Economics of Prevention

A Workshop Sponsored by the NIH Health Economics Common Fund Program and the Office of Disease Prevention

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Table of Contents

Acronym Definitions

Acronym	Definition
ACA	Patient Protection and Affordable Care Act
CAC	coronary artery calcium
CDC	Centers for Disease Control and Prevention
CDHP	consumer directed health plan
CMS	Centers for Medicare & Medicaid Services
FDA	Food and Drug Administration
HPV	human papillomavirus
NIH	National Institutes of Health
ODP	Office of Disease Prevention
OECD	Organisation for Economic Co-operation and Development
PROSPER	Promoting School-community-university Partnerships to Enhance Resilience
USPSTF	U.S. Preventive Services Task Force

Executive Summary

On August 27 and 28, 2015, the National Institutes of Health (NIH) Health Economics Common Fund Program and Office of Disease Prevention (ODP) sponsored a workshop on the Economics of Prevention. The goals of the workshop were to showcase research supported by the Health Economics Common Fund Program, discuss the state of the research field, and identify gaps and opportunities to be addressed in future research.

The workshop was organized in four main sessions: (1) use of preventive services, (2) targeting and personalization in prevention, (3) behavioral economics—insights for prevention, and (4) evaluating preventive interventions. Participants included leading researchers in economics and preventive medicine and staff from the NIH and other federal agencies within the U.S. Department of Health and Human Services.

Keynote Address: Prevention, Harm Reduction, and Policy

The keynote address, delivered by Richard Frank, Assistant Secretary for Planning and Evaluation of the U.S. Department of Health and Human Services, distinguished between harm reduction and use reduction prevention policies. Although both approaches aim to minimize the social costs of harmful consumer products or behavior, harm reduction policies seek to reduce the average harm to users, whereas use reduction policies seek to reduce use itself. Examples of harm reduction policies include needle exchange programs, which provide clean needles to intravenous drug users to limit the spread of infectious disease, and e-cigarettes, which might be a less harmful alterative to smoking.

Harm reduction policies are controversial for ideological and evidentiary reasons, and few analyses comprehensively consider the net effects of harm reduction programs. The extent to which harm reduction policies reduce average harms, and whether they increase or decrease rates of use, is unclear. Modeling the outcomes of harm reduction programs is challenging because these programs change incentives for complex social behaviors that are strongly affected by social context. It is likely that the optimal solution for multiple domains might be a combination of harm reduction and use reduction strategies.

Session 1: Use of Preventive Services

A variety of incentive strategies have been suggested to encourage greater use of high-value preventive services. Presenters discussed studies of incentives for increased use of prevention targeting employees, providers, and those in specific types of health plans, as well as reductions in out-of-pocket costs. Overall, the findings indicate that reducing the cost that individuals pay for the services or offering them monetary incentives for participating in prevention programs appears to increase their use modestly. The impacts of increased physician reimbursements and switching from traditional to high-deductible health plans on preventive services utilization are minimal.

Participants discussed the possibility that even a modest cost for preventive services might change consumer perceptions and create barriers to seeking services. Understanding the barriers to preventive services use, in addition to possible incentives, is an important research topic.

Session 2: Targeting and Personalization in Prevention

Risk stratification tools, biomarkers, and other targeted or personalized approaches might help prevent negative health outcomes while minimizing the harms of overtreatment. However, the effectiveness and cost-effectiveness of these approaches is uncertain. This session featured modeling studies that elucidated circumstances under which greater targeting would and would not be cost-effective, a theoretical overview of the relevant economic factors, and of how risk-stratified analyses of clinical trials can lead to different, more nuanced conclusions than traditional approaches.

The cost-effectiveness of targeted prevention strategies is likely context-specific and sensitive to a number of assumptions. Risk stratification, on the other hand, is a general approach that can be applied in many different contexts. Workshop participants identified the incorporation of treatment harms into risk models as an important topic for further study.

Session 3: Behavioral Economics—Insights for Prevention

Behavioral economics, a method of economic analysis that applies psychological insights into human behavior to explain economic decision making, might provide useful insights for prevention. Presentations in this session explored different approaches to promote healthful decisions among clinicians and the public. Evidence suggests that social interventions, such as peer comparisons, are generally more effective than educational interventions in changing behavior. Interventions that make the healthful choice the easy choice are particularly effective. These include improved default options, active choice to require an opt-in/opt-out selection without a default, and providing services in ways that are physically and temporally compatible with individuals' daily routines.

Behavioral interventions can provide inexpensive and scalable means to steer individuals toward desired behaviors; however, the effects of individual interventions are typically modest. A combination of multiple strategies will likely be needed to achieve optimal outcomes. Several additional research questions include the durability, social acceptability, and cost-effectiveness of behavioral interventions.

Session 4: Evaluating Preventive Interventions

Models are useful tools for predicting and evaluating possible outcomes of public health policies. Because achieving public health outcomes and assessing cost-effectiveness require a long timeframe, it is often not feasible for governments to wait for empirical observations before implementing policies. Models can help separate the effects of policies from potential confounding factors, account for heterogeneity in individual characteristics, and provide a variety of outcome measures and cost estimates to satisfy a range of information needs. Nonetheless, models have several inherent limitations. For example, models cannot predict the

future or determine causal relationships. Models rely on accurate data inputs and on humans to make final policy judgments. The results of modeling studies, such as a microsimulation model of the cost-effectiveness of mammography screening in several real and hypothetical scenarios, can inform the development of cost-effective prevention policies and help policy makers anticipate needed modifications as the landscape changes.

The Future of the Economics of Prevention

It is important to identify ways in which prevention policies can be better informed by a strong evidence base. Researchers have begun to identify effective and ineffective approaches, although many evidentiary gaps remain. Sharing models and improving input data, such as by identifying the characteristics and needs of different populations, may lead to methodological improvements that expand the evidence base.

Workshop participants agreed that in the future conducting many small, inexpensive randomized controlled trials and observational studies can help identify promising policies to study in larger contexts. Results of these trials should be interpreted cautiously, and interventions should be scaled up in a stepwise manner to determine their reproducibility in different contexts. Combining multiple promising interventions may further augment desired outcomes.

Workshop Summary

On August 27 and 28, 2015, the National Institutes of Health (NIH) Health Economics Common Fund Program and Office of Disease Prevention (ODP) sponsored a workshop on the Economics of Prevention. The goals of the workshop were to showcase research supported by the Health Economics Common Fund Program, discuss the state of the research field, and identify gaps and opportunities to be addressed in future research.

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Richard Hodes, co-chair of the Health Economics Working Group and Director of the National Institute on Aging, welcomed participants and emphasized the importance of determining effective strategies to prevent adverse health outcomes. Doing so will require research across many domains, including individual behavior, analysis of systems, and implementation science. Understanding the interaction between prevention and personalization—a present area of focus for the NIH—is also of interest.

Opening Remarks

David Murray, Director, Office of Disease Prevention

Preventing human disease is a component of the NIH mission. Similarly, several areas of health economics research are consistent with and will help further the NIH mission to enhance health, lengthen life, and reduce illness and disability. Salient questions regarding the economics of prevention include:

- What are the costs and benefits of preventive interventions?
- What are the best methods to evaluate costs and benefits?
- What role do incentives play in health behaviors and decision making?
- How do economic analyses influence health care policies?
- How does insurance affect health care service utilization?
- What can economic models tell us about the effects of various preventive interventions and combinations, including differential effects of universal and targeted approaches?

The ODP encourages and coordinates prevention research across the NIH Institutes and Centers and with external partners. In 2014, ODP staff developed a strategic plan with six priorities to help better characterize the NIH prevention portfolio, identify gaps, encourage the use of better methods, enhance collaborative research, disseminate effective programs, and increase the visibility of prevention research. The ODP is working with partners within and outside of the

NIH to demonstrate progress toward its strategic priorities by the end of 2018. Health economics research plays an important role in this process.

Keynote Address: Prevention, Harm Reduction, and Policy

Richard Frank, Assistant Secretary for Planning and Evaluation, U.S. Department of Health and Human Services

The U.S. government engages in many public prevention activities in order to mitigate adverse public health outcomes and externalities stemming from the use of harmful consumer products such as tobacco. Although all public prevention policies aim to minimize the social costs of such products, there is an active debate between policies that seek to reduce the harms of use and those that seek to reduce use itself. The debate is driven by many factors, including ideology, evidence, and perceived incentives associated with policy alternatives

Determining which policy approach is most likely to minimize social costs requires answering complex questions that are likely context- and product-specific. Key questions include: How much do harm reduction efforts reduce the average harm to users? Do harm reduction efforts that lower the costs of using increase the rates of use? Or do they lower barriers to treatment and reduce net use? What are the cost implications for non-users? Two examples, needle exchange programs and e-cigarettes, highlight the analytical complexities of prevention policies.

Needle Exchange Programs

Needle exchange programs represent a harm reduction policy to prevent the spread of infectious diseases by providing clean needles to intravenous drug users. The most common arguments against needle exchanges are that they might encourage intravenous drug use and that they do not direct users to treatment programs. Federal law currently prohibits the use of federal funding to support needle exchange programs. Several states and municipalities operate, or are considering implementing, needle exchange programs.

A 2004 World Health Organization report reviewed the scientific literature and concluded that needle exchange programs are effective and cost-effective at reducing the spread of HIV without increasing injecting drug use rates.[1] Moreover, needle exchange programs might create an opportunity for public health workers to engage drug users and offer education, testing, and treatment.

E-Cigarettes

The negative health consequences of smoking cigarettes are well known. E-cigarettes might serve as a less harmful alternative to smoking or aid those attempting to quit altogether. Detractors argue that the health impacts of e-cigarettes are uncertain and that their perceived safety might increase rates of tobacco use.

[1] The World Health Organization report can be found at http://www.who.int/hiv/pub/prev_care/effectivenesssterileneedle.pdf?ua=1

Extant scientific evidence suggests that e-cigarettes likely pose lower health risks to both users and bystanders compared to cigarettes. E-cigarettes may help smokers reduce their consumption of cigarettes. Initial evidence suggests that e-cigarette use reduces smoking rates in persons aged 14 to 18 years. More research is needed to understand the long-term health effects of e-cigarette use, the health risks of e-cigarettes to bystanders, and the complete relationship between e-cigarette use and cessation or uptake of cigarette smoking, especially among youth. Although the Food and Drug Administration (FDA) does not currently regulate e-cigarettes that are not marketed for therapeutic purposes, the agency has issued a proposed rule to regulate e-cigarettes similar to tobacco products.

Conclusions

Few analyses comprehensively consider the net effects of harm reduction programs. Modeling the outcomes of harm reduction programs is challenging because these programs change incentives for complex social behaviors that are strongly affected by social context. The implication is that policy approaches that provide a net benefit in one context may not do so in another context. Attempts to construct behavioral models to simulate outcomes have found that the results are sensitive to many assumptions. Finally, because the common goal of prevention policies is to minimize social costs, a combination of harm reduction and use reduction strategies might be the most effective approach.

Session 1: Use of Preventive Services

The Effect of the ACA on the Use of Preventive Care among Medicaid Enrollees

Adam Atherly, University of Colorado

One goal of the Patient Protection and Affordable Care Act (ACA) is to increase the use of preventive services, especially among low-income populations. To accomplish this, the ACA provides incentive payments to state Medicaid programs that cover preventive services without cost-sharing, expands Medicaid eligibility, and temporarily increases Medicaid reimbursement rates for preventive services.

Atherly's study examined the relationship between payment rates and the use of preventive services to inform the potential effects of the ACA. Using data from the Medical Expenditure Panel Survey, the investigators constructed probit models and used a difference-in-differences approach to estimate the probability of preventive services use among Medicaid, Medicare, privately insured, and uninsured populations. Five preventive services recommended by the U.S. Preventive Services Task Force (USPSTF) were considered.

The results revealed no significant association between payment rates and preventive services use in the Medicaid population. Medicaid enrollment status was associated with use of only one screening procedure. Only minor differences between Medicaid and Medicare screening rates were observed despite different payment rates. Results remained robust after sensitivity analyses.

Compared to the privately insured population, Medicaid enrollees were less likely to receive preventive services; however, this difference disappeared after controlling for demographic factors. The uninsured population was the least likely to receive preventive services, an association that remained after demographic adjustment. For all insurance types, there were significant differences in utilization of preventive services based on state of residence. Therefore, although expanding Medicaid eligibility will likely increase the use of preventive services, changes in payment rates will likely not influence use of services, and differences will remain based on demographic and geographic factors.

A Natural Experiment of Value-based Incentives for Preventive Services

John Hsu, Massachusetts General Hospital and Harvard Medical School

The ACA eliminated patient cost-sharing for preventive services in 2011, with exemptions for certain existing insurance plans. Hsu's study investigated the impact of reduced cost-sharing on utilization of three pediatric preventive services: preventive office visits, child vaccination for rotavirus, and adolescent vaccination for human papillomavirus (HPV). Preliminary results were presented.

Cost-sharing of all physician office visits decreased from 2007 to 2013 in a sample of privately insured individuals aged 25 and younger, especially in 2011 and later. Cost-sharing for preventive services visits decreased more than for all other office visits. The percentage of individuals with at least one annual preventive office visit increased over the same time period. Younger children were more likely to have a preventive office visit than older children in all years.

The impact of cost-sharing on rotavirus vaccine initiation (one dose) and completion (two or three doses) was examined in a sample of nearly 150,000 infants born in 2009. The results indicated that a cost-sharing increase of $10 for the vaccine visit was associated with a 3 percent decrease in the odds of initiating and a 5 percent decrease in the odds of completing the rotavirus vaccine schedule within 1 year of birth.

The HPV vaccine has the potential to reduce the incidence of cervical and other cancers, yet its adoption faces cultural and political obstacles in the United States. The investigators examined rates of initiation and completion of the vaccine in boys and girls aged 10 to 26 from 2007 (when the vaccine became available) to 2012. Although both initiation and completion rates increased, the initiation increased faster than completion. Eliminating cost-sharing had a small positive effect on vaccination rates.

There is a body of literature clearly indicating that increased cost leads to decreased utilization of services. On the other hand, the present work demonstrates that reducing cost improves utilization only modestly. Thus, reduced cost-sharing for preventive services and other value-based insurance designs should be considered as but one of several strategies to improve utilization of preventive services.

The Impact of Wellness Programs and Incentives on Preventive Services

Alison Evans Cuellar, George Mason University

Many employers offer wellness programs to educate employees and raise their awareness of preventive health services. Less commonly, some employers offer financial incentives to encourage use of preventive services. The ACA allows employers to offer rewards up to 30 percent of the cost of coverage. Evans Cuellar's study examined the impact of incentive programs on preventive service utilization by comparing employers with wellness and incentive programs to employers offering only wellness programs.

Incentive programs differed between employers in terms of the total amount of incentives, the amount awarded for different types of services, and whether rewards were linear or given only when members met a specified threshold of utilization. The study outcomes were the rates of cervical screening, mammogram screening, colorectal cancer screening, preventive office visits, blood sugar tests, and cholesterol tests.

The study is ongoing; preliminary results were presented.

The Long-term Effects of Consumer Directed Health Plans on Use of Preventive Services

Neeraj Sood, University of Southern California

Consumer directed health plans (CDHPs) are health insurance plans with a high deductible and an associated tax-free health savings account. CDHPs have low premiums and are therefore attractive for healthy individuals with low expected health care utilization. CDHPs are increasingly common, growing from 4 percent of employee health plans in 2006 to 20 percent in 2013. Approximately 80 percent of insurance plans offered in current health care exchanges are CDHPs.

Prior studies have shown that CDHPs reduce health care costs through at least the third year compared to traditional insurance plans. Yet how CDHPs achieve cost savings is unclear. Do consumers who use CDHPs reduce all types of health care usage indiscriminately, or do they reduce only low-value care? Preventive care is perceived as high value and is exempt from cost-sharing. Do CDHPs increase the use of preventive care because members have an incentive to avoid costly treatment for any medical conditions they may develop? Or do CDHPs reduce the use of preventive care because members see physicians less frequently and may be unaware of the preventive care cost-sharing exemption?

Sood's study assessed the impact of CDHPs on preventive care (e.g., screenings for breast, cervical, and colon cancer) using claims data from 37 large employers over a 4-year period. The treatment cohort comprised individuals who were enrolled in a traditional health plan for 1 year and switched to a CDHP for the subsequent 3 years. The control cohort comprised individuals who were continuously enrolled in a traditional health plan for 4 years whose employer never offered a CDHP.

Screening rates in the treatment group were modestly higher than in the control group during the baseline year prior to CDHP enrollment. Members of the treatment cohort tended to live in zip codes with higher median income and education levels, which might explain this difference. After CDHP enrollment, there were no differences in screening rates among individuals who did not receive screening in the baseline year. There was a weak positive effect for colon cancer screening among individuals who received screening in the baseline year. In the first year, CDHPs had modestly lower rates of screening; however, there were no differences by the end of the study.

One possible explanation for the lack of differences in screening rates between the treatment and control groups is that individuals in CDHPs were confused about their plan's benefit structure. This is evidenced by spikes in demand for screening prior to CDHP enrollment, which indicates a perception of high cost-sharing for preventive services in the CDHP, and toward the end of the plan year, when individuals are most likely to have exhausted their deductibles.

These results suggest a need to examine new strategies for increasing the use of preventive services. Reducing out-of-pocket costs for preventive services might not be enough to increase use.

Discussion

Workshop participants discussed the findings that reducing out-of-pocket costs for preventive services might not be enough to increase use. Because the government or health care system assumes these costs, it is worth considering whether the money could be better spent on other activities, and the cost shifted back to the consumer. On the other hand, it is possible that even a modest cost for preventive services would change consumer perceptions and create barriers to seeking services. Understanding the barriers to preventive services use, in addition to possible incentives, is an important research topic.

Other research considerations discussed included the complexity of mediational pathways when studying a diverse range of services (e.g., those that require office visits versus those that do not), the challenge of targeting interventions toward populations who need them rather than those who are relatively healthy at baseline, and the need to examine the impact of interventions that seek to foster a better understanding of the terms of different health insurance plans.

Session 2: Targeting and Personalization in Prevention

Impact of Personalized Medicine on the Cost-effectiveness of Prevention: Example of Colorectal Cancer Screening

Sujha Subramanian, RTI International

The objectives of this study were to (1) develop a framework for microsimulation modeling to assess the impact of personalized medicine on the costs and benefits of screening, (2) create a prototype model for colorectal cancer screening, and (3) identify cost-effectiveness thresholds for personalized approaches to colorectal cancer screening. Colorectal cancer was selected

because of its high prevalence, low rate of screening, availability of risk-stratification tools, and other factors.

The prototype model included modules on genetic risk assessment, natural history of disease, and screening and treatment schedules. The model considered a present scenario with limited risk assessment, a personalized scenario with risk assessments based on family history, and a future scenario with an added hypothetical biomarker test.

Results demonstrated that the compliance rate is the major driver of life-years gained. The personalized scenario was considered cost effective for all compliance levels, whereas the incremental cost per life-year gained was considerably higher in the future hypothetical biomarker scenario. Compared to the present scenario, the personalized scenario reduced the harms from screening (due to false positives and colonic perforation) at all compliance levels.

The results of this study suggest that personalized screening approaches can be cost-effective and can reduce harms of screening. High-cost (greater than $1,000 per person) risk stratification is unlikely to be cost-effective. High rates of compliance are critical to improving colorectal cancer screening outcomes. Outstanding research questions include whether patients and physicians will adopt risk stratification, the feasibility of obtaining accurate family history in practice, and the real costs of adopting risk assessment in routine practice.

Using Modeling to Evaluate the Role of Coronary Calcium Screening to Guide Cardiovascular Disease Prevention

Michael Pignone, University of North Carolina

Epidemiologic and basic science research is generating abundant information about risk factors of diseases, yet how best to translate risk factor data into clinical practice is unclear. Determining whether clinical use of a novel risk factor is appropriate requires an understanding of its costs, harms, and potential effect on treatment decisions and outcomes. Clinical decision makers might benefit from models that weigh the relevant factors.

Physicians prescribe preventive therapies, such as statins and aspirin, based on estimated cardiovascular disease risk. Coronary artery calcium (CAC) is a marker of atherosclerotic burden that improves cardiovascular disease risk prediction; however, measuring CAC adds cost, decision-making complexity, and radiation exposure. It is unclear whether the prescription threshold for statins would be affected by adding CAC to currently used cardiovascular risk factors. The present study used modeling to determine which patients, if any, would benefit from adding CAC to conventional risk factor assessment to guide statin therapy for cardiovascular disease prevention.

The results indicated that the benefit of CAC screening depends heavily on assumptions, especially the disutility of taking a pill daily and the baseline cardiovascular event risk. For example, CAC screening was not worthwhile for a 55-year-old woman with a 10-year cardiovascular event risk of 7.5 percent assuming no disutility and generic statin costs; the best strategy was to treat all with statins. When even a modest amount of disutility is assumed,

however, the preferred strategy changed to treat if CAC is greater than zero. In high disutility scenarios, the best strategy was to treat no patients with statins. Similar trends were observed with respect to cardiovascular event risk, where the best strategies were to treat no patients in low-risk scenarios, treat if CAC is greater than zero for moderate risk, and treat all without CAC screening in high-risk scenarios.

CAC screening might be cost-effective when statins are costly and patients are somewhat reluctant but not unwilling to take medication. The benefits are likely greatest for intermediate-risk patients and are derived mainly from avoiding statin exposure of low-risk patients. Availability of low-cost, low-radiation CAC scans could increase the cost-effectiveness of CAC screening.

Some Economics of Targeted versus Universal Prevention

Donald Kenkel, Cornell University

The basic concept of prevention is that certain investments can reduce either the risk of illness (primary prevention) or the risk of losses due to illness (secondary prevention). Both primary and secondary prevention can be either universal (suitable for everyone) or targeted (recommended only for high-risk subgroups) depending on cost-effectiveness. Whether private prevention decisions are socially optimal is an important and multifaceted question. Kenkel presented a mathematical model to guide thinking about how private decisions about prevention compare to socially optimal levels of investment in prevention.

The so-called paradox of prevention reflects the observation that many preventive measures that benefit a population offer few benefits to individuals, and many measures that benefit an individual offer few benefits to society. This is because small risks are often distributed among a large portion of the population, while large risks are distributed among only a relative few. The paradox arises if one assumes that societal benefits are defined by the number of cases prevented. Individuals, however, purchase preventive services only if the expected loss prevented is greater than the cost. Maximizing the net benefits of prevention, therefore, is not the same as maximizing the number of cases prevented because large numbers of low-risk individuals represent both a large number of cases and higher costs.

Another consideration is the ex ante moral hazard that insurance against a loss reduces the incentive to invest in prevention. Investing in prevention creates positive spillovers for everyone in the insurance pool. This is not market failure; firms can respond by changing insurance premiums based on the level of prevention, thus aligning individual and group incentives. However, if insurers are unable to reflect individuals' prevention efforts in insurance premiums, then they have a stronger incentive to cover prevention services. However, adverse selection, or attracting more high-risk individuals, is a potential risk of expanded coverage for preventive services. This problem may be limited, however, because adverse selection requires individuals to know their risk types, which they often do not (e.g., the low use of genetic tests).

Individual decisions about prevention may lead to non-optimal overall investments in prevention for other reasons. Individuals often make time-inconsistent decisions that discount

future benefits of prevention. Similarly, individuals make decisions based on imperfect and potentially biased risk perceptions, which can either under- or overestimate risks and affect resource allocation.

Suggested research topics include distinguishing between universal and targeted approaches in a wide range of preventive interventions, including clinical preventive services as well as those addressing, for example, substance abuse and youth conduct disorder. Insights from insurance models that address ex ante moral hazard and the relationship between individual and group benefits could be applied to other entities that may effectively act as insurers, such as employers, communities, and governments. The implications of the use of genetic information in health insurance market also require investigation. Although insurers are legally prohibited from using genetic information, incentives to use genetic data may remain.

Personalized Risk Information in Cost-effectiveness Studies

David Kent, Tufts Medical Center

Clinical evidence comes from groups of patients, yet treatment decisions are made for individuals. Applying the overall results of clinical trials to all patients might not lead to the best outcomes. Achieving optimal outcomes requires an understanding of individualized treatment effects; however, clinical trials measure effects at a group level and do not indicate which particular patients benefited from or were harmed by treatment. Conventional subgroup analyses that consider one variable at a time inadequately account for the true heterogeneity of patient characteristics. These analyses lead to multiplicity and spurious false-positive results.

An alternative approach is to use risk models to understand the variability of treatment effects in clinical trial populations. The premise is to assign risk scores to patients and to stratify analyses based on the resulting risk distribution. The distribution of risk in a population is often skewed; for example, the median risk score is usually much lower than the mean risk score, when expressed as a probability. In these cases, a treatment might benefit high-risk patients greatly but will not benefit, or might even harm, low-risk patients.

In this project, Kent and colleagues estimated risk distributions of more than 30 randomized controlled trials and re-analyzed the results using risk stratification. Examples from the Diabetes Prevention Program and National Lung Screening Trial demonstrate that treatment effects are, indeed, heterogeneous across risk percentiles. Relative risk reductions frequently, but not always, tend to be similar across the entire distribution, whereas absolute risk reductions are much greater for high-risk than low-risk groups.

Risk-based analyses can reveal counterintuitive findings. Overall effectiveness results may be driven primarily by a small set of high-risk patients. Thus, the average benefit often overestimates the benefit received by most patients and may obscure treatment harms. There may be substantial variation in treatment effects even in high-risk populations. Risk modeling is a promising approach for targeting therapies and prevention strategies.

Discussion

Workshop participants discussed the use of risk stratification in different settings. Risk models are better developed for some interventions (e.g., statin therapy) than others (e.g., colonoscopy); however, the approach itself is generic and can be applied in different contexts. Risk-stratified analyses are most useful when the decision threshold is near the population average and the value of additional information is high.

One aspect that requires further study is the incorporation of treatment harms into risk models. Like treatment benefits, the distribution of treatment harms is likely heterogeneous. Treatment benefits in high-risk groups would be attenuated if the risk of treatment-related harms is correlated with baseline risk. Conversely, if these parameters are negatively or not correlated, then the heterogeneity in treatment effects would be greater.

Group Discussion

Application of Models

Value of information modeling approaches might be useful for NIH portfolio analysis and decision making. These approaches, in addition to other tools, could be used to identify high-priority areas with insufficient investment. Useful information could likely be obtained for relatively low cost.

Risk assessment tools are available in some fields of medicine, such as cardiology. These tools, however, are likely underutilized. One reason for this is that past guidelines advocated for universal approaches to treatment. More recent guidelines in the United States and Europe emphasize risk-based approaches. The hope is that more providers will adopt these strategies.

Different regions of the country have different population disease profiles, mortality rates, and public policy decision-making needs. Adapting general models for region-specific populations and goals might be desirable. One strategy is to populate models with synthetic cohorts that differ in their underlying characteristics to reflect those of a particular region. Adapting existing models for regional needs is relatively inexpensive compared to designing new models.

Methodological Improvements

Availability of high-quality data is critical to improving the accuracy of models. One methodological challenge is that different model components sometimes share the same variables. For example, cost-effectiveness and risk-stratification models both require a life expectancy function. Congruent models are needed in these cases. Sometimes the needed data are unavailable.

Although there is a growing culture of data sharing, model sharing among researchers remains uncommon. Workshop participants agreed that the field would benefit from research groups sharing models. Replicating models based on peer-reviewed publications is usually not possible. Resource limitations are one barrier to model sharing because documenting models sufficiently so that others can use them requires personnel time. The emergence of modeling

collaboratives and improvements in web-based technology will facilitate model sharing in the future.

Public Health Economics at the Centers for Disease Control and Prevention

Kakoli Roy, Centers for Disease Control and Prevention

The Centers for Disease Control and Prevention (CDC) have worked to build capacity in public health economics since 1992. The CDC now employs approximately 80 economists and sponsors a 2-year postdoctoral fellowship for economists and related personnel. The number of CDC economists as a proportion of its total workforce compares favorably to other divisions of the U.S. Department of Health and Human Services.

The CDC recognizes that economic evidence is a key component of policy decisions. Cost-effectiveness, cost-benefit, budgetary, and actuarial analyses all draw on economic evidence to support policy decisions. The economics team based in the CDC Office of the Director aims to conduct policy-relevant, time-sensitive, cross-cutting analyses to promote the use of economic evidence to inform key policy decisions. The team also encourages external researchers to focus on policy-relevant questions. For more information about economic and policy analysis at the CDC, visit http://www.cdc.gov/policy/.

Session 3: Behavioral Economics—Insights for Prevention

Interventions to Curtail Antibiotic Overuse: A Multisite Randomized Trial

Jason Doctor, University of Southern California

Acute respiratory infections account for about 10 percent of ambulatory care visits in the United States. Approximately 44 percent of these patients are prescribed antibiotics; half of these prescriptions are inappropriate based on clinical guidelines. Inappropriate antibiotic prescribing contributes to rising health care costs, formation of antibiotic-resistant bacteria, and adverse drug events. Prior interventions to curtail inappropriate prescribing have focused on physician education with limited success. In this study, researchers tested the effect of social interventions on prescriber behavior.

The first pilot study tested an intervention using a low-cost public commitment device. A poster-sized letter to patients indicating providers' commitment to reducing inappropriate antibiotic use, including the providers' signatures and photographs, was hung in randomly selected participating provider offices. After 3 months, results indicated a 19.7 absolute percentage reduction in inappropriate antibiotic prescribing for acute respiratory infections in the posted commitment letter group.[2]

[2] Meeker, Daniella, Tara K. Knight, Mark W. Friedberg, Jeffrey A. Linder, Noah J. Goldstein, Craig R. Fox, Alan Rothfield, Guillermo Diaz, and Jason N. Doctor. "Nudging Guideline-Concordant Antibiotic Prescribing: A Randomized Clinical Trial." *JAMA Intern Med* 174, no. 3 (January 27, 2014): 425–431.

The second pilot study investigated decision fatigue by examining antibiotic prescription rates throughout the day. The results showed that the likelihood that a physician will write an inappropriate antibiotic prescription is 26 percent greater at the end of the workday than at the beginning.

A multisite randomized controlled trial evaluated the ability of three behavioral interventions, alone and in combination, to reduce inappropriate prescribing of antibiotics for acute respiratory infections compared to an education-only control. The first intervention, accountable justification, prompted prescribers to provide a one-sentence justification for every antibiotic prescription in the electronic health record system. If no justification was provided, then the field would be populated with "no medical reason." Justifications were shared with peers. The second intervention was a peer comparison, where providers received emails indicating whether they were a top performer compared to their peers in terms of appropriateness of antibiotic prescriptions. The third intervention was a pop-up window in the medical record that suggested non-antibiotic alternatives.

The results of this trial are being evaluated to determine whether social and behavioral nudges are likely more effective in changing behavior than making rational appeals. If effective, then behavioral interventions may offer partial solutions to health policy problems and could be applied together to have a larger effect on reducing inappropriate prescribing.

Financial Incentives to Quit Smoking

Jody Sindelar, Yale School of Public Health

Financial incentives may be more effective smoking cessation interventions than health messages, particularly for low-income smokers. Low-income smokers tend to have a strong present bias and spend a large portion of their income on smoking. Financial gains are immediate and certain, whereas the health benefits of smoking cessation are future and uncertain. In addition, the health impacts of smoking are well-known in the United States, reducing the likelihood that health education campaigns will change behavior.

Previous studies have investigated the impact of providing small payments on smoking cessation; however, the effect of messaging on the financial opportunity cost of smoking is unknown. In the present randomized field study, investigators displayed brochures with either health or financial smoking cessation messages in neighborhoods in New Haven, Connecticut. The brochures were displayed in check cashing establishments, health clinics, and grocery stores to determine the effect of priming. The outcome measure was the number of brochures picked up, which was considered a proxy for interest.

The results supported the hypothesis: significantly more financial than health brochures were picked up, and more were picked up in financial than in health or neutral settings. The investigators are now planning follow-on studies to confirm the results. In addition to being a promising strategy for smoking cessation, this study contributes to a larger effort to develop novel, low-cost, scalable approaches to improve health habits.

Behavioral Economics, Self-control, and Behavior Change

David Laibson, Harvard University

Behavioral economics seeks to understand how social interventions—including incentives, education, and different types of nudges—can affect behavior change. Initial research in this field was motivated by efforts to increase personal savings rates. Lessons from the savings domain can also apply to health. For example, information campaigns are a poor mechanism to increase savings. Similarly, a 2009 study found that a New York City policy requiring restaurants to display calorie information did not prompt consumers to order smaller meals; in fact, average calories ordered increased after the policy change.[3]

Health and savings behaviors share many similarities. Individual and societal goals are often well-aligned. Improving individual health or finances helps control societal costs. In many cases, individuals want to change their behavior, yet they struggle to do so. The challenge is to align intentions and actions.

Improving default options, such as for retirement accounts, is an effective way to promote savings. The same has been demonstrated in the health setting: 33 percent of participants received flu shots in programs requiring participants to opt-in to flu shot appointments, whereas 45 percent received flu shots in programs requiring opt-out of appointments. The downside, however, is that more than 50 percent of participants missed a scheduled appointment.

Softer approaches also help to guide individuals to better health decisions. One study investigated the effects of different forms of mail communications on flu vaccine adherence. The control group received a standard informational mailing, whereas the treatment groups received enhanced mailings with either a self-guided "make a date plan" or a similar "make a date and time plan." Thirty-three percent of participants in the control group received a flu shot, compared to 34.6 and 37.2 percent in the treatment groups, respectively. Another study found that physical proximity to flu shot clinics is associated with compliance among employees at a single worksite.

Active choice is a strategy that aims to overcome procrastination and improve self-control. Active choice programs require participants to select participation or nonparticipation in a given program; a default opt-out is not permitted. A pilot study that implemented active choice for home delivery of prescription medicines for chronic conditions saw a three-fold increase in home deliveries after implementing active choice, representing a total annual savings of $1.17 million.

In summary, inexpensive, scalable interventions can successfully align intentions with actions. Combining multiple strategies will likely be needed to achieve optimal outcomes. Strategies that are effective for health behavior change mirror those that work for savings. There is an

[3] Elbel, Brian, Rogan Kersh, Victoria L. Brescoll, and L. Beth Dixon. "Calorie Labeling and Food Choices: A First Look at the Effects on Low-Income People in New York City." *Health Affairs* 28, no. 6 (November 1, 2009): w1110–1121.

outstanding research need to determine the social boundaries between policies that are acceptably paternalistic and those that are obtrusive or will be resented.

Discussion

More research is needed to determine the limits of behavioral "nudges," or subtle interventions designed to steer individuals toward desired behaviors. Whether the effect of these interventions is durable and lasting is unknown. Similarly, it is not clear whether individuals revert to previous behaviors after an intervention is stopped. The most successful behavioral interventions, however, are those that make it easier to make good choices (e.g., auto-enrollment). The effect of such interventions is likely durable. Nascent research suggests that nudges might be more effective for some populations, such as low-income and low-education households, than others.

Few have assessed the cost-effectiveness of behavioral interventions for health choices. Some behavior change goals might be better achieved with alternative approaches, such as taxes or other punitive measures.

Session 4: Evaluating Preventive Interventions

Translational Opportunities in Economic Evaluation: Planning and Financing Evidence-based Prevention

Max Crowley, Pennsylvania State University

Evidence-based policy initiatives, especially those that consider cost-effectiveness, are becoming increasingly common. Some of these, such as the Results First Initiative, conduct meta-analyses to assess the cost implications of public programs. Such approaches rely on accurate economic estimates from the literature, and programs that lack evidence for cost-effectiveness have a competitive disadvantage.

An increasingly popular strategy to improve public policy outcomes is pay for success financing. Also called performance-based contracting, this strategy aligns incentives for government, private investors, and nonprofit prevention service providers. Private investors pay for the delivery of programs known to reduce future public costs. Government-paid reimbursements are then tied to independent evaluations of whether the expected cost aversion was achieved. From 2014 to 2015, 14 new initiatives involving pay for success financing of prevention programs began in the United States.

One successful prevention program, Promoting School-community-university Partnerships to Enhance Resilience (PROSPER), is considering pay for success financing to enable a nationwide expansion. PROSPER cultivates community prevention by leveraging existing local efforts. The program provides technical assistance and allows schools and communities to choose from a menu of evidence-based interventions for preventing substance abuse and other harmful behaviors. For example, an intervention to prevent prescription opioid use was shown to prevent new cases at a cost of about $2,125 per averted user compared to a systems cost of $7,500 per new user.

Researchers are increasingly engaging economic evaluations to demonstrate programs cost, benefits, and return-on-investment. The NIH-funded Prevention Economics Planning and Research Network is one example of interdisciplinary research efforts committed to building the science of investing in healthy development and strengthening methods for estimating prevention's cost and benefits. While economic evaluations of preventive interventions are often recognized as innovative and informative to policy makers in review, there is a need for increased attention to methodological rigor and support for methods development. This includes improved methods for modeling uncertainty within economic estimates, increased support for linking new and existing prevention trials to administrative data sources, as well as developing more robust models for informing policy and budget making.

Why We Can't Do without Models and What We Can't Do with Models

Franco Sassi, Organisation for Economic Co-operation and Development

Models are quantitative tools that simulate real-life processes. The two major categories of models are predictive and evaluative. The Organisation for Economic Co-operation and Development (OECD), in partnership with organizations such as RAND and the World Health Organization, uses evaluative microsimulation models to simulate life trajectories of individuals and populations over time. These microsimulation models account for heterogeneity of individual characteristics and the outcomes of life events. Applications include prevention of non-communicable diseases caused by obesity and alcohol use.

Models are needed to predict or evaluate likely outcomes of public health policies. Because achieving public health outcomes requires a long timeframe, it is often not feasible for governments to wait for empirical observations before implementing policies. Determining whether an intervention is cost-effective may take even longer—several decades in some cases—than determining whether it is effective.

Models are also useful for separating the effects of policies from potential confounding factors, accounting for heterogeneity in individual characteristics, and providing a variety of outcome measures to satisfy a range of information needs. Modeled outcomes, for example, can include effectiveness in a population with changing behaviors, implementation, coverage, and time to reach a steady state. Models can estimate the financial impacts of policies, assess combinations of different interventions, and evaluate the potential interactions with other variables.

Barriers to the development of models include limited computational power, inadequate data availability, and difficulty making accurate predictions based on sparse data. But these barriers are being gradually overcome by advances in computing, data availability, and statistical approaches to handle data. Models are often complex and obscure, and modeling studies are often difficult to publish, making it less attractive for scholars to engage in this type of research.

Although models are exceptionally useful for public health policy making, they have some inherent limitations. Models cannot predict the future; they can only exclude confounders to understand the effects of policies. Models cannot objectively represent reality; they rely on assumptions that must be transparent and changeable. Models cannot determine causal

effects; they incorporate causal relationships determined by empirical studies. Models cannot assess tradeoffs between outcomes; human decision makers must determine the optimal outcome based on model outputs.

Technology Diffusion and Cost-effectiveness of Mammography Screening in Older Women

Ya-Chen Tina Shih, MD Anderson Cancer Center

Breast cancer is the most frequently diagnosed cancer and the leading cause of cancer death in women. The 2015 USPSTF recommendation for biennial mammography screening for women aged 50 to 74 years; the recommendation took into consideration the harms associated with false positives. Nonetheless, the Centers for Medicare & Medicaid Services (CMS) reimburse physicians for annual mammography screening with no upper age limit. CMS also covers new cancer treatments, such as trastuzumab for breast cancer, which tend to be more effective but also very expensive.

Motivated by the question of whether it is financially sustainable for CMS to cover both frequent screening and costly new treatments, the present study considered whether scientific advances in breast cancer treatment reduce the cost-effectiveness of mammography screening in older women. The study used a microsimulation model to follow individuals from a cohort of 500,000 women born in the 1960s surviving to at least age 65 without a history of breast cancer. The model evaluated the cost-effectiveness of five different screening strategies and treatment with or without trastuzumab. A cost-effective strategy was defined as having an incremental cost-effectiveness ratio of $100,000 or less. A probabilistic analytical approach accounted for uncertainty.

In the base case scenario, without trastuzumab therapy, the no screening strategy was most cost-effective until a threshold societal willingness to pay for an additional quality-adjusted life-year (QALY) of $86,600, above which biennial screening was the best strategy. In the scenario with trastuzumab treatment, the decision cut point increased only slightly—this was largely driven by the fact that trastuzumab benefits only a small subset of breast cancer patients because only 20 to 25 percent of patients are HER2-positive. A third scenario evaluated the impact of a hypothetical treatment that benefited all patients equally. In this scenario, the decision cut point to move from no screening to biennial screening increased to $92,000.

Based on the model results, the optimal screening strategy for CMS should be biennial screening up to age 75. New treatments, especially those that are highly effective and benefit the majority of patients, appear to reduce the cost-effectiveness of mammography screening. Future research will consider the impacts of screening women older than 80 and younger than 65 years. Modeling the impact of less than perfect compliance is of interest. There are also plans to project the budgetary impacts for CMS of the optimal screening strategy.

Discussion

A shared concern is how readily policy makers consider new evidence. It is difficult to change current practice by physicians, governments, and the general public. For example, research has

found that the Drug Abuse Resistance Education (D.A.R.E.) program is ineffective, yet it remains popular and is widely implemented across the country. One attractive solution is to leverage the existing D.A.R.E. infrastructure and replace the content with a demonstrably effective curriculum.

One suggestion to increase the credibility and acceptability of models among policy makers is to increase transparency and demonstrate validity against empirical data when available.

What's Next for the Economics of Prevention?

John Cawley, Cornell University

Harm Reduction Policies

Harm reduction is a controversial approach to prevention that seeks to decrease the adverse consequences of risky behaviors. There are many possible harm reduction policies. Opioid substitution therapy, for example, provides heroin users with alternative drugs, such as methadone or buprenorphine. Methadone is administered in specialized clinics because of the still substantial overdose risk, whereas buprenorphine is less risky and generally self-administered. Another drug, naloxone, is an opioid receptor antagonist that can counteract acute heroin overdoses. Other potential harm reductions include needle exchanges to reduce HIV transmission; medicinal marijuana to replace alcohol or other drugs; nicotine patches, gum, or e-cigarettes to mitigate smoking; and emergency contraceptive medications, free condoms, and legalized prostitution to reduce some of the risky outcomes of sex.

Several questions about the effectiveness of harm reduction strategies remain: How elastic is participation in risky behaviors to the existence of harm reduction methods? Do public policies aimed at reducing harms signal that society condones risky behaviors, and could this lead to long-term increases in participation in the risky behaviors? What restrictions should apply to the availability of harm reduction? Prescription of buprenorphine, for example, is strictly regulated, and some advocates have called for physicians to have increased flexibility to prescribe it. As another example, universities differ in how available they make the plan B (morning after) pill; some require a nurse consultation whereas others make the pill available in vending machines in the dorms. Should there be age limits or marketing restrictions on harm reduction products, such as nicotine replacements?

One concern is that the benefits of harm reduction may be overstated. This proved true for several historical examples, including low-tar cigarettes (which are not more healthful than regular cigarettes), methadone (which is less harmful in some ways than heroin but can still cause fatal overdoses), and heroin (which was originally developed by Bayer to be a non-addictive alternative to morphine). Studies to investigate the harm reduction of several approaches are ongoing. Preliminary evidence is mixed and possibly context dependent. For example, studies have shown that the availability of e-cigarettes reduces youth smoking rates and legalized prostitution reduces rape and sexually transmitted infections. On the other hand, one study found that legalization of medical marijuana increased not only marijuana use but also binge drinking, with no effect on the use of hard drugs.

How to Convey Information

Although policy makers have long focused on determining *what* information to provide to the public, there is an increasing emphasis on *how* to convey information so that it is comprehensible and useful. For example, governments and companies are rethinking how to display nutrition information on food products. Approaches include adding calorie counts to restaurant menus and color-coding supermarket product labels. Identifying more effective ways to communicate important public health information is relevant for primary, secondary, and tertiary prevention.

Lessons from Neurobiology

Prevention policies can leverage our understanding of neurobiology. Two parts of the brain—the neocortex (which is deliberative) and the limbic system (which is impulsive)—are often in conflict. Many policies are rational appeals to the neocortex and provide information, instructions, taxes, or incentives to influence behavior. Alternatively, policies could empower the neocortex over the limbic system, for example, by offering pre-commitment strategies, or demand less of the neocortex by making the healthy choice the easy choice. Another option is to give up on the neocortex and simply eliminate or ban certain unhealthy choices. Policies could also appeal to the limbic system, such as graphic warnings on cigarette packages.

Health Insurance Changes and Prevention

The ACA mandated several changes to prevention policies, and many questions remain. CMS and many private insurers must now cover all preventive services recommended by the USPSTF with no cost-sharing. Is it socially optimal for everyone to receive every service recommended? Does the health system have sufficient capacity, and are taxpayers prepared to bear the cost?

Even with no cost-sharing, some individuals will not seek services. What incentives, if any, should be offered? The ACA allows group insurance plans greater latitude to offer wellness programs, including health-contingent rewards. Such programs can help plan sponsors internalize external costs and can serve as a pre-commitment device to help enrollees to help themselves. These programs, however, do not apply to individual policies or CMS and could facilitate discrimination against preexisting conditions.

Moderated Discussion

Moderator: John Cawley, Cornell University

Broad policy changes, such as those introduced by the ACA, are sometimes implemented without a strong evidence base. Workshop participants agreed that conducting many small, inexpensive randomized controlled trials can help identify promising policies to study in larger contexts. Discrete choice experiments, for example, can be administered quickly via the internet. Observational studies, including those with linked administrative data, are also useful.

One challenge is that results of randomized trials are not always generalizable and often lack external validity. Results of small trials should be interpreted cautiously, and interventions should be scaled up in a stepwise manner to determine their reproducibility in different

contexts. Another challenge is overcoming the tendency of companies and even governments to quickly implement an intervention at a large scale or abandon the intervention altogether based on its perceived utility rather than based on the evidence.

Improving the health of low socioeconomic status and other difficult to reach populations is a particular need. Evidence suggests that policies designed to make the healthy choice the easy choice are especially effective for these populations. Workshop participants suggested learning more about the needs and values of target populations to design policies that motivate healthful behaviors.

Appendix 1: Workshop Agenda

Thursday, August 27, 2015

1:00 p.m.	Welcome and Introductions	Gregory Bloss Richard Hodes
1:15	Opening Remarks	David Murray
1:30	Keynote Presentation	Richard Frank
2:00	Session 1: Use of Preventive Services	
	The Effect of the ACA on the Use of Preventive Care among Medicaid Enrollees	Adam Atherly
	A Natural Experiment of Value-based Incentives for Preventive Services	John Hsu
	The Impact of Wellness Programs and Incentives on Preventive Services	Alison Evans Cuellar
	The Long-term Effects of Consumer Directed Health Plans on Use of Preventive Services	Neeraj Sood
3:15	Break	
3:30	Session 2: Targeting and Personalization in Prevention	
	Impact of Personalized Medicine on the Cost-effectiveness of Prevention: *Example of Colorectal Cancer Screening*	Sujha Subramanian
	Using Modeling to Evaluate the Role of Coronary Calcium Screening to Guide Cardiovascular Disease Prevention	Michael Pignone
	Some Economics of Targeted versus Universal Prevention	Donald Kenkel
	Personalized Risk Information in Cost-effectiveness Studies	David Kent
4:45	Group Discussion	
5:30	Adjourn	

Friday, August 28, 2015

9:00 a.m.	Welcome	Gregory Bloss John Haaga
9:15	Session 3: Behavioral Economics—Insights for Prevention	
	Interventions to Curtail Antibiotic Overuse: A Multisite Randomized Trial	Jason Doctor
	Financial Incentives to Quit Smoking	Jody Sindelar
	Behavioral Economics, Self-control, and Behavior Change	David Laibson
10:15	Break	

10:30	Session 4: Evaluating Preventive Interventions	
	Translational Opportunities in Economic Evaluation: Planning and Financing Evidence-based Prevention	Max Crowley
	Why We Can't Do Without Models and What We Can't Do With Models	Franco Sassi
	Technology Diffusion and Cost-effectiveness of Mammography Screening in Older Women	Ya-Chen Tina Shih
11:30	What's Next for the Economics of Prevention? Overview and Moderated Discussion	John Cawley
12:30 p.m.	Adjourn	

Appendix 2:
List of Participants

MEETING CHAIRS

Gregory Bloss, National Institute on Alcohol Abuse and Alcoholism
John Haaga, National Institute on Aging

INVITED SPEAKERS

Adam Atherly, University of Colorado
John Cawley, Cornell University
Max Crowley, Pennsylvania State University
Jason Doctor, University of Southern California
Alison Evans Cuellar, George Mason University
Richard Frank, Office of the Assistant Secretary for Planning and Evaluation, Department of Health and Human Services
John Hsu, Massachusetts General Hospital and Harvard Medical School
Donald Kenkel, Cornell University
David Kent, PACE Center and Tufts Medical Center
David Laibson, Harvard University
David Murray, Office of Disease Prevention, National Institutes of Health
Michael Pignone, University of North Carolina
Franco Sassi, Organisation for Economic Co-operation and Development
Ya-Chen Tina Shih, MD Anderson Cancer Center
Jody Sindelar, Yale University
Neeraj Sood, University of Southern California
Sujha Subramanian, RTI International

FEDERAL PARTICIPANTS

Department of Health and Human Services
Amber Jessup, Office of the Assistant Secretary for Planning and Evaluation

National Institutes of Health
Michele Barnard, National Institute of Diabetes and Digestive and Kidney Disorders
Marie Bernard, National Institute on Aging
Partha Bhattacharyya, National Institute on Aging
Nina Brahme, National Cancer Institute
Regina Bures, *Eunice Kennedy Shriver* National Institute of Child Health and Human Development
Robert Carter, National Institute of Arthritis and Musculoskeletal and Skin Diseases
Eric Coles, National Heart, Lung, and Blood Institute
Diarmuid Coughlan, National Cancer Institute
Aria Crump, National Institute on Drug Abuse

Bruce Cuthbert, National Institute on Mental Health
Mary Cutting, National Institute of Dental and Craniofacial Research
Marina Dathe, National Cancer Institute
Maryam Doroudi, National Cancer Institute
Paul Gaist, Office of the Director
Patricia Gallagher, National Library of Medicine
Stephanie George, Office of Disease Prevention
Sharmistha Ghosh-Janjigian, National Cancer Institute
Amy Goldstein, National Institute of Mental Health
Sue Hamann, National Institute of Dental and Craniofacial Research
Lynne Haverkos, *Eunice Kennedy Shriver* National Institute of Child Health and Human Development
Richard Hodes, National Institute on Aging
Laura Hsu, National Institute of Dental and Craniofacial Research
Grace Huang, National Cancer Institute
Karen Huss, National Institute of Nursing Research
Thomas Insel, National Institute of Mental Health
Rosalind King, *Eunice Kennedy Shriver* National Institute of Child Health and Human Development
Andrey Kuzmichev, Office of Disease Prevention
Jacqueline Lloyd, National Institute on Drug Abuse
Nancy Miller, Office of the Director
Linda Nebeling, National Cancer Institute
Lisbeth Nielsen, National Institute on Aging
April Oh, National Cancer Institute
Hiromi Ono, National Institute on Drug Abuse
Georgeanne Patmios, National Institute on Aging
John W. R. Phillips, National Institute on Aging
Stephane Philogene, Office of Behavioral and Social Sciences Research
Eve Reider, National Center for Complementary and Integrative Health
William Riley, Office of Behavioral and Social Sciences Research
Megan Roberts, National Cancer Institute
Adelaida Rosario, National Institute on Minority Health and Health Disparities
Katrina Serrano, National Cancer Institute
Keisha Shropshire, Office of Disease Prevention
Belinda Sims, National Institute on Drug Abuse
Barbara Sorkin, Office of Disease Prevention
Martina Taylor, National Cancer Institute
Chan Thai, National Cancer Institute
Nadarajen Vydelingum, National Cancer Institute
Farzana Walcott, National Cancer Institute

Centers for Disease Control and Prevention
Madeleine Baker-Goering, Office of the Director
Donatus Ekwueme, National Center for Chronic Disease Prevention and Health Promotion
Scott Grosse, National Center on Birth Defects and Developmental Disabilities
Feijun Luo, National Center for Injury Prevention and Control
Ismael Ortega, Office of Infectious Diseases
Kakoli Roy, Office of the Director
Ninee Yang, Office of Public Health Scientific Services
Xinzhi Zhang, National Institute on Minority Health and Health Disparities

OTHER PARTICIPANTS

Caitlin Brandt, The Brookings Institution
Holly Richards, Organisation for Economic Co-operation and Development
Stefani Schmidt, MITRE Corporation
Angela Sharpe, Consortium of Social Science Associations

CONTRACTOR STAFF

Chandra Keller-Allen, Rose Li and Associates, Inc.
Rose Maria Li, Rose Li and Associates, Inc.
Samuel Thomas, Rose Li and Associates, Inc.