on health; effects on health-related behaviors; the accessibility of health care; and the long-term effects of opportunities associated with place (Ellen et al, 2001; MacIntyre & Ellaway, 2000). While implementing our process, we gained a new appreciation for the significance of perception in health care access: Even when theoretically appropriate and accessible facilities are proximate to patients' actual geographic location, specific communities and neighborhoods still struggle with health care access. This is because health care needs to be more than accessible: it needs to be *perceived* as accessible. Just because there is a hospital in an impoverished area does not mean that its neighbors will see it as a viable option for their own health care, regardless of whether they will actually be served there.

In terms of our method, we remain committed to a group model building approach, including the development and use of scripts, such as our use of a "small but wrong" model as a step-by-step guide to introducing system dynamics methodology to a group unfamiliar with it and its lexicon. Without these, we would not have garnered the quality of input we have from our stakeholders. We have also found unexpected value in one of the very first group model building scripts we employed: identifying stakeholders' hopes and fears for their communities and our project. We

have come to rely on those as a key reference in prioritizing project work: How well are we building toward our partners' hopes? What are we doing to ameliorate their fears?

Constructing scripts, or even adapting existing scripts, requires substantial preparatory work; but without that investment, group model building sessions would not produce the immense value that they do – for both the modeling team and for participants. They also provide interim guides for a key concept that emerged from our group model building experience, which is the management of expectations. Setting clear expectations for the entire pilot, as well as each session and each session's component (governed by scripts), was crucial to facilitating the successful completion of our pilot work such that participants remain enthusiastic and committed to participation even after we move to another site, and even though it will be years before we return to them with a finished model.

We quickly discovered that modeling even a simplified version of the supply chain was a complicated task. Flows through the chain for creating physician supply are seemingly straightforward, involving just three main phases: undergraduate medical education; graduate medical education; and active practice. But there are thousands of possible pathways, and individuals can leave and re-enter the chain at different points. They can also emigrate and immigrate at multiple points along the chain. Modeling this required substantial effort and consultation with experts in order to reach the optimum compromise between simplification and realistic representation. All of these difficulties were also compounded by data limitations that made some flows difficult to parameterize. We have struggled with data throughout this process, from having to rely on data points increasingly removed from the local area context (our "fall back positions"), to the complexity, absence, and incompleteness of real world data. On the demand side, national data on health care utilization cannot completely reflect locality specific patterns, even when applied to local area demographics. On the supply side, we used the data set for physicians which is generally accepted as the industry standard, and we found that it produced significant overestimates of supply. This has led us to the realization that we need to focus next on improving data we had initially hoped were sufficient. Moreover, comparable data on PAs and APRNs simply do not exist. We need solutions to these data dilemmas. As we move forward, we will be exploring the development and refinement of parameter estimates through multiple methods, including the group model building process itself. Fortunately, we have learned that this process can contribute to improved data by helping us to verify data points, identify or confirm data errors and shortcomings, and connect us with better data, as well as to identify strategies for improving the data, all of which will create improvements in our model but also contribute more broadly to the fields of health workforce research and planning.

The model itself is still in development, but it has already revealed some key insights. Some reinforced lessons learned from our national projections, and others were new. These include: the importance of a concomitantly aging population and physician supply; the significant impact medical school recruitment strategies can have on aligning future supply with population health needs; how slightly different flows of future physician residents through the graduate medical education pipeline (including location, program and specialty choice decisions) can dramatically impact an area's available supply of physician capacity; and the potential for an ever-widening gap between capacity to provide visits and the need for visits even with the anticipated growth in the absolute numbers of physicians, PAs and APRNs.

Next steps

Our immediate next step is to produce a final report for our pilot site, documenting for our participants what we have accomplished to date, as well as sharing with them all the data we have collected and compiled. We will soon move on to our second site, where we will attempt to replicate our process, with some improvements, and continue to build and modify our model. Eventually, through a series of local area partnerships, we hope to develop a model and model development process that can be used for any local area in the U.S. which is interested in using our approach to inform their physician workforce planning. We will then be able to return to all our former partner sites, such as Cleveland, with a more refined product for them to use. Each successive site where we work on the model will constitute a test of our model and process. We anticipate a constant improvement process, taking Version 1.0 back to Cleveland once we are ready, and Version 1.1 to the site after that. In the interim, beginning with our upcoming second site, we will be implementing a formal evaluation process in conjunction with our model building, examining more formally the validity of both our model-in-progress and our modeling process.

We also plan to apply the process, model and data improvements developed for local areas to the development of a new national physician workforce model which treats the national health care landscape not as a single continuum, but as a diversity of contexts, capacities and communities. With what we have learned from working with localities, we expect to be able to improve upon our past methodology for national modeling. How actively it engages the national debate will be the final test of the model and method.

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Appendix A: Group Model Building Scripts Used To Date

GMB I

Hopes and Fears (Andersen & Richardson)

Elicited participant hopes and fears for model and for project more generally.

A Sketch of a Very Small and Wrong Simulating Model (Andersen & Richardson)

Introduced participants to iconography and lexicon of system dynamics modeling through use of a small model that employed concepts familiar to participants but which was wrong enough not to bias their conceptions of what should go into the real model.

Eliciting Graphs of Key Variables over Time (Andersen & Richardson)

Small group exercise that elicited reference mode behavior of variables of interest to participants.

Preliminary Policy Levers of Interest (Andersen & Richardson)

Small group exercise that elicited from participants the policy levers that most interested, and were most relevant to, them.

Systems Story Creation Involving Key Stakeholders (Andersen & Richardson)

Small group exercise that had participants put together stories of how the local health care system works and what the effects of various policy changes might be, using the key variables and policy levers of interest generated during prior activities.

Stakeholder Power and Interest (Andersen & Richardson)

OBJECTIVE: Participants plotted stakeholders who had interest in the issues we were addressing along two axes: interest and power. (See Appendix B.) This was used to help identify key stakeholders who were not yet participating in the GMB process.

PROCESS: During the Systems Story Creation activity, a facilitation team member recorded the names and organizations of stakeholders to health policy. The group then discussed where they should go on the axes of interest and power to affect change in the health workforce. The discussion lasted approximately 20 minutes.

ASSESSMENT: While the group initially considered public health as the issue on which to gauge interest, most of the positioning translated quite well to health workforce – the true objective of the activity. After some edits after the session, we shared the grid with participants during the following session and in follow-up conversations. This grid also helped us to revise our invitee list for the second group model building session to ensure a more complete group.

GMB II

Feedback: The Good, the Bad & the Ugly (Dill & Yunker)

> Small group exercises that had participants mark up sketches of the model, adding elements they felt were missing (the “bad”), crossing out elements they felt were wrong (the “ugly”), and highlighting featured they felt we had right (the “good”).

Setting Priorities (Dill & Yunker)

> Small group exercise that asked group members to prioritize the fixes identified during the feedback sessions in order to focus next steps in model development.

GMB III

How Does Care Structure Shape Health Care Demand and Supply? (Hirsch, Dill & Yunker)

> A series of detailed, in depth reviews of the data used in the model to check face validity of key model parameters and help us improve our calculations of key model concepts.

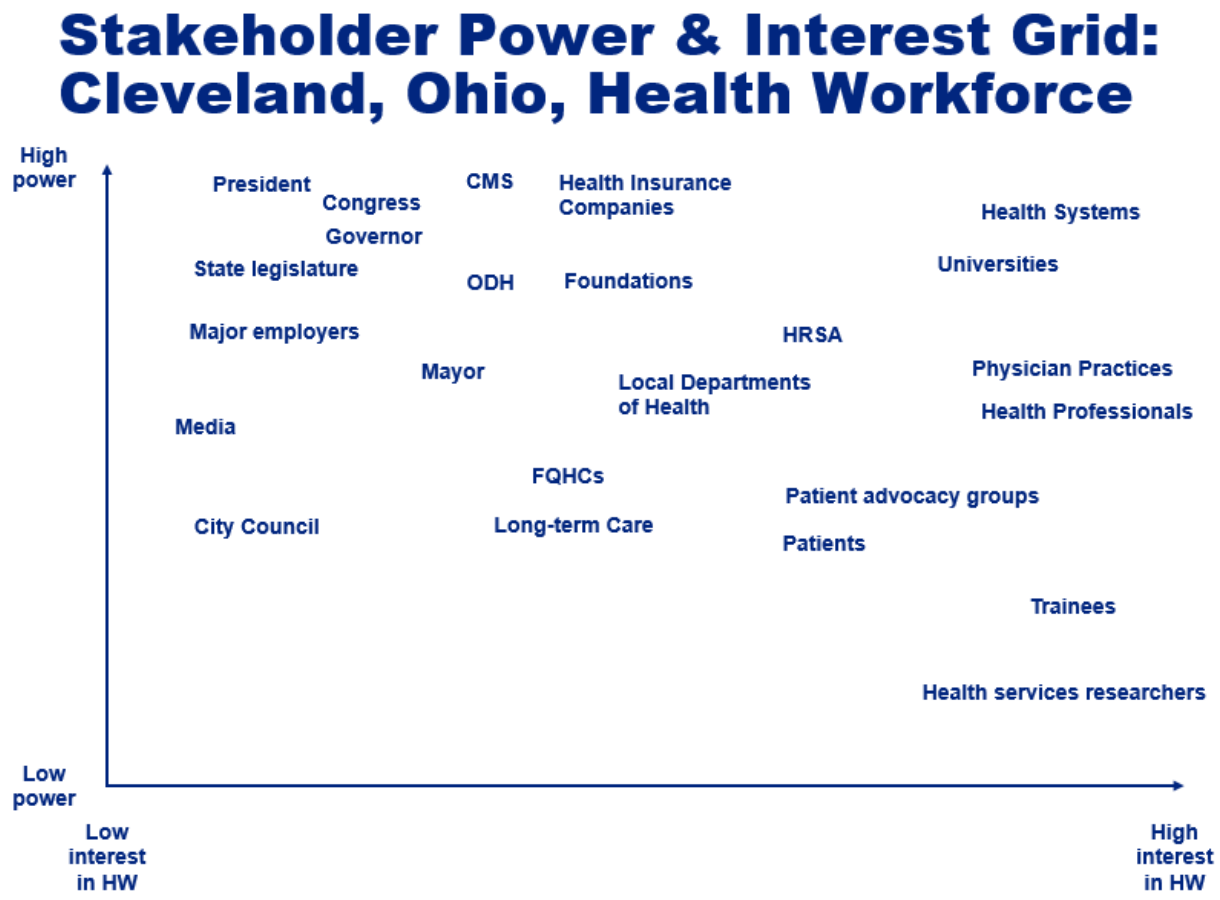
Pipeline (Dill & Yunker)

> Participants placed key policy levers on a sketch of the new pipeline model structure we had developed.

What Are We Missing? (Dill & Yunker)

> Returned participants to the original “Hopes and Fears” script to assess how well we had performed thus far.

Appendix B: Power and Interest Grid



Appendix C: Group Model Building Participants

GMB I (9)

- Advocacy Coordinator, regional health care consumer advocacy organization
- Assistant Dean for Community Engagement and Admissions, medical school
- Assistant Dean for Student Affairs, medical school
- Board of Trustees member, county hospital system; Health economics professor
- Chief Medical Officer, major health system
- Dean, College of Science and Health Professions, university
- Professor emeritus. medical school; Community Advisory Board Member
- Executive Director, health and community development nonprofit research organization
- Preventive Medicine physician and county health department liaison, major health system

GMB II (17)

- Advocacy Coordinator, regional health care consumer advocacy organization
- Assistant Dean for Community Engagement and Admissions, medical school
- Board of Trustees member, county hospital system; Health economics professor
- Chief Medical Officer, major health system
- Chief Wellness Officer, FQHC
- Dean, medical school
- Director, urban physician training partnership program
- Director of Multicultural Program, medical school
- Director of Workforce Development, association of health centers
- Economic research associate, university
- Professor emeritus, medical school; Community Advisory Board Member
- Executive Director, health and community development nonprofit research organization
- Manager of Graduate Medical Education, major health system
- Medical Student, medical school
- Preventive Medicine physician and county health department liaison, major health system
- Residency Director, hospital system
- Senior Vice President of External Relations, major health system

GMB III (7)

- Advocacy Coordinator, regional health care consumer advocacy organization
- Assistant Dean for Student Affairs, medical school
- Dean, medical school
- Director, urban physician training partnership program
- Executive in Residence, university; professor emeritus at medical school; Community Advisory Board Member, urban physician training partnership program
- Medical Student Coordinator, health system
- Senior Instructor, health system; recent graduate of physician training pipeline
- Staff, urban physician training partnership program