POLICY BRIEF
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Predicting the Effects of the Affordable Care Act: A Comparative Analysis of Health Policy Microsimulation Models

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INTRODUCTION

The 2010 Patient Protection and Affordable Care Act (ACA) calls for significant policy changes that have meaningful and widespread implications for the U.S. health system. Given the magnitude and breadth of these provisions, policymakers and analysts need tools to estimate the potential effects on the health system and its participants. Microsimulation modeling is one such tool, serving as a mechanism for estimating the potential behavioral and economic effects of public policies on decision-making units. For the purposes of health policy microsimulation modeling, these decision-making units include individuals, households, and employers, as well as government.

Microsimulation models were utilized throughout the legislative process that led to the passage of the ACA, and these models continue to play a prominent role in understanding the likely effects of federal health care reform provisions on insurance coverage and cost at both the national level and, increasingly, within individual states. The use of health policy microsimulation modeling at the state level is particularly important, as the states—which start from very different political, social, and economic circumstances—have considerable flexibility in how they choose to implement the many provisions of the ACA.

Today, the Federal and state governments, as well as private organizations, are using five major federal health policy simulation models. The first is owned by the Federal government and was developed by the Congressional Budget Office (CBO). This simulation model is used extensively to score legislation and was used during the formulation of the ACA. The other four models are owned by private entities and include: the Gruber Microsimulation Model (GMSIM) developed by Dr. Jonathan Gruber at the Massachusetts Institute of Technology (MIT); the COMPARE model developed by the RAND Corporation; the Urban Institute's Health Insurance Policy Simulation Model (HIPSM); and the Lewin Group's Health Benefits Simulation

ABOUT THE PROGRAM
State Health Reform Assistance Network, a program of the Robert Wood Johnson Foundation, provides in-depth technical support to states to maximize coverage gains as they implement key provisions of the Affordable Care Act. The program is managed by the Woodrow Wilson School of Public and International Affairs at Princeton University. For more information, visit *www.statenetwork.org*.

ABOUT SHADAC
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Model (HBSM). Other microsimulation models exist in both government (e.g., the model used by the Office of Tax Analysis in the Department of the Treasury and a model developed by the Agency for Healthcare Research and Quality (AHRQ)) and the private sector. However, the five major models identified here have dominated in practice and are the models this brief refers to as the “major health policy models” or “major microsimulation models.”

This brief aims to explain the basics of microsimulation modeling so that policymakers and analysts are able to secure the optimal model for their needs. With this in mind, the brief addresses three questions:

1. What are health policy microsimulation models and what are their components?
2. What are the similarities and differences among the five major federal health policy models?
3. What types of questions should policymakers and analysts consider when evaluating contracting options for health policy microsimulation?

WHAT IS A HEALTH POLICY MICROSIMULATION MODEL?

Health policy microsimulation models use micro-data on persons (or households, employers or other micro-units) and simulate the effect of changes in health policy on each of these units. Differences before and after a policy change can be analyzed at the micro level and then aggregated to show the overall effect of a policy change. It is their use of individual-level information at every stage of the analysis that distinguishes microsimulation models from other sorts of economic or statistical modeling. When used to inform the design of new types of policy or to predict the impact of a policy, microsimulation models can provide a consistent and structured framework in which to explore a range of “what if” questions about the outcomes of policy permutations.[1,2]

To conduct a health policy microsimulation analysis, modelers first establish the baseline scenario to reflect the status quo (e.g., premium and coverage distribution). Next, they model the behavioral responses of individuals and employers to a particular policy change(s) to arrive at a new scenario. Finally, they use the updated status information (e.g., new premium and coverage distribution after modeling the policy change) from the new scenario to update premiums and other information in order to estimate output for subsequent years during which the policy is in effect.

Data Infrastructure

The foundation of any microsimulation model is the data infrastructure. The five major health policy models all use individual-level, population survey data from Federal government sources to represent the U.S. population. These population survey data include information about individuals’ demographic characteristics, household structure, income, employment status, and health insurance coverage (e.g. employer-sponsored, non-group, Medicaid/CHIP, or none), as well as other attributes.

Since a primary focus of the five major health policy models is to estimate the effects of public policy on insurance coverage, and because employer-sponsored insurance (ESI) is the predominant way through which the non-elderly population in the United States obtains coverage, each of the five models also uses government or private sources of data on U.S. employers to capture the distribution and characteristics of businesses in the United States.

The third major type of data used by the models is federal and proprietary survey data that captures medical spending and premiums. Modelers use these data to estimate health insurance premiums for both ESI and coverage in the non-group market.

Once the data infrastructure is built, the model can generate estimates corresponding to the baseline scenario. Then, the model uses information about particular policy provisions to estimate how the behavior of individuals and employers may be affected once the provisions are implemented.

Behavioral Assumptions

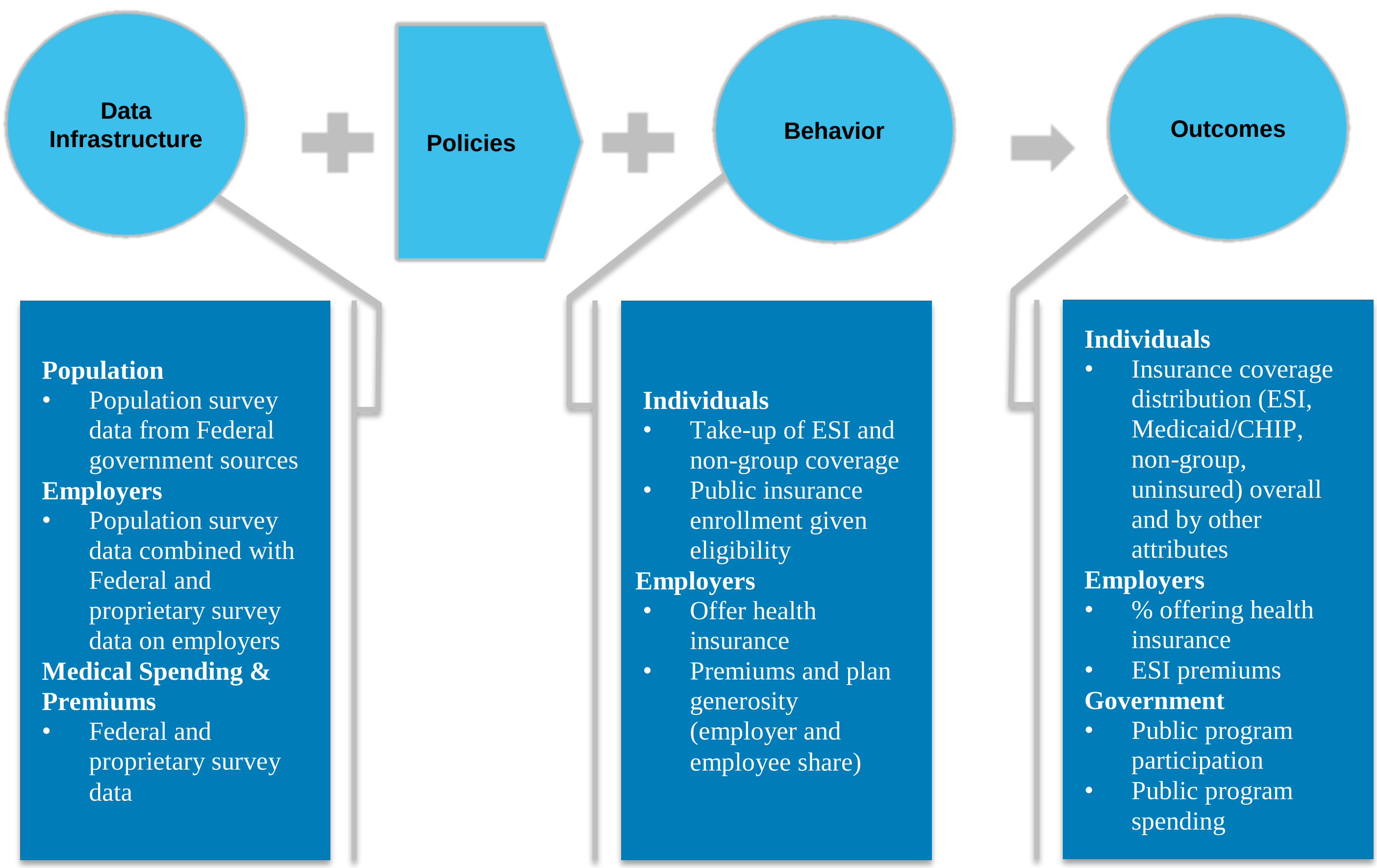
Modelers are able to simulate the effects of a variety of public policies by applying assumptions or decision-rules about how individuals and/or employers might respond to the specifics of a given policy. These assumptions about behavioral responses are typically derived from estimates generated in peer-reviewed scholarly research. For example, to determine an appropriate assumption about take-up rates for different types of coverage, models use research about individuals' price-sensitivity as it relates to whether or not they take up health insurance. Models also leverage research focusing on public insurance when incorporating behavioral responses into the model. For example, the models might take account of the probability that an individual enrolls in a public program if he or she is eligible or the probability that a person with an ESI offer switches to public insurance upon becoming newly eligible. Modelers also consider the price sensitivity of employers when estimating whether employers offer coverage, the generosity of the coverage offered, and the employer contribution toward the premium.

Outcomes

Microsimulation models can generate a number of outcomes. Among the major health policy models included in this study, the most common outcome is the distribution of insurance coverage. In addition to generating an estimate of the overall distribution, the models can produce summary statistics that show how the distribution of insurance coverage varies by income, geography, and other factors. Microsimulation models can also inform policymakers and analysts about how ESI offer rates and premiums may change as a result of policy provisions. Finally, these models can provide the Federal and state governments with information about how different provisions will affect public program participation and spending. These various outcomes can be considered jointly to assess the efficiency and effectiveness of particular policy provisions; for example, to generate estimates of the cost per newly insured person.

Figure 1 provides an overview of the components of health policy microsimulation models.

Figure 1: Health Policy Miscrosimulation Modeling



WHAT ARE THE SIMILARITIES AND DIFFERENCES AMONG THE FIVE MAJOR FEDERAL HEALTH POLICY MODELS?

Data Infrastructure – Population Data

The major health policy models use three population data sources representative of the civilian, non-institutionalized U.S. population (Table 1). The first is the Current Population Survey Annual Social and Economic Supplement (CPS-ASEC), which is widely used by economists and health services researchers. Importantly, the CPS-ASEC can support state-level estimates for a majority of states. The second population data source used is the Survey of Income and Program Participation (SIPP). The SIPP is smaller in size than the CPS-ASEC but it follows individuals over time and asks more detailed questions about income and public program enrollment. The third population data source is the Medical Expenditure Panel Survey Household Component (MEPS-HC). This survey is sponsored by AHRQ and it contains detailed information on individuals' medical care spending as well as insurance, demographics, and employment information.

Data Infrastructure – Employer Information

A key feature of all five major microsimulation models is the construction of synthetic firms: Modelers use statistical matching methods to take working individuals from population surveys (CPS-ASEC, SIPP, or MEPS-HC) and group these individuals together in ways that reflect how they would be distributed within and across U.S. firms. The creation of synthetic firms is a critical step in modeling the elements of health insurance coverage, as decision-making by employers regarding insurance provision is assumed to depend on the characteristics and preferences of its workers. Three key sources provide U.S. employer data that feed into the synthetic firms of the five major health policy models, including Statistics of U.S. Businesses, the Bureau of Labor Statistics' National Compensation Survey, and the Kaiser Family Foundation/ Health research & Educational Trust Employer Health Benefits Survey (KFF/HRET), which is an annual survey of employers regarding their provision of health insurance (Table 1).

Data Infrastructure – Medical Spending and Premium Prices

To estimate premiums for private insurance (ESI and non-group coverage), the major models rely on three data sources (Table 1). The first of these is the MEPS-HC from which the modelers use individuals' medical care spending data and assumptions about loading fees (e.g., administrative expenses and profits) to construct premiums. The second source is the MEPS Insurance Component (MEPS-IC), which is an annual federal survey of U.S. establishments that collects information on premiums, employer/employee contributions, and coverage types for businesses that offer health insurance as a component of compensation. Finally, the third data source is the Kaiser Family Foundation/HRET Employer Health Benefits Survey.

The major microsimulation models use two basic methods to construct estimated baseline premiums for ESI. The first method is to estimate premiums using predicted medical spending among workers (and dependents) affiliated with each synthetic firm, aggregate across the firm, and then apply adjustments for loading fees (i.e., administrative expenses plus profits) and state regulations. The second method is to use reported premium data found on the MEPS-IC or the KFF/HRET survey and apply adjustments to account for generosity differences by firm size, geographic variation in costs, and/or state regulatory environments.

Table 1. Model Comparison: Data Sources

	CBO	GMSIM (Gruber)	COMPARE (RAND)	HBSM (Lewin)	HIPSM (Urban Institute)
Population Data*	2002 SIPP	2005 CPS-ASEC	2008 SIPP	2002-2005 MEPS-HC	2009/2010 CPS-ASEC
Employment Data	BLS National Compensation Survey	BLS National Compensation Survey	KFF/HRET Statistics of U.S. Businesses	KFF/HRET 1997 Robert Wood Johnson Foundation Employer Survey	Statistics of U.S. Businesses
Medical Spending and Premium Data	2004 MEPS-HC	2004 MEPS-IC 2005 MEPS-HC	2007-2008 KFF/HRET 2002-2003 MEPS-HC	2006 KFF/HRET 2002-2005 MEPS-HC 1997 Robert Wood Johnson Foundation Employer Health Insurance Survey	2006-2008 MEPS-HC

*The core population data used by these models are not the most currently available; however, the modelers use calibration techniques to update the population attributes so that they reflect the current demographic distribution.

To construct estimated baseline premiums for the non-group market, the most common strategy is to use individual health spending information from the MEPS-HC and to adjust for demographics, health status, and geography. Modelers then apply a loading factor to reflect administrative expenses and profits consistent with what is known about them for the individual market. Two models, Gruber's GMSIM and Urban Institute's HIPSM, also benchmark their results to individual health plan premium findings reported by America's Health Insurance Plans (AHIP), the insurance industry's trade association.

Table 2 provides a comparison of how the five major models construct estimated baseline premiums for both the ESI and non-group markets.

Behavioral Assumptions

With the data infrastructure generated and the baseline scenario established (i.e., population, workers assigned to synthetic firms, premiums and coverage distribution estimated), the next step is to quantify the anticipated behavioral responses of individuals and employers to a given policy change. The five major health policy simulation models use two basic approaches to calculate these expected responses: an elasticity-based approach and a utility-based approach.

An *elasticity-based approach*, used by CBO, Gruber, and the Lewin Group, relies on findings from the empirical health economics and health services research literature to estimate changes in demand for insurance by individuals and provision of insurance by employers resulting from *changes in price*. An elasticity is defined as the percentage change in quantity demanded given a percentage change in price. Since the outcome of interest is binary (a person either takes up ESI coverage or he/she does not; an employer either offers coverage or not), the quantity demanded is expressed as a probability.

Table 2. Model Comparison: Baseline Premium Construction

	ESI Premium Construction	Non-Group Premium Construction
CBO	• Expected aggregate spending of a firm's workers • Actuarial values assigned based on firm size, income, health status • 9% to 27% loading fee applied depending on firm size • Incorporates state-specific information	• Factor-based approach using information on age, sex, health, experience, and state • 29% loading fee applied • Includes state-specific information/adjustments
GMSIM (Gruber)	• Individual-level cost index (age/sex/health rating) averaged over synthetic firm; index aligned to employer premium distribution to assign premium to firm • Actuarial value assigned based on income and firm size • Loading fee implicit in premium • Adjusted for state variation in premiums	• Age-health status spending distribution from MEPS applied to CPS • Loading fee applied with fixed (15%) and variable components; varying load component equal to 30% of average unloaded non-group cost, based on age interval • Includes state-specific information/adjustments
COMPARE (RAND)	• Firm-specific premiums based on experience-rated and community-rated estimates (former use predicted spending of workers and dependents, while the latter use 12 pools based on 4 census regions by 3 firm sizes) • Actuarial values assigned based on firm size • 8.3% to 20% loading fee applied depending on firm size • No detailed information available about incorporation of state-specific information	• Age-health status risk pools to estimate spending from MEPS-HC for those reporting individual coverage • Loading fee applied (details not available) • Includes state-specific information/ adjustments (approximated)
HBSM (Lewin)	• Use expenditures of workers and apply rating practices (e.g., small group market) to estimate premiums; premiums also estimated for self-funded plans • Actuarial values assigned based on comparison of employer plan to standard benefits • 5.5% to 40% loading fee applied depending on firm size • State code imputed to MEPS and state small-group rating rules applied	• Predicted spending and rating practices (age, sex, health status) • 40% loading fee applied • Includes state-specific information/adjustments
HIPSM (Urban Institute)	• Built from risk pools from underlying health care costs; blend of actual and expected costs • Actuarial value assigned based on firm size • Loading fee applied depending on industry and firm size • Accounts for state variation in spending	• Predicted spending among those in non-group market; model based on age sex, health status, and "typical" rating rules • Loading fee applied (details not available) • Includes state-specific information/adjustments

The RAND Corporation and Urban Institute use a utility-based approach to estimate changes in the demand for and employer provision of insurance coverage. For a utility-based approach, each individual has a set of insurance options from which he or she can choose (e.g., ESI, non-group coverage, public coverage, or no coverage (uninsured)). The utility or satisfaction that an individual gets from selecting one of the options depends on his or her expected out-of-pocket costs (co-payments, co-insurance) under each option; the value of health care consumed; his or her expected premium contribution; tax incentives (e.g., favorable tax treatment of ESI employer contributions); and the ratio of his/her expected costs (out-of-pocket and premium contributions) to income. Information from the insurance options is then translated into effects on one or more of these factors. The five major models also usually incorporate information about "non-monetary" attributes of the options (e.g., the stigma of public insurance). The individual is assumed to choose the insurance option that maximizes his or her utility.

With a *utility-based approach*, an employer's decision to offer insurance is contingent on its worker's total willingness to pay (WTP; that is, the combined WTP of all workers in a synthetic firm) for insurance as compared to the total cost of the employer offering insurance as a fringe benefit, including the premium and HR administrative fixed costs. Willingness to pay is calculated from the equation corresponding to the utility model.

Compared to elasticity-based approaches, utility-based approaches are much more complex in terms of their estimation; however, utility-based approaches have the advantage of not relying as heavily on estimated behavioral responses that occurred in the past under different regulatory and policy environments. On the other hand, utility-based approaches are in fact calibrated to ensure that the behavioral responses they generate are within the range of elasticities reported in the research literature.

Outcomes

The major microsimulation models can generate a substantial amount of summary data, but the most frequently reported information pertains to the coverage distribution and the change in spending for individuals, employers, and government resulting from enactment of key coverage provisions. While the type of outcome information produced is often similar across the models, the use of different modeling approaches and different data infrastructures and assumptions largely prohibits an apples-to-apples comparison of estimated effects (Table 3).

Table 3. Illustrating the Challenge of Comparing Microsimulation Output: Reduction in Uninsured

	COMPARE Model (RAND)	HPSIM (Urban Institute)
Approach	Estimate status quo as of 2016 and then apply reform provisions	Simulate provisions as though implemented in 2011
Outcome	Reduction in uninsured from 52 million to 18 million – 34 million gain coverage	Reduction in uninsured from 50.9 million to 23.3 million – 27.6 million gain coverage

WHAT TYPES OF QUESTIONS SHOULD POLICYMAKERS AND ANALYSTS ASK WHEN CONSIDERING MICROSIMULATION?

Microsimulation models have been and continue to be used by states in their ACA implementation efforts. However, because all of the major models are built on a data infrastructure that is national in orientation, it is important to take into consideration the extent to which a given model can be tailored to incorporate the demographic, economic, and regulatory characteristics of a specific state. With this in mind, the following are some key questions states should ask as they consider the use of microsimulation models:

> *Beyond adjusting for the demographic and health status profile of the population in my state, in what ways can a model be customized to reflect the health care market environment that may affect coverage and costs? For example, does the model take into account practice style or provider capacity?*

To what extent can a model incorporate decisions about state-based Exchange functions or other decisions to be made by state policymakers that would affect premiums and coverage decisions (e.g., pooling the individual and small-group markets)?

More general (i.e., less state-specific) questions worth considering include:

To what extent can a model generate information about distributional effects (e.g., attributes of the newly insured)?

How might the model results be used to assess the impact of the ACA from an economic standpoint?

How easily can certain provisions be relaxed in order to gauge their importance? For example, if the individual mandate is ruled unconstitutional by the U.S. Supreme Court, how would its elimination affect estimates of coverage, premiums, and overall spending?

What value does the model have after 2014? How can it be used in the longer-term with respect to ongoing ACA implementation?

CONCLUSION

The five major health policy microsimulation models have so far been used to estimate the impacts of a number of ACA provisions including: exchange implementation; premium and cost-sharing subsidies for exchange-based plans; employer shared responsibility requirements; the Medicaid expansion; and the individual coverage mandate. These models can serve as a useful tool in health policy planning and implementation. However, the models are complex, with varying data infrastructures, different approaches to estimating behavioral responses, and multiple steps and assumptions embedded in the modeling process. Given this complexity, the utility of these models for policymakers and analysts depends on the ability of those who will be using them to ask direct and useful questions about their flexibility and how they can be tailored to reflect a state's particular needs.

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