

Economics of Personalized Health Care & Prevention

Health Economics Common Fund

National Institutes of Health

TELECONFERENCE JULY 19, 2012

Executive Summary

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Introduction

The National Institutes of Health (NIH) Common Fund was enacted into law by Congress through the 2006 NIH Reform Act to support cross-cutting, trans-NIH programs that involve participation by multiple NIH Institutes or Centers (ICs) or that otherwise benefit from strategic planning and coordination. The Common Fund's Health Economics Program aims to support research on how specific features of the structure of health care delivery organizations and reimbursement systems influence how health care technologies are adopted and combined by health care providers, how they are applied or used for specific patients, and how those features could be modified to enhance effectiveness. The overall goal is to identify and evaluate strategies to improve efficiency in the production of health and the delivery of health care services.

The Health Economics Program held a teleconference on July 19, 2012, with health economists and other researchers with specific knowledge in the area of personalized health care and prevention. The purpose of the teleconference was to clarify the state of the science and to identify gaps in current research knowledge. Six of the invited participants gave brief presentations followed by discussion. An agenda and participant list can be found in the Appendices.

Several overarching themes were discussed throughout the teleconference:

- Personalized medicine is much broader than using genetics to inform medical decisions and should be thought of generally as using information about an individual (e.g., phenotype, clinical response, preferences, behavior) to make more precise decisions.
- The focus should be on economics broadly, including research on value and decision making, and not limited to economic evaluations of the implications for costs.
- Economic research on personalization should incorporate multiple perspectives, disciplines, and methods.
- There is a need for research on current applications of personalized medicine in clinical practice to determine a baseline against which to measure changes.
- Data collection and research should incorporate both theoretical modeling and implementation in practice (e.g., data collected and analyzed from hospitals, physician practices, community clinics).
- Personalized medicine is unlikely to be useful, efficient, or cost-effective in all cases; its utility will depend on the conditions surrounding particular interventions and subpopulations.
- A population approach is needed to find the right balance between premature translation of technologies into practice and new technologies being "lost in translation." An evidence gap exists between the development of new genomic and other technologies and adequate understanding of how to translate them into practice.

Presentations

Economic perspectives on personalized health care and prevention: An overview

Kathryn Phillips, University of California, San Francisco

This field of research is growing, yet consolidated information is lacking and many barriers to conducting this research exist. Key research gaps include: 1) insufficient evidence about how personalized medicine is implemented in real-world settings; 2) uncertainty about whether personalized medicine can be cost-saving and cost-effective; 3) inadequate consideration about the method of targeting in economic analyses; and 4) lack of clarity on how to assess the value of personalized medicine, especially from the payer's perspective. It is also important to consider the role of family members and their behavior, as well as patient and provider preferences.

Dr. Phillips proposed six approaches for future research strategies in the economics of personalized medicine:

1. Focus on value and utilize multiple methods of assessing value
2. Develop a comprehensive database of economic analyses of personalized medicine
3. Use real-world data in economic analyses
4. Consider patient heterogeneity in economic analyses
5. Prepare for upcoming challenges of assessing value of emerging technologies
6. Incorporate behavioral economics into value assessments.

Discussion. The participants discussed the development of a database of economic analyses of personalized medicine. The goal of such a project would be to capture the economic data and factors that will cause the value of personalized medicine approaches to vary. Such a database would allow for investigations of two key questions that must be answered: 1) overall, how does cost-effectiveness of personalized medicine compare to other interventions and 2) when is personalized medicine cost-effective. A database of economic analyses and relevant variables is needed to be able to answer these questions and identify where future efforts should be focused.

Public health genomics: A population approach to personalized health care and prevention

Muin J. Khoury, Centers for Disease Control and Prevention and National Cancer Institute, National Institutes of Health

P4 medicine is a systems approach to medicine that includes predictive, preventive, personalized, and participatory medicine components with the goal of better defining health and wellness for individuals, rather than simply treating diagnosed diseases. Dr. Khoury posited that a fifth “P” — the population perspective—should be integrated into each of the four components:

1. Predictive: ecological model of health
2. Preventive: principles of population screening
3. Personalized: principles of evidence-based medicine
4. Participatory: essential public health functions and population sciences

Public health genomics, or a population approach to genomics and personalized medicine, may seem counterintuitive. Finding the right balance to advance genomics and personalized medicine is essentially expanding the translation highway by examining all the determinants of health—social, genetic, etc.—and developing the right policies to act. It is a holistic, multidisciplinary, and ecological approach. It is likely that personalized medicine will result in an increase in health care costs, at least initially, until the level of precision is refined. All the related disciplines, including economics, need to work together to address these issues.

Discussion. Participants discussed concerns that emerging technologies will be prematurely used without sufficient evidentiary thresholds for use in practice or research on the impacts on the health care system, which could drive up overall costs of health care and widen health disparities. Many individual cost-effectiveness analyses find that specific interventions are cost-effective but do not necessarily generate cost savings. It is unclear whether and how it could be determined that personalized medicine approaches in general are cost-effective. Uncertainty and complexity surrounding emerging technologies result in a lack of sufficient cost and effectiveness data for these types of analyses. Technology is advancing at a faster pace than the understanding of what to do with the data generated from the technology.

Economics of basic research and research and development on personalized interventions

Dana P. Goldman, University of Southern California

Information economics defines two types of goods—experience goods and search goods—and can provide a general framework with which to examine personalized medicine. An experience good is one whose quality can only be determined through consumption, whereas a search good is one whose quality or features can be determined prior to use (purchase). In theory, personalized medicine (e.g., genotyping, companion diagnostic) transforms a particular therapy from an experience good to a search good by reducing uncertainty about its efficacy for a particular patient based on clinical biomarkers.

This model has implications for innovation. Companion diagnostics, for example, have the potential to shrink the market for a particular therapy but also generate additional value to a population. Potentially increased profits raise incentives for firms to invest in research and development of companion diagnostics, and more research and development results in better likelihood of a product's success. The availability of a companion diagnostic affects the therapeutic market's size and profitability and the profitability of both the diagnostic and drug development in the long run.

There is a tension in society about how we encourage the development of diagnostics. For personalized medicine to really emerge, innovators have to be able to not only capture additional value, but also coordinate the diagnostic and treatment. The presented model suggests that blanket reforms across all therapeutic markets may not be as effective as more targeted reforms. Potential policy levers include replacing fixed pricing with flexible pricing, providing intellectual

property protection for diagnostics, and using value-based reimbursement. Reimbursement tied to value has the potential to unambiguously improve outcomes.

Discussion. Participants discussed the opportunity presented by combining economic theory with what is known about how people behave in the real world. The real dilemma for payers is figuring out what technologies to cover and how to cover them. There is huge variability in personalized medicine products, companies, and payers. Questions also were raised about whether and how value-based reimbursement would work in practice.

Economics of translation and implementation of personalized interventions

Anirban Basu, University of Washington

Dr. Basu identified two types of personalized medicine in the context of comparative effectiveness research: active and passive. Passive personalization for existing treatments involves learning by doing, N of 1 trials, and adaptation. Active personalization involves research to identify new genotypical or phenotypical markers for incremental effectiveness or harm and the translation of this evidence into practice. Even absent the personalized medicine agenda, passive personalization occurs in typical clinical practice, and the implications vary for chronic disease management versus treatment decisions that cannot be undone (e.g., surgery). It is critical that the status of passive personalized medicine is well researched and understood before various approaches of active personalized medicine can be evaluated and compared to the status quo or “no active personalization.” Quantifying the effect of passive personalization is important for the evaluation of treatments and can help ascertain the incremental value of any new active personalization agenda.

Potential avenues for population-level research include 1) using a comparator to active personalization that reflects baseline levels of communication in practice (i.e., passive personalization); 2) considering low-cost ways to improve the baseline; and 3) developing predictive algorithms for effects. Opportunities for research on individual-level decision making include 1) potential for personalizing the application of personalized medicine technologies (e.g., targeting who gets the diagnostic based on a biomarker); 2) development of prediction algorithms; and 3) alignment of incentives for private industry to invest in research and development for new genomic markers where little can be learned from passive personalization.

Discussion. Discussion focused on the role of preferences in the passive versus active personalization model presented. Incorporating preference relationships and how they factor into net benefits, acceptable trade-offs, and willingness to take risk could open up concepts of shared decision making and personal utility. Providing patients with personalized information about the effects and multi-dimensionality of outcomes would enable them to better apply their preferences when choosing a treatment.

It was noted that because of the gap between emerging technologies and an understanding of how they can be applied, the tools available today are not adequate for measuring medical quality signal, which is why there is physician apathy and lack of reimbursement. Most of the “precision”

medicine is not all that precise. There will be some contexts in which personalized medicine will be more beneficial than in others.

Opportunities in the economics of personalized health care and prevention

David Meltzer, University of Chicago

Personalized medicine should be defined broadly and not confined to genetics or -omics data informing preventive, diagnostic, and treatment decisions for patients and populations. Personalized medicine should be thought of simply as the practice of medicine that uses information about the person to prevent, diagnose, and treat disease (or promote wellness).

Dr. Meltzer identified three areas of opportunity for economic research to inform personalized medicine practice and policy: 1) traditional clinical approaches to personalized medicine including nongenetic information (e.g., patient factors, environment, characteristics of the technology, value of the patient-clinician relationship); 2) multi-perspective analyses of public and private benefits and costs of personalized medicine (e.g., value of information analyses, business models); and 3) the role of behavior in the value of personalized medicine (e.g., impact of self-selection issues on cost-effectiveness for individuals and populations, patient characteristics). The emphasis on behavior and environment does not have to be in competition with the biological, genetic aspects of personalized medicine. Better understanding of the economic implications of behavioral and environmental factors in personalized medicine can enhance the value of biological information.

Discussion. It was noted that Dr. Meltzer's broad definition of personalized medicine includes genotype (focus of current enthusiasm and research); phenotype, clinical response, and preference (basis for traditional clinical decision making); and behavior (often an unrecognized factor in personalization). The context of personalization is the heterogeneity of patient response to treatment; current selection to treatment does not optimize outcomes. There are some conditions for which personalization will be of limited value and others for which it will be of high value. There is a need for observational studies to characterize current practice in order to estimate the value of changing practice, consideration of multiple perspectives, and research and tools that support clinicians and patients in decision making. Participants discussed the variability in patients' desire to be engaged in decision making and the extent to which evidence has shown that level of education predicts self-selection to proper treatment and whether those two phenomena might be related.

Economics of personalization in prevention and public health

Donald Kenkel, Cornell University

The goal from a social sciences perspective is to consider how an economic approach to thinking about the behaviors of consumers and firms will lead to personalized medicine. An interesting question concerns when private decisions made in markets lead to the socially optimal efficient use of prevention.

It is important to examine the factors influencing both the demand and supply of prevention. Studies of how consumers make health care decisions can be extended to think about why consumers might value a predictive test as an information source. A test is only valuable if it has a use. The value of a predictive test could go well beyond improved health outcomes; new genetic or other predictive health information could be valuable for other reasons, leading to short- and long-term changes in behavior.

The insurance market implications for genetic testing must be better understood. Consumers are concerned that insurance companies will use genetic information to discriminate in providing or charging for coverage. The Genetic Information Nondiscrimination Act (GINA) of 2008 bans the use of genetic information in health insurance markets, but it does not seem to have eliminated consumer concerns. From an economic perspective, GINA actually creates asymmetric information in that consumers could have greater knowledge than the payers, which could lead to adverse selection (i.e., high-risk consumers would purchase more health insurance, which could lead to a separating equilibrium in the insurance market).

At this very early stage of personalized medicine, population-based research might not be interesting because a small percentage of people are using a particular test. A productive strategy would be to combine social science research with randomized controlled trials and cost-effectiveness studies.

Discussion. It was noted that the public health perspective is to examine individuals in the context of communities. The greatest impact at the population level for health promotion and prevention is at the base of underlying factors: socioeconomic conditions, context for decision making, and long-lasting protective interventions. The weakest health impact comes from individual counseling and education, which is the focus of personalization. When applied to healthy people, individual-level interventions have less of an impact from a population perspective. The Centers for Disease Control and Prevention (CDC) has identified several genomic tests that are considered ready for use (e.g., BRCA1/2, newborn screening panel of 31 core conditions, Lynch syndrome testing, HLA testing, HER2 mutation). There is a different balance of benefits and harms when the use of genetic information on a population basis is considered. It is more challenging to apply personalized medicine to public health, although newborn screening stands out as a highly successful example.

Focusing on the genetics involved in a particular condition has led to discovery of only incremental risk factors in those genes that predispose individuals to the conditions; the reality is that each condition is complex and has multifactorial genetic and environmental determinants. This dilemma becomes much more difficult when trying to implement personalized health care and prevention strategies at the population level, with the exception being rare single gene disorders.

Conclusion

Several participants expressed support for a broad view of personalized medicine and the need for research to address it in the context of value and decision making. Research activities identified by participants as potentially of interest to NIH included data collection, particularly observational data and data on personalization as it is currently happening, economic model development, methodological development, and research on technological assessment (not technological assessment itself). It appears no other agency is focused on the long-term consequences of the advances in the personalization of medicine for the economy and society. Participants expressed the need to examine the incentives to innovate, the role of regulation, efficient payment methodologies, and how to incorporate these economic analyses into clinical trials and practice. A key research question to address is determining at what point and under what circumstances private decisions will lead to socially optimal levels of personalization in both treatment and prevention.

Strategies for conducting economic research on the personalization of health care and prevention include modeling and theory development, researching methods for technological assessments, combining economic analyses with clinical trials and other randomized controlled trials, collecting more real-world observational data that will enable economic analyses, partnering with other agencies and organizations, and approaching these questions from a behavioral economics perspective.

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Health Economics Common Fund, National Institutes of Health

July 19, 2012

Teleconference Agenda

Note: *These will be fast-paced sessions that take advantage of the fact that participants have the opportunity to review the commissioned papers in advance. Each presenter should speak for 10 minutes or less, concentrating on gaps in current knowledge and opportunities for research advances rather than summarizing a paper or research project. Discussant comments should be limited to 5 minutes or less and will serve as a lead-in to 10 minutes of topic-specific discussion among the group. The meeting will conclude with 25 minutes of guided discussion of research priorities, with an opportunity for brief closing statements from each invited participant.*

1:30 p.m.	WELCOME and INTRODUCTIONS	Gregory Bloss
1:40	Purpose of Teleconference	John Haaga
1:45	<i>Economic perspectives on personalized health care and prevention: An overview</i>	Kathryn Phillips
1:55	Discussion	
2:05	<i>Public health genomics: A population approach to personalized health care and prevention</i>	Muin J. Khoury
2:15	Discussion	
2:25	<i>Economics of basic research and R&D on personalized interventions</i>	Dana Goldman
2:35	Discussant—Kathryn Phillips	
2:50	<i>Economics of translation and implementation of personalized interventions</i>	Anirban Basu
3:00	Discussant—John Bridges	
3:15	BREAK	
3:20	<i>Economic efficiency and performance assessment for personalized interventions</i>	David Meltzer
3:30	Discussant—Elena Elkin	
3:45	<i>Economics of personalization in prevention and public health</i>	Donald Kenkel
3:55	Discussant—Muin J. Khoury	
4:10	Facilitated Discussion	Gregory Bloss
4:35	Closing Statements	Invited Experts
4:45 p.m.	ADJOURN	

Economics of Personalized Health Care and Prevention
Health Economics Common Fund, National Institutes of Health
July 19, 2012
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