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***ReThink Health Dynamics:
Understanding and Influencing Local Health System Change***

by

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Abstract

Health system reform is a national priority in the U.S., but it is increasingly being pursued through a mosaic of local initiatives. More and more concerned leaders in cities, towns, and regions across the country are working within their local health systems to achieve better health, better care, lower cost, and greater equity. Such ambitious and widely dispersed ventures, however, are hard to plan, unwieldy to manage, and slow to spread. Further progress could occur if diverse stakeholders were better able to play out intervention scenarios, weigh trade-offs, set aside schemes that are unlikely to succeed, and enact strategies that promise the most robust results. Through the Rippel Foundation's *ReThink Health* initiative, veteran leaders and creative methodologists are learning what it takes to spark and sustain system-wide improvements in different settings. Interactive simulation modeling and game-based learning support innovators by bringing greater structure, evidence, and creativity to the action planning process. In this paper we provide an overview of the *ReThink Health Dynamics* simulation model by providing a summary of its structure, intervention options, data sources, user interface, experiences in pilot sites, initial insights, evaluation plan, and possibilities for further development and diffusion.

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Rethinking National Health Reform

Debates about health reform in the U.S. commonly call for national solutions. Most Americans concede *that* the country's health system needs fundamental change. However, there is little consensus about *how* to achieve the main objectives of better health, better care, lower cost, and greater equity. With attention centered on large-scale legislation, insurance strategies, and the promise of federal leadership, millions of citizens and health professionals alike have come to regard themselves as spectators to a high-stakes national drama unfolding far from their direct influence. Meanwhile, the need to change becomes ever more conspicuous as health care costs rise; medical bankruptcies increase; premature deaths add up; productivity and competitiveness decline; inequity remains entrenched; investments in education, economic development, and other priorities shrink; and scores more symptoms of the ailing health system either intensify or stay stuck at alarming levels (Institute of Medicine, 2002; Commission to Build a Healthier America, 2008).

Health care is delivered almost entirely locally and much of its cost is affected by local decisions, such as investments in new hospital services. Similarly, population health status and the demand for health care is strongly shaped by conditions much closer to home—that is, through the habits, exposures, choices, and services that people encounter routinely in their homes, workplaces, schools, neighborhoods, doctors' offices, and other nearby settings. Useful steps and supportive policies may be enacted at the national level, but the most significant innovations will likely require concerted action in local settings, led by those who are able to work effectively across their differences and strong enough to confront those who stand in the way of necessary change.

When innovators do attempt to transform their local health systems they often face many challenges, beginning with the perception that local actors have little control over the conditions that shape health and health care. Diverse, often conflicting interests among stakeholders may be a barrier to systemic change. And even when stakeholders come to the table to engage in good faith, there is usually a narrow focus on fine-tuning care delivery and financing, with less attention to the wider determinants of health and sources of vulnerability. There is also an absence of frameworks for evaluating alternative interventions in context. Interventions chosen may reflect what is popular at the time without regard to their likely net impact on health status, cost, equity or other objectives. Many planners are looking for better ways to anticipate how different strategies may play out in their system as a whole; and without that ability, they often discover after the fact that their initiatives either lacked necessary resources or conflicted with one another, inadvertently undermining the potential for long-term progress.

National Purpose, Local Action

Despite these challenges, more and more concerned leaders in cities, towns, and regions across the country are beginning to rethink their local health system and experiment with new ways to achieve profoundly better results across the board. Such ambitious and widely dispersed ventures, however, are hard to plan, unwieldy to manage, and slow to spread. Through the Rippel Foundation's *ReThink Health* initiative, veteran leaders and creative methodologists are learning what it takes to spark and sustain system-wide improvements in different settings (Fannie E. Rippel Foundation, 2012). The initiative emphasizes three mutually-supportive spheres of innovation:

- **Stewardship**, which recognizes that health and health care are common resources that can be safeguarded through collective ownership, prioritization, norm-setting, and long-term governance (Ostrom, 1990; McGinnis, 2011; Teisberg, 2009);
- **Organizing**, which elicits shared values among diverse stakeholders and builds their power for concerted action (Ganz, 2010a, 2010b); and
- **Dynamics**, which uses simulation modeling and game-based learning to develop sharper foresight in understanding how the health system tends to change or resist change over time, as well as greater strength to pursue high-leverage policies (Homer and Hirsch, 2006; Sterman, 2006; Milstein, 2008).

The remainder of this paper summarizes progress to date in creating a suite of simulation models within the ReThink Health initiative.

ReThink Health Dynamics

Important health innovations often begin with a “*What if...*” question. However, the full implications of such questions are rarely explored because innovators typically cannot think through the complexities of the health system with their unaided minds. The *ReThink Health Dynamics* program helps by employing simulation modeling and game-based learning, two established techniques for planning in complex situations. These tools, despite their many limitations and uncertainties, can bring more structure, evidence, and creativity to the challenge of asking and answering “*What if...*” questions.

This project builds upon decades of prior dynamic analyses of health policy. Some of the most relevant early models date back to the 1990s, such as the project on “*Mastering the Transition to Capitation*” for the Healthcare Forum (Hirsch and Kemeny, 1994) and the “*Healthcare Microworld: Creating Integrated Care and Healthier Communities*” for the New England Healthcare Assembly (Hirsch and Immediato, 1998, 1999; Innovation Associates, 1997). In the past decade, the “*Prevention Impacts Simulation Model (PRISM)*” has helped reveal strategies to address a massively entangled constellation of chronic diseases (including heart disease, diabetes, obesity, and dozens more) and it has since been calibrated to represent nearly 70 different regions (Homer et al, 2008, 2010). Other models have helped guide local planning of cardiovascular disease programs (Hirsch et al, 2010). In addition, SD models have also been developed in the last few years to explore pathways for national health reform. For instance, the “*HealthBound*” model and game was developed by the CDC to help people think more broadly about health reform options and to allow them to discover, for themselves, how to devise a promising way forward (Milstein et al, 2009, 2010, 2011; Homer, Hirsch, Milstein, 2007).

Drawing inspiration and building on the technical achievements from these pioneering projects, the ReThink Health project sought to combine the most essential structures and empirical information into a new model, rendered at a local level, where they may better reach innovators positioned to lead transformative change.

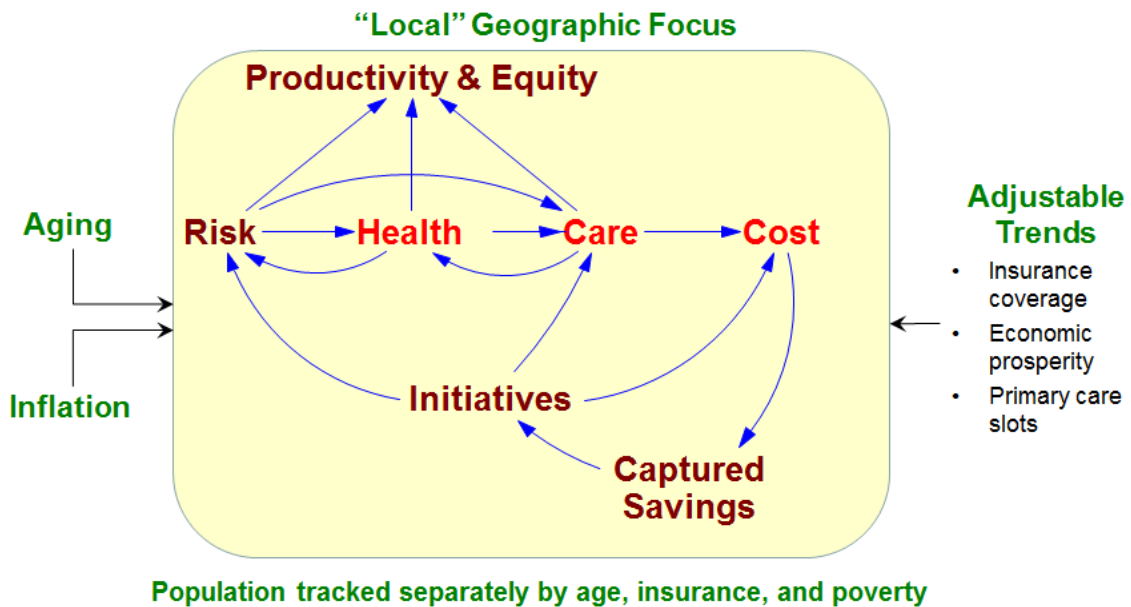
Representing Local Health System Change

The ReThink Health model is a realistic, yet simplified, representation of a local health system over time. With a distinctive place-based and wide-angle view, this model tracks changes in population health, health care delivery, health equity, worker productivity, and health care costs under a variety of conditions—all within a single, testable analytic framework that is tied to many sources of empirical data (ReThink Health Dynamics, 2012).

The main purpose of this tool is to estimate the likely health and economic consequences over time for dozens of interventions that may be enacted at a local or regional level. Simulated scenarios featuring one or more of these broad, strategic interventions may be studied as a prelude to action in the real world. By first simulating alternative actions, stakeholders may expose schemes that have significant downsides, and also build support for strategies with the greatest potential to improve health system performance.

Figure 1 shows an overview of the model’s main elements. The focus is on changes in health, care, and cost over time. To do that, the model represents several essential features of the population in a particular geographic area such as its age distribution, fractions that are economically advantaged and disadvantaged, and fractions insured and uninsured. Two critical forcing trends, population aging and health care price inflation, are considered along with several others that users may adjust to test a range of future scenarios, such as the implications of local economic decline. The model also tracks worker productivity as well as equity between advantaged and disadvantaged groups in terms of comparative burden of illness and deaths and access to care.

Figure 1: Overview of Model Elements



Internally, the model accounts for changing levels of risk or vulnerability stemming from unhealthy behaviors, crime, and environmental hazards, as well as poverty and lack of insurance. Together, those drivers affect health status over time, including the prevalence

of physical illness (mild and severe), mental illness (controlled and uncontrolled) as well as acute episodes (urgent and non-urgent), and deaths.

Health status and illness prevalence, in turn, determine both the demand and cost for health care in different locations (i.e., routine and acute office visits, outpatient procedures and tests, hospital emergency room and inpatient stays, as well as post-acute/extended care in skilled nursing facilities, at home, and in hospice). The volume and nature of care delivered also feed back to affect health status, for example, by slowing the progression of chronic illness from mild to severe forms.

Finally, the model estimates the program cost for each simulated initiative over time. If those interventions do succeed in saving health care costs (relative to benchmarks set for particular segments of the population), then users may choose to capture and reinvest those savings in an effort to sustain necessary initiatives over time.

Geographic Focus

When modeling a local health system, an immediate challenge is to find the right geographic focus. This is rarely an easy decision because most salient risks, needs, and resources vary widely from place to place. Also, there may be significant migration when accessing health care services into and out of a particular region. Still other considerations focus on data availability, which tends to be increasingly difficult at smaller scales.

Our goal within the ReThink Health modeling project is to help local leaders understand what may be necessary to get the most impact from their investments and avoid situations where, over time, their efforts are undermined by events occurring outside of their traditional sphere of influence. After reviewing local data and considering where policy insights are likely to be most influential, users typically focus either on a contiguous set of zip codes, a county, a Health Service Area, or a Health Referral Region.

Population Groups

The model divides the population into ten groups, each with a relatively distinct profile of health status and health care utilization. These particular groupings also correspond closely to particular insurance categories (Table 1).

Table 1: Population Sub Groups

<i>Population Subgroup</i>	<i>Principal Insurance Type</i>
Youth (ages 0-17)	
• <i>Advantaged, Insured</i>	<i>Commercial coverage</i>
• <i>Advantaged, Uninsured</i>	<i>Mostly self-paid</i>
• <i>Disadvantaged, Insured</i>	<i>Medicaid</i>
• <i>Disadvantaged, Uninsured</i>	<i>Mostly uncompensated</i>

Population Subgroup	Principal Insurance Type
Working Age (ages 18-64)	
• <i>Advantaged, Insured</i>	<i>Commercial coverage</i>
• <i>Advantaged, Uninsured</i>	<i>Mostly self-paid</i>
• <i>Disadvantaged, Insured</i>	<i>Medicaid</i>
• <i>Disadvantaged, Uninsured</i>	<i>Mostly uncompensated</i>
Senior (ages 65+)	
• <i>Advantaged</i>	<i>Medicare</i>
• <i>Disadvantaged</i>	<i>Dual Medicare + Medicaid</i>

The dividing line between advantaged and disadvantaged is set at 200% of the US federal poverty level. People in the lower income groups tend to have higher prevalence of health risks and chronic illness. Insurance or the lack of it affects health care utilization. The 65+ population is not divided by insurance status because almost everyone in the U.S. over 65 is covered by the Medicare insurance program.























These groups differ significantly in their characteristics. Physical illness occurs with higher prevalence among those who are older, disadvantaged, and/or uninsured. Unhealthy behavior is more prevalent among the disadvantaged and slightly more common among the uninsured. The disadvantaged use the ER more often and those who are both uninsured and disadvantaged use it most frequently, in part because they have the lowest sufficiency of primary care providers. People who are advantaged and insured visit specialists and receive tests and procedures more often. Seniors have the highest rates of acute episodes for a given level of physical illness.

Initiative Options

The model represents more than a dozen distinct initiatives. Each one may be simulated individually or in combinations to study the likely consequences over time from 2000-2040 on many metrics of health, care, cost, productivity, equity, spending, and savings. Table 2 summarizes the current menu of options.

Initiatives in the first column reduce health risks faced by the population including those arising from risky behaviors (such as smoking or physical inactivity), environmental hazards (such as air pollution or workplace injuries), and crime (including incidents that require hospitalization as well as those that inhibit physical activity). Another strategy, called Pathways to Advantage, helps reduce the detrimental effects of poverty by helping disadvantaged people move up and by preventing those who are advantaged from slipping into poverty.

Table 2: Initiative Options

Risk	Health	Care	Cost
 Enable healthier behaviors  Reduce environ hazards  Reduce crime  Create pathways to advantage	(affected by Risk & Care)	 Better routine care  Control mental illness  Support adherence  Increase PCP efficiency  Reduce hospital-acquired infections  Recruit PCPs (private)  Recruit PCPs (safety net)	 Coordinate care  Create PCP medical homes  Better post-discharge care  More hospice use  Increase hospital efficiency
Initiative Funding			
 Establish an innovation fund (size and duration)	 Capture and reinvest savings (negotiate with payers)	 Share captured savings with providers*	
Background Trends			
 Expand insurance by Federal mandate; Net loss of insurance coverage	 Economic trends affecting poverty	 Primary care slots	

Better health care can be delivered in many ways, as shown in the middle column. These include efforts to improve care for chronic physical illness, control mental illness, support patient adherence for routine care, reduce hospital acquired infections, improve efficiency of primary care, and recruit primary care providers for private and/or safety settings.

A final group of initiatives, in the right-hand column, may directly reduce costs. These include strategies to coordinate care in ways that reduce duplication and unnecessary procedures, establish medical homes where a greater range of needs are met in primary care practices, improve post-discharge care for patients who have been hospitalized, expand use of hospice for patients nearing the end of life, and boost hospital efficiency. Additional options let planners direct certain initiatives only to the disadvantaged or to safety net facilities, as a way of concentrating limited resources among those who have the most to gain.

Financing Initiatives

There are two options for funding the selected initiatives. First is to designate a specific innovation fund that can launch a new set of interventions. This initial investment could come through in-kind contributions, new funds, or redirected resources. Users can set the size and duration of the innovation fund to any level that they wish. By default, the initial values correspond to 1% of total health care costs for just 5 years.

The second mechanism to pay for new initiatives is through capturing savings that may accrue over time because of those initiatives themselves. At each time step, the model calculates savings against benchmarks, which users may set for each segment of the population (i.e., separately for Medicare, Medicaid, or Commercial insurers). Some fraction of those savings may then be reinvested to sustain the selected initiatives over

time. Furthermore, a portion of those savings may also be shared with local providers to acknowledge their critical role in lowering health care costs.

These mechanisms for calculating and allocating savings are analogous to the Accountable Care Organizations (ACOs) that are now being piloted across the U.S. (Centers for Medicare and Medicaid Services, 2012; Fisher, 2011). Such organizations have both the incentives and ability to invest in ways that improve the value of care rather than just its volume. They also offer a conduit for sharing savings with those who are in a position to make the best use of reinvested funds, including health care providers as well as allies working further upstream. Our next iteration of the model will also represent shifting payment schemes from conventional fee-for-service to a per capita basis (e.g., as with global contingent payments).

With these flexible financing features, the ReThink Health model may be useful to ACO planners who want to simulate a variety of scenarios and evaluate options based on system-wide performance. This sort of analysis may reveal strategies with great promise, and in turn, spark new questions about how particular institutions may be affected in the short term (such as an insurer, a hospital, a provider group, or an employer). The ReThink Health model reports quarterly financial impacts in some specificity, with 5 categories of payer expenditures, 8 categories of provider revenues, 11 measures of system-wide spending and savings, as well as summary measures of workforce productivity and health care costs for workers. More detailed considerations involving fine-grained economic analyses for each entity in a local health market, for example, may then be addressed by complementary models such as the “US Health Care in Transition” tool, which is currently used for executive education at the Wharton School of Business as well as in custom projects with financial officers of various institutions (Simulation Associates, 2012).

Integrated Causal Framework

Figure 2 summarizes what is in fact a very intricate causal structure for tracking health system dynamics over time. Interventions are shown in green and outcome measures in red. Intermediate variables in brown connect interventions and outcome measures. Improvements in routine care and adherence of patients to chronic illness regimens, for example, affect the frequency with which chronically ill patients have acute episodes and, in turn, mortality rates and health care costs resulting from expensive hospital treatment. Other interventions such as PCP recruiting and redesign of practices for efficiency can increase the adequacy of primary care capacity. Without adequate capacity, more people go to the ER and costs of care are higher. Increased use of hospice and improved post discharge care will affect the cost per episode and health care costs overall.

shown to be well correlated with particular illnesses and predictive of health care utilization. Some of the most common data sources are summarized in Table 3.

Table 3: Primary Information Sources

Primary Information Sources for ReThink Health Modeling
<p>Local, State, and Regional Data</p> <ul style="list-style-type: none"> • Local/regional/state surveys • Local/regional/state research reports • Administrative data • Ad hoc information gathering
<p>Local Adjustments from National Sources</p> <ul style="list-style-type: none"> • US Census and Its American Communities Survey • Vital Statistics • National Health Expenditure Accounts • Consumer Price Indices (Bureau of Labor Statistics) • National Health Interview Survey (NHIS) • National Health and Nutrition Examination Survey (NHANES) • Behavioral Risk Factor Surveillance System (BRFSS) • National Ambulatory Medical Care Survey (NAMCS) • National Hospital Ambulatory Medical Care Survey (NHAMCS) • National Nursing Home Survey (NNHS) • National Home Health Care Survey (NHHCS) • National Survey of Children’s Health • Medical Expenditure Panel Survey (MEPS) • Smoking-Attributable Mortality, Morbidity, and Economic Costs (SAMMEC) • Dartmouth Atlas of Health Care
<p>Prior Integrative Studies of Health System Dynamics</p> <ul style="list-style-type: none"> • HealthBound Model and Game (representing U.S. health system dynamics; see Milstein, Homer, Hirsch 2010; Milstein, Homer, Briss, et.al. 2011; Homer, Hirsch, Milstein 2007) • Chronic Illness in a Complex Health Economy (representing inflationary trends and self-sustaining tendencies of the health care industry; see Homer, Hirsch, and Milstein, 2007) • Prevention Impacts Simulation Model (PRISM) (representing multiple chronic diseases, risks, and interventions; see Homer, Milstein, et.al. 2008, 2010; Hirsch, Homer, et.al. 2010)

Baseline Scenario

The baseline scenario draws upon all input data to yield a cohesive description of the health and health care landscape in the specified location as it changes over time. This baseline is not intended to be an exact numerical forecast. Instead, it provides a plausible and straightforward reference to use when comparing the results of simulated scenarios. It assumes that most contextual conditions remain constant at their 2010 values, although it allows for expected growth and aging of the population, continued health care price inflation, and increasing non-reimbursement of hospital-acquired infections.

All future trends in the baseline scenario arise from these assumptions as they ripple through the model’s causal connections, which link risk to disease/injury to health care utilization to provider income and health care costs, and more. This baseline scenario serves as a clear starting point for comparing the effects of simulated interventions.

Online User Interface

We made an early commitment to put the model in the hands of local leaders rather than position model builders as the gatekeepers for interpreting insights from this tool. This commitment reflects the idea that models can only be truly useful if they help people develop better intuition about the systems in which they work. Local health dynamics are marked by time delays, nonlinear relationships, feedback processes, and other features that make it difficult to anticipate the full range of effects from any intervention. Without better intuition about how these systems work, it is easy to misperceive the causes of problems and adopt solutions that are ineffective or worsen the problem. Sterman and others advocate using “virtual worlds,” principally simulations, to gain better understanding (Sterman, 2006). Virtual worlds offer advantages of time compression, immediate feedback, and transparency that enable users to experiment with alternative scenarios and learn rapidly by trying many interventions in a risk-free environment. Turning the model into such a virtual world required an Internet-based interface that would allow users to craft scenarios of their own design and examine the likely results in some depth, drilling down to understand why things happen in a simulation rather than having a black box that produces a few summary statistics out of context.

Figures 3 and 4 illustrate typical input screens for creating a new scenario and deciding how to fund it. Sliders move along scales of 0 to 100, allowing users to specify the relative reach, intensity, and cost of each initiative. Check boxes enable users to focus certain interventions selectively, for example, by concentrating mental health services among the disadvantaged population or redesigning primary care specifically for safety net clinics. Planners may also specify start times for each intervention, allowing them to test particular sequences or layered strategies over time.

Figure 3: Screen to Create New Scenarios

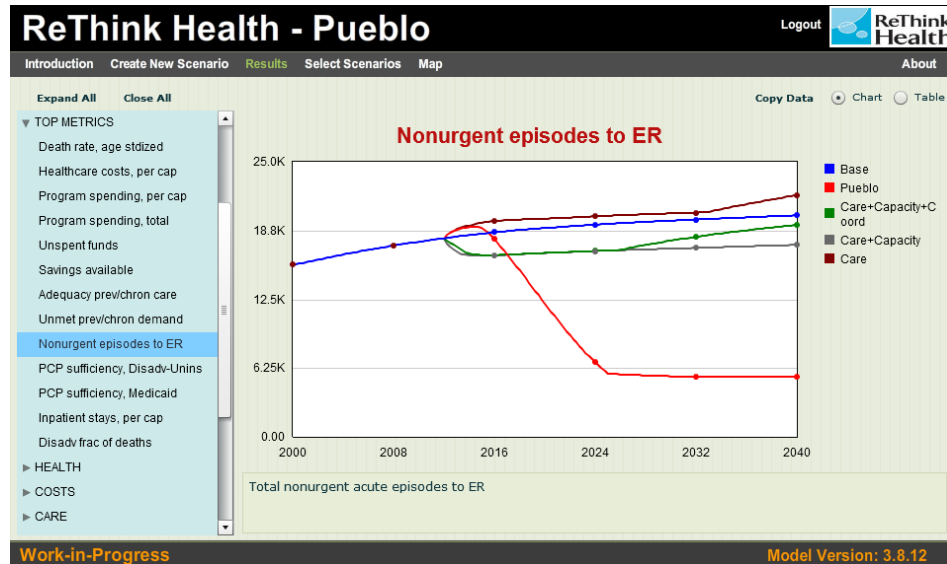


As shown in Figure 4, users can configure an innovation fund that feels realistic by setting its annual amount and duration. A checkbox indicates whether a fraction of savings produced by interventions will be reinvested to support the selected initiatives; and three more sliders specify what that fraction will be from the revenue streams of each major insurance type. Prospect of capturing and reinvesting savings is a new concept for most stakeholders, but an important one for exploring whether an intervention plan is practical, scalable, and sustainable.

A final set of sliders lets users designate a percentage of savings that can be redirected to physicians and hospitals as incentives for cooperating with initiatives that may lower their own income from patients. In the absence of shared savings, as utilization and net incomes decline, providers tend to respond by generating new sources of revenue. Because this “supply push” response (Wennberg, 2010) is explicitly reflected in the model, users may consider how it may be operating in their own system and discuss the extent to which it may be undermining their collective goals for cost reduction.

Figure 4: Screen to Configure Initiative Financing

The online interface also enables users to see the results of simulated scenarios (Figure 5) across a large number of variables that may be viewed either in charts or tables. Those results are arranged hierarchically by topic, enabling users to drill down and understand how things are changing across the system in some detail. Users also have the ability to compare up to six scenarios simultaneously to see how the overall pattern of consequences plays out differently under different conditions.

Figure 5: Screen to Explore Results and Compare Selected Scenarios

Early Experiences in Pilot Sites

Over the past year, the ReThink Health model has been demonstrated repeatedly and well-received by diverse practitioners, subject matter experts, policy analysts, and philanthropists—many hundreds in all. There appears to be a strong consensus that this tool is a unique and useful representation of local health system dynamics. As a result, it is being considered for use by a variety of innovators, such as architects of community-oriented accountable care organizations (ACOs), local coalitions preparing for regional health initiatives, and planners thinking about how community health assessments, now required for all non-profit hospitals in the U.S., will affect decisions about intervention strategy and resource allocation.

Beyond offering greater foresight, this model also motivates action by letting leaders see and feel what high-leverage innovation could accomplish in their particular setting. Diverse teams in several cities have begun to configure the ReThink Health model to reflect their circumstances. Also, a widening circle of innovators is now using this tool to question how their local health system is structured, how it may change or resist change, and what they could do—alone and together—to achieve better results.

The project has secured formal commitments from five regional teams, and each site continues to make substantial progress.

Pueblo, CO: A locally-calibrated model is now being used in Pueblo as part of their formal regional Triple Aim planning process. Beginning in the fall of 2011, dozens of scenarios were analyzed using the ReThink Health model and the most attractive ones were reviewed by senior leaders from regional health and health care agencies. The greatest enthusiasm centered on a package of interventions featuring Care Coordination, Post-Discharge Planning, Healthier Behaviors, Pathways to Advantage, Better Preventive/Chronic Care, Better Support for Adherence, Recruitment of Safety Net PCPs, and Sharing Cost Savings with Providers. In addition, most stakeholders expressed a strong commitment to remain engaged and help define precisely what it would take to significantly influence Triple Aim outcomes for the population as a whole. An initial

strategic plan was drafted, based in part on insights from their modeling. That document outlines the goals, organizational structure, shared data system, financing requirements, and stewardship plan for a sustained and effective Triple Aim initiative. Next, the draft plan will be reviewed and improved through exchanges with local leaders and area residents, eventually pressing toward the implementation of a dedicated portfolio of initiatives and metrics for tracking progress over time.

Manchester, NH: A locally-calibrated model is now being used by members of the Manchester Sustainable Access Project (MSAP) as part of their efforts to strengthen the local health care safety net. During a three-hour retreat last November, senior organizational leaders explored a suite of simulated scenarios, which identified several possible structures for community-level investment and distribution of cost savings. The group also began to see how other stakeholders, such as employers, elected officials, insurers, and citizens at large, might be needed to advance this work. Next, the group plans to engage with the larger Healthy Manchester Leadership Council in using the model to assess and prioritize responses to community health needs. An experienced organizational development coach (Sherry Immediato) has been advising the MSAP staff about how they might use the model and its surrounding processes to pursue their larger objectives for health system improvement.

Contra Costa County, CA: Founding members of the Contra Costa Regional Triple Aim committee convened several times in the summer and fall of 2011 to consider whether and how the RTH model might advance their work. They decided to proceed with local modeling and identified 10 zip codes in West Contra Costa as the area that they most want to study with a policy simulation tool. Data gathering commenced in December and is now largely completed, following an initial review of their baseline scenario. The group is also conducting an inventory to identify ongoing initiatives that may affect health, care, and cost in the region. A crosswalk is being developed to examine connections (and gaps) between those system-change initiatives and the model's menu of intervention options. In addition, several teams of colleagues from Contra Costa Health Services, Kaiser Permanente, and Healthy Richmond participated in a 14-week distance learning course on *Organizing for Health*, offered by sister branch of the ReThink Health initiative (Fannie E. Rippel Foundation, 2012).

Alameda County, CA: Leaders representing approximately 10 organizations in Alameda County convened several times last summer and fall, albeit in slightly different configurations each time, to consider whether and how the ReThink Health model might advance their work. They decided to proceed with local modeling and identified the entire county jurisdiction as the area that they most want to study with a policy simulation tool. That decision followed the strong advice from several agency leaders, particularly the Alameda Health Consortium and the Alameda Alliance for Health, to align this tool as closely as possible with other county-wide policy and resource planning activities. Data gathering commenced in December and a fully calibrated model was completed in March.

One of the first uses occurred in April, when the county's medical officer (Dr. Muntu Davis) was called upon to discuss the value of prevention in a hearing convened by the County Board of Supervisors. Despite having limited time (7 minutes), he chose to highlight insights from their new ReThink Health model. Not only did this convey useful

information about the topic of the day (the health and economic effects of prevention), it also demonstrated the value of having a broad, integrative tool for thinking about how any major investment might play out over time. By all accounts, the Supervisors saw great value in this sort of pragmatic policy analysis and have since devoted a longer block of time on their August agenda to consider a wider range of scenarios from the ReThink Health Alameda model. This offers a unique opportunity to shift the public conversation from a typically disjointed view of particular topics toward a consistent, structural study of alternative policies and opportunities to transform the health system as a whole.

Whatcom County, WA: A team of approximately 20 local leaders was formed to engage with this project. Together they bring a remarkable range of experience and influence, with representation from area hospitals, health care access organizations, community clinics, family care centers, mental health agencies, the health department, economic development groups, educators, clergy, and the county Sherriff. The site coordinator, Marc Pierson, has experience leading effective group modeling projects and sees this effort as an opportunity to deepen their local capacity to use this methodology, in conjunction with others, more effectively. Two PhD modelers in the area will be trained as part of this work. They quickly understood the data needs for this project and were able to deliver, largely autonomously, the information that is required to configure a model for Whatcom County.

A general blueprint for health reform in Whatcom has been articulated, centering on the idea of an “Accountable Care Community” (Whatcom Alliance for Healthcare Access, 2011). They regard this community-wide emphasis as an important extension beyond the conventional limits of an accountable care organization. Equipped with the ReThink Health model, Whatcom leaders believe that they will be positioned to reinforce that population perspective and also sharpen their focus on enacting a package of high-leverage interventions.

Initial Insights

The model is still in its early stages of development, but those who have used it have already learned some important lessons. The model illustrates some of the main pitfalls or “failure modes” that tend to disappoint or derail regional change ventures. Naturally, it is also used to examine promising strategies, but significant benefits stem from developing a clearer consensus—based on veteran experience, research, and dynamic analyses—about how to anticipate common problems and position nascent initiatives to pursue higher-leverage strategies.

Some of the main failure modes are ones that participants can discover for themselves using the ReThink Health model. These include

- Unsustainable program financing (i.e., attempting too much without adequate funding);
- Exacerbating bottlenecks (i.e., especially those affecting primary care);
- Supply push responses from providers and hospitals that undercut health care cost savings (i.e., expanding breadth of services to compensate for drops in utilization and income);

- Far-sighted actions that have long delays before changing key performance metrics (e.g., behavioral, environmental, and social policies);
- Comparing alternative strategies using only a short time horizon (i.e., thereby drawing biased conclusions about the relative cost-effectiveness of different interventions); and
- Improving health, care, or cost while perpetuating or exacerbating inequities.

All of these phenomena, and more, can be traced to the dynamically complex structure of a local health system. In addition, when equipped with explicit model-based scenarios, planners may better address other shortcomings that tend to plague multi-stakeholder endeavors such those stemming from poor stewardship, disorganization, and dysfunctional teams.

An example of how regional change initiatives sometimes produce unintended consequences can be seen from what happens when a one tries to implement programs without regard for their systemic impacts. The following illustration highlights insights from a model configured for Pueblo, Colorado. These results may vary in different locations because of their different conditions.

Two simultaneous interventions are undertaken in this example, both beginning in 2012: (1) greater efforts are made to assure that providers adhere to routine guidelines for preventive and chronic care; and (2) medical homes are created to assure that more care occurs in visits to primary care providers (PCPs). Both of these initiatives are recommended as promising approaches to deliver better care at lower cost. The landmark publication, *Crossing the Quality Chasm*, emphasizes adherence to guidelines as a prerequisite for quality care (Institute of Medicine, 2001); and the medical home concept is endorsed by major physician groups (American College of Physicians, 2012).

One might expect these interventions to produce lower overall costs by reducing the frequency of acute episodes (due to better routine care) and by concentrating more care with less expensive PCPs (medical home) vs. specialists or hospitals. However, as shown in Figure 6, the per capita cost of care in this scenario (red line) is actually higher than the baseline (blue line) where no interventions occur (6% higher by the end of the simulations in 2040). Why does this happen?

Adhering more consistently to guidelines places a greater demand on PCP's time; and the establishment of medical homes similarly intensifies demand for their services. Before these new initiatives were enacted, all subgroups of the population had a sufficient supply of PCPs to meet their demands, with the one exception being those who are disadvantaged and uninsured, where the sufficiency of PCPs was only 63%. However, after these two PCP-intensive initiatives are put in place, that situation changes dramatically. Within a just a few years, all subgroups experience sharp drops in their sufficiency of PCPs. This failure to fully accommodate the demand for primary care has consequences that lead to higher cost, principally because many of those who cannot get care at a PCP office for nonurgent episodes will go to ERs and receive care at much greater expense. Indeed, as Figure 7 shows, by the end of the simulation, the number of nonurgent episodes seen in the ER rose by over 270%.

Figure 6: Healthcare Costs per Capita in a Scenario with Better Routine Care and Medical Home (Red Line) vs. Baseline (Blue Line)

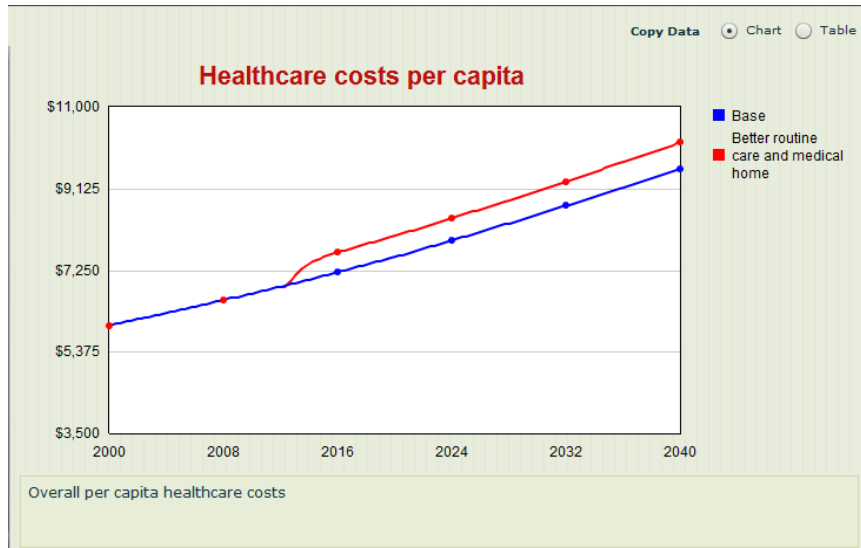
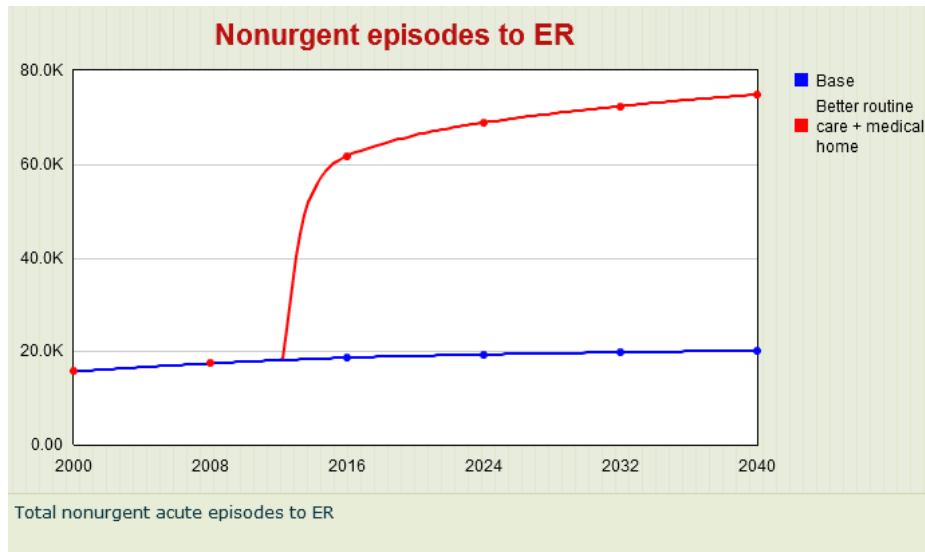


Figure 7: Nonurgent Episodes to the Emergency Room in a Scenario with Better Routine Care and Medical Home (Red Line) vs. Baseline (Blue Line)



This scenario shows how interventions that appear to offer direct benefits can end up having adverse consequences if implemented in isolation and without regard to the local capacity to meet the demand for care (which itself may vary considerably in different regions). Adherence to care guidelines and medical homes are not inherently bad strategies. They do, however, depend on having adequate resources in the surrounding health system. The ReThink Health model tracks these resource requirements and alerts planners to the need for thinking about other steps that might be needed to implement successfully initiatives like the two highlighted here.

Fortunately, leaders have begun to appreciate the importance of combining complementary interventions and assuring appropriate program financing. They have found that there are no single solutions and that efforts to push any one strategy as hard as possible will not yield the full pattern of desired results over time. It takes a well-crafted set of interventions—and the capacity to sustain them over time—to move the system in a significantly new direction. Wisely reinvesting health care cost savings is often a central component in the most compelling scenarios. This realization, in turn, may better equip citizen leaders to engage with payers and negotiate profit-sharing arrangements that channel badly needed resources to the most effective change agents.

Scientific Critique

Guided by the standards of modeling practice (Sternman, 2000), we are taking multiple approaches to critique the scientific integrity of this tool. It is important to appreciate that although the ReThink Health model is new, it builds on previously well-established system analyses, now extended to represent stakeholder interests and intervention opportunities at a local level. Still, we continually strive to determine how trustworthy the model is for its stated purposes (i.e., to support a place based and wide angle approach to health reform strategy). Some of the questions guiding our iterative modeling process focus on

- *Policy Scope & Metrics*: How useful are the intervention inputs as well as the health and economic outputs? This involves a close consideration of the stakeholder perspectives, population sub-groups, health states, and causal structures represented in the model.
- *Dynamic Behavior*: How well does the model capture real-world dynamics, particularly in its responses to intervention scenarios over time?
- *Credibility*: How credible are the conclusions that users may draw from this tool, particularly regarding the relative direction, timing, and magnitude of intervention effects?

In its current stage of development, the most pertinent tests that we have conducted address structural sensitivity (i.e., comparing results under different boundary assumptions) and behavioral realism (i.e., confirming that there are convincing reasons for all patterns of results). Many other tests, such as historical reproduction, have also been conducted. Indeed, a routine step before beginning scenario testing with each new calibration of this model involved examining scores of baseline metrics to assure that they are all internally consistent, within plausible ranges, and fit closely to any available historical data points and time series.

In addition to our own testing and iterative development, we have also invited critiques from external colleagues. The first formal scientific review of the ReThink Health model was held at the Dartmouth Center for Health Care Delivery Science in September 2011, just weeks after the model was first calibrated. Chaired by Elliott Fisher, this preliminary review sought to assess how well-suited the model is for its goals and to respond to any significant shortcomings. The participants included a diverse mix of health system scholars, economists, engineers, policy analysts, organizational researchers, philanthropists, game designers, and more. Despite their varying backgrounds, the group

was remarkably engaged and quickly able to see the value of the model. Those advisors strongly supported the project's direction and technical achievements. Their suggestions to delve deeper into supply-push dynamics prompted us to examine historical data on physician responses to past reimbursement cuts and those findings are now reflected in the current model.

A second advisory session was then held about three months later. That meeting focused specifically on reviewing selected economic results, metrics of interest to employers, as well as assumptions about price inflation. Additional input has come through demonstrations sponsored by the Institute for Healthcare Improvement and other organizational allies.

Finally, yet most importantly, we place great value in the experiences of our local collaborators. Their close examination of this tool, in each of five pilot sites, has helped to assure that the model is both an accurate representation of their current circumstances and a robust tool for thinking about plausible futures.

Formative Evaluation

The benefits of strategic modeling lie in its ability to bring greater structure, evidence, and creativity to public judgments and long-term action. Success for the ReThink Health Dynamics project, during this initial phase, was firstly a matter of feasibility. In other words, the project had to engage several teams of local stakeholders and work with each of them to design and configure a model so that it reflects the circumstances in their region. These local models then had to demonstrate their value by offering a shared, neutral framework for diverse stakeholders to use when considering innovations in their local health system.

We engaged a team of highly qualified evaluators to help capture and reflect on experiences during this pilot phase. Together, our primary focus has been on learning how this type of modeling may enhance ongoing efforts to transform local health system dynamics, as well as to characterize the conditions under which that happens (Pawson, 1997). A draft framework for formative evaluation was proposed and refined with input from principal stakeholders.

The evaluation team has been gathering information from many sources in all five pilot sites (i.e., direct participant-observation, document review, and key participant interviews). Their data management and analysis framework is anchored in the literature on group modeling and guided by a three-part domain framework, shown in Figure 8, emphasizing local context, engagements, and consequences over time (Huz et al, 1997; Rouwette et al, 2002; Berard, 2010). Furthermore, a dynamic understanding of the stages and processes involved in generating foresight and building strength through scenario planning is being used to understand the precursors for high-leverage action. We are also learning about readiness and the optimal timing for different types of methodological support.

Preliminary findings have emphasized the following insights.

- A collaborative with broad organizational diversity, members with formal and informal authority, a history of strong collaboration, and an inquisitive system perspective will be most likely to use the ReThink Health model effectively and efficiently. Tailored support may be needed to develop such a collaborative.
- At least four distinct leadership capacities are needed in each community to work effectively with this tool: convening/coordinating stakeholders; gathering data; owning the model; and championing change. Resources will be needed to support these capacities.
- Local collaboratives will be at different places with regard to their need, maturity, and context as they engage with the model. Tailored support will be needed to address both the adaptive and technical challenges of using the model.

Figure 8: Domains for Formative Evaluation

Context	Engagement	Effects/Consequences
Community Collaborative <ul style="list-style-type: none"> • Composition and size – decided how? • Heterogeneity • Affiliation • Culture (i.e., conflict, learning, collective action) • Formality • Leadership (including role of coordinator) • Geography • Resources 	Pre-project Activities <ul style="list-style-type: none"> • Who initiated contact • Initial reactions and deliberations • Motivation for initiating the intervention • Initial expectations and goals (implementation of results, etc.) • Modeling/facilitation team and relative roles 	Individual <ul style="list-style-type: none"> • Reaction to the model – value added, ownership, trust • Learning and Insights – broader perspective of the system in which they work, understanding of the problem, trade-offs, consequences of inaction, leverage points (high-low) • Commitment to implement the results of the model • Changed behavior
History of Collaborative <ul style="list-style-type: none"> • Time together • Evolution of partnerships • Other projects and accomplishments 	Model <ul style="list-style-type: none"> • Process for developing • Sources of information • Process for eliciting knowledge • Size and Dynamic complexity • Level of Community Engagement in Model development (model development v. customization/calibration) • Role of modelers 	Group <ul style="list-style-type: none"> • Exchange of viewpoints; focus constructive conversation • Alignment • Shared language • Engagement of key stakeholders • Capacity for collective stewardship
Health System <ul style="list-style-type: none"> • Provider viability • Local ACA activity (including ACOs) • System integration and financing 		
History with Rippel <ul style="list-style-type: none"> • Other RTH interventions 	Facilitation/Support <ul style="list-style-type: none"> • Self-directed v/s facilitated • Extent of support (modeling assistance v. continued follow-up facilitation, guidance, and interpretation) • Meetings – content, process, scripts • Time investment <ul style="list-style-type: none"> ◦ Modelers ◦ Facilitator ◦ Community Participants • Time span of intervention • Facilitator role and participant perceptions (i.e., neutrality, credibility) • Follow-up activities 	Organization/System <ul style="list-style-type: none"> • Actions taken change the system • Results of system changes • Effective uses for simulated scenarios (align resources, create partnership, advance policy, a deal, a program, a contract)
Problem Identification/Selection (Rouwette, 2002, p.23) <ul style="list-style-type: none"> • Extent to which the stakeholders have information regarding the problem (analytical dimensions) • Stakeholders in dispute regarding problem (social dimensions) • Geographic focus 		Methods <ul style="list-style-type: none"> • Further use (modeling, systems thinking) • Modeling seen as a more efficient means than tackling similar problems with more conventional methods

Development and Diffusion

There are a number of directions in which the ReThink model may evolve. These will be prioritized based on user interest and feasibility. Some possible enhancements are to:

- Represent shifting payment schemes from fee-for-service to per capita payments;
- Focus interventions by age group;
- Disaggregate upstream initiatives by representing implementation options that have different cost-effectiveness profiles such as (1) regulation and taxation; (2) promotion and access; and (3) personal services;
- Address typical externalities such as the impact of health care costs on local employment, employer-provided coverage, medical bankruptcy, the local tax base, and discretionary funds for other social priorities;
- Represent the cost and health impacts of expected health care technology trends, a significant source of price inflation.

Conclusion

The ReThink Health Dynamics model has already begun to shape the aspirations and understanding of innovators seeking to transform the local health systems. Five configurations of the model are available online and diverse colleagues across the country have begun to use these tools to advance their work. Approximately 160 users have generated 1,500 simulated scenarios to date, with the main phase of policy analysis beginning in three sites, and two more engagements just getting under way. The ReThink Health model has proven useful to diverse leaders as they search for more effective ways to produce better health, better care, lower cost, and greater equity. Participating colleagues have developed greater foresight to anticipate likely pitfalls and “failure modes”, while at the same time learning how to combine interventions for better effects. Moreover, those lessons may be more compelling because local leaders will have the model for their own use, calibrated with data representing their region, and can try a number of different alternatives before choosing the one best suited for their circumstances and needs.

Based on experiences with early adopters, the practical utility of this tool is becoming more apparent. The model offers a neutral framework that broadens people’s thinking and helps them move beyond the confines of politics or history. It builds shared understanding and supports productive strategizing, which rarely occurs when individuals cling to a narrow view of the system biased by their own perspectives and interests. The model also stimulates creativity and experimentation, as alternative scenarios that might otherwise have been dismissed can be easily played out and studied for clues about how to make a difference.

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