

Personalized Health Information Technology (pHIT) Task Force Pilot Study

Summary Update and Status Report



Personalized Health Information Technology (pHIT) Task Force Pilot Study

Summary Update and Status Report

**California Council on Science and Technology
May 2011**

LEGAL NOTICE

This report was prepared pursuant to a formal request (October 2008) by the Secretary of the California Business, Transportation and Housing Agency (BTH) to enter into a partnership with the California Council on Science and Technology (CCST) to conduct an assessment of the economic impact of personalized medicine in California and recommend a state role in furthering its development. A subsequent request (December 2009) from the Health Benefits Committee (HBC) of the California Public Employees Retirement System (CalPERS) to CCST's Personalized Health Information Technology (pHIT) Task Force, required the preparation of this report by May 2011 on its Phase I Pilot Study. This report does not represent the views of BTH or CalPERS, its employees, or the State of California. The BTH and CalPERS, the State of California, its employees, contractors, and subcontractors make no warranty, express or implied, and assume no legal liability for the information in this report; nor does any party represent that the use of this information will not infringe upon privately owned rights.

ACKNOWLEDGEMENTS

We would also like to thank the numerous project partners for their generous support for this project. Lead project partners include the California Institute for Telecommunications and Information Technology (Calit2), UCSD; California Business, Transportation and Housing Agency (BTH); California Public Employees Retirement System (CalPERS); the California Office of Health Information Integrity (CalOHII), HHS; Anthem/Well Point; CentriHealth; Genomic Health, Inc.; Myriad Genetics, Inc.; and Cancer Commons.

COPYRIGHT

Copyright 2011 by the California Council on Science and Technology. Library of Congress
Cataloging Number in Publications Data Main Entry Under Title:
Personalized Health Information Technology (pHIT) Task Force Pilot Study:
Summary Update and Status Report
May 2011
ISBN- 978-1-930117-45-7

Note: The California Council on Science and Technology (CCST) has made every reasonable effort to assure the accuracy of the information in this publication. However, the contents of this publication are subject to changes, omissions, and errors, and CCST does not accept responsibility for any inaccuracies that may occur. CCST is a non-profit organization established in 1988 at the request of the California State Government and sponsored by the major public and private postsecondary institutions of California and affiliate federal laboratories in conjunction with leading private-sector firms. CCST's mission is to improve science and technology policy and application in California by proposing programs, conducting analyses, and recommending public policies and initiatives that will maintain California's technological leadership and a vigorous economy.

For questions or comments on this publication contact:

California Council on Science and Technology
1130 K Street, Suite 280
Sacramento, California 95814
(916) 492-0996
ccst@ccst.us

STATE OF CALIFORNIA

ARNOLD SCHWARZENEGGER
Governor

Department of Alcoholic Beverage Control
Department of Corporations
Department of Financial Institutions
California Highway Patrol
California Housing Finance Agency
Department of Housing & Community Development
Department of Managed Health Care
Department of Motor Vehicles
California Board of Pilot Commissioners



DALE E. BONNER
Secretary

Department of Real Estate
Department of Transportation
Office of the Patient Advocate
Office of Real Estate Appraisers
Office of Traffic Safety
California Film Commission
California Office of Tourism
Infrastructure and Economic Development Bank
Public Infrastructure Advisory Commission

BUSINESS, TRANSPORTATION AND HOUSING AGENCY

December 20, 2010

Susan Hackwood
Executive Director
California Council on Science and Technology
5005 La Mart Drive, Suite 105
Riverside, CA 92507

Dear Dr. Hackwood:

It is with sincere gratitude that I write this letter to acknowledge the work of the California Council on Science and Technology (CCST), as requested by and in partnership with the Business, Transportation and Housing Agency, to create the Personalized Health Information Technology pilot (pHIT). The work of this distinguished group has contributed to California's leadership in bioscience and the quest for understanding how to translate the avalanche of available genomic information into secure and useful clinical tools. It is of vital importance that the pHIT work be continued to maintain California's leadership, to further innovation and continue the economic contribution of bioscience within the State.

The very nature of genomic data and its uses are evolving. The pHIT pilot addresses some of these technical and use questions. The pilot study creates a pathway to apply use of genomic health data and may lead to a better understanding of how to improve health care quality. The fact that the work of the pHIT pilot will create the first and only publicly-available breast cancer ontology is, in itself, a tremendous contribution to improving health care. This accomplishment is considerable and your leadership has helped make it happen.

As CCST considers its work for the coming year, I am hopeful that you continue your leadership role in personalized health. In particular, I support efforts for your follow-up to the existing pHIT pilot to examine how personalized health information can be better understood, protected, and utilized in the name of improving health care quality, cost-effectiveness and bioscience innovation.

Susan Hackwood
December 20, 2010
Page 2

Again, thank you for your collaboration, responsiveness, and work on behalf of the State of California.

Sincerely,

A handwritten signature in black ink, appearing to read "Dale E. Bonner", with a long horizontal flourish extending to the right.

DALE E. BONNER
Secretary

cc: Kathryn Lowell, Deputy Secretary
Business, Transportation & Housing Agency

STATE OF CALIFORNIA

ARNOLD SCHWARZENEGGER
Governor

Department of Alcoholic Beverage Control
Department of Corporations
Department of Financial Institutions
California Highway Patrol
California Housing Finance Agency
Department of Housing & Community Development
Department of Managed Health Care
Department of Motor Vehicles



DALE E. BONNER
Secretary

Office of the Patient Advocate
Department of Real Estate
Office of Real Estate Appraisers
Office of Traffic Safety
Department of Transportation
California Film Commission
California Office of Tourism
Infrastructure and Economic Development Bank

BUSINESS, TRANSPORTATION AND HOUSING AGENCY

October 16, 2008

Dr. Susan Hackwood
Executive Director
California Council on Science and Technology
1130 K Street, Suite 280
Sacramento, CA 95814-3965

Dear Dr. Hackwood,

Personalized medicine is an emerging group of industries in California with possible opportunities for economic development as well as improving the quality and cost of the state's healthcare system. We are seeking to build a partnership with the California Council on Science and Technology (CCST) that will assist the state in assessing the economic impact of personalized medicine on our state.

We would like to create task forces in the areas of macroeconomics, regulation, and information technology. These task forces would provide us with: (1) the design for a pilot study characterizing the economic impacts of personalized medicine in California; (2) guiding principles for lowering any regulatory burdens on emerging companies involved in personalized medicine; and, (3) an assessment of how the state's HIT infrastructure effort can facilitate inter-institutional sharing of information and materials necessary for biomarker validation.

We appreciate the work CCST has done to date in providing the state with critical background information about our technology-based industries. Personalized medicine is another area in which the expertise of your members could be utilized to provide the state a solid understanding of the pertinent issues faced by this group of industries and their relative impact on the economic future of California.

Sincerely,

Dale E. Bonner
Secretary

Table of Contents

I. Executive Summary	1
II. Request from California Business, Transportation and Housing Agency (BTH) to CCST regarding Personalized Medicine	3
III. CCST Personalized Medicine Project Planning and Development	6
IV. Proposed Task Force Charge	10
V. Research and Identification of Genomic Tests Used in Standard Medical Practice	11
VI. Identification of pHIT Pilot Study Partners	12
VII. Development of Proposed Pilot Study Framework	13
VIII. Planning Meetings with CalPERS as Primary Health Data Source Provider for Pilot Study	14
IX. Research on Health Insurance Portability and Accountability Act (HIPAA) Privacy Issues	15
X. pHIT Fund Raising Activities	16
XI. Other Outreach and Potential Partnerships	17
XII. Creation of Ontology Panel	18
XIII. Summary Status of Phase I pHIT Pilot Study Report: May 2011 Report to CalPERS	23
XIV. Next Steps	24

I. Executive Summary

Information technology (IT) is becoming increasingly embedded in all aspects of society, including healthcare. Innovations enable digitization of patient medical records, secure management and exchange of healthcare information, and greater connectivity between patients and their physicians. Simultaneously, advances in biomedical sciences provide an expanding array of molecular diagnostics and genomic tests to inform personalized care for patients, from indicating predispositions to familial disease to predicting benefits of therapeutic treatment regimens. Whole genome sequencing for patients is on the horizon, presenting both significant opportunities and challenges in healthcare information management, security, and interpretation.

Although a number of genetic/genomic tests are currently available to patients with, or at risk for, breast cancer, the current healthcare system lacks a standardized means of assimilating information from these tests to inform personalized care for patients. Whole genome sequencing and new discoveries in clinical and basic research only aggravate this problem. As a result, the patient and physician are poised to become overwhelmed by exponentially increasing amounts of data.

The Personalized Health Information Technology (pHIT) Task Force pilot study (CCST 2011) is designed to apply cutting-edge information technology resources to the integration of molecular and genetic/genomic data with health records of breast cancer patients, thus enabling rapid adoption and meaningful use of new information in the course of decision-making and clinical care of breast cancer patients, across socioeconomic boundaries, in all care settings.

The pHIT pilot study is developing a system to translate clinical and basic research results into comprehensible information for use by both patients and clinicians to support their decision-making in the midst of the data deluge. To date (May 2011), the pHIT pilot study has completed development of an ontology, or knowledge representation for breast cancer care in the context of molecular and genetic/genomic information. Upon full implementation, this ontology will be open-source, publically available, and developed in a manner that can be easily scaled to include additional sources of information (i.e. new tests, emergent findings from clinical and basic research, new treatment guidelines, new resources, etc.).

In partnership with Cancer Commons [CancerCommons],¹ the pHIT Task Force will, upon receipt of pending grant funding, develop the first Molecular Disease Model (MDM) for breast cancer, creating an interactive “living” online document that shares the entirety of breast cancer knowledge from basic research to clinical trials, updated regularly by a national council of experts. The breast cancer MDM and ontology will be published and freely accessible to any patient,

1 CancerCommons. <http://cancercommons.org/>

clinician, researcher or other interested party with access to the Internet. Cancer Commons (See <http://www.cancercommons.org/>) has developed an example of such a resource for melanoma and has recently published an overview. (Vidwans, 2011). A rapid learning community is being developed for all cancers, enabling cross-pollination of discoveries and therapies between diverse cancer types. Based in California, Cancer Commons is pursuing development of MDM's with collaborators across the country, including this project.

In addition to generating new, accessible knowledge resources, the pHIT Pilot Study goes further to extend these resources into decision support tools that interpret diverse sources of data, providing patient-centric knowledge to both the individual with breast cancer and the clinician. One such tool is the "Targeted Therapy Finder" (TTF) application ("app") [CollabRX].²

The following is a summary update on the pHIT pilot study as well as a background summary of the development and current status of this project.

² CollabRX. Targeted Therapy Finder. <http://therapy.collabrx.com/melanoma>.

II. Request from California Business, Transportation and Housing Agency (BTH) to CCST regarding Personalized Medicine

In Fall 2008, Kathryn Lowell, BTH Deputy Secretary, Health and Life Sciences, approached the California Council on Science and Technology (CCST) regarding forging a partnership between the California Business, Transportation and Housing Agency (BTH) and CCST for purposes of exploring the potential value of a state role in personalized medicine industry development in California.

BTH September 2008 meeting with Stakeholders in Personalized Medicine

Following those discussions, BTH, in partnership with CCST, convened a “stakeholders” meeting entitled “Exploring the State’s Role in Personalized Medicine” on September 19, 2008 (See Appendix A for 9/19/08 meeting agenda). At that meeting, BTH Secretary Dale Bonner announced that Governor Schwarzenegger would like BTH to assume, in addition to a regulatory emphasis, a strong focus on accelerating job growth and economic development in California. The Secretary emphasized his view that Personalized Medicine (PM) offers economic development opportunities for the State. In addition to representatives from CCST and BTH, the September 19th meeting was attended by a broad cross section of private sector firms primarily focused in the biosciences, as well as representatives from academia, federal laboratories, and insurers, in addition to relevant organizational representatives, including but not limited to Bay Bio, California Institute for Regenerative Medicine (CIRM), the California Association of Health Plans, etc.

Highlights of the contributions and recommendations made by participants are listed below, as extracted from meeting notes from the 9/19/08 meeting.

Following the meeting, on September 25, 2008, Deputy BTH Secretary Kathryn Lowell sent a memorandum to Secretary Bonner which cited a November 2006 report, “The Case for Personalized Medicine.”³ The report, published by the Personalized Medicine Coalition, contains the following findings:

“The general, personalized medicine therapies and diagnostic tests have not yet prompted widespread review and cost-effective analysis, but a number of studies that have been conducted provide some insights, as well as preliminary validation of the economic benefits of personalized medicine in the delivery of healthcare.”

3 Personalized Medicine Coalition Press Release, 11/14/06: PMC November 2006 Report issued at Burrill Personalized Medicine Meeting, “The Case for Personalized Medicine,” http://www.ageofpersonalizedmedicine.org/objects/pdfs/TheCaseforPersonalizedMedicine_11_13.pdf

Administrative topics:

- BTH mission to focus on business side of healthcare.
- The historical tension between science and law should be acknowledged; California has opportunities for leadership in this arena.
- Disadvantages of PM: greater cost of diagnostics, smaller patient markets for therapeutics, need to share medical information, accelerated Health Information Technology (HIT), diagnosis without treatment, need for re-education of health care professionals.
- Advantages of PM: Cost/benefit examples; can't afford to continue current health care costs; State role already present in stem cell research.
- It would be helpful for the State to commission studies that would help gather basic data to analyze and make a case for expansion of personalized medicine use, i.e. conduct a retrospective and prospective study that examines economic benefits.
- Incentives currently do not exist to nurture growth of industry.
- Identify genetic drivers of chronic disease, thereby providing opportunities for reducing costs to state through preventative health care, etc.
- State should look at priority areas where there is currently no incentive to do research. Example: Can we look at use of genomic data to help keep people healthier (preventative care)? Currently there is no incentive to do that type of research.
- Big issues in personalized medicine (PM) include:
 - Healthcare economics
 - Privacy
 - Workforce
 - Technology
 - Business Climate

Regulatory topics:

- Regulatory help needed to improve clarity and consistency in regulatory arena; particularly related to enforcement.
- Need a plan for rational adjudication of issues in the personalized medicine arena.
- Explore regulation of diagnostics, impact on business, etc.
- Determine models for reimbursement from preventative perspective.
- Need for a regulatory climate allowing for innovation to occur.

Topics related to impact of PM on quality health care:

- PM not limited to management of therapy.
- PM targets medicine, administering medicine and predicting and detecting onset of disease.

- Definition of personalized medicine as information based healthcare, i.e. person-by-person resolution ushered in by sequencing of human genomes.
- Through use of personalized medicine, healthcare can trump disease care.

Industry/private sector perspectives

- PM is not an industry, but a movement involving multiple industries.
- May not learn useful knowledge from genomes; genome sequence is not enough; need gene expression.

Insurer perspectives

- Biggest challenges: reimbursement aspect, disincentives and migration into and out of health plans cause benefits to not be realized by company overseeing administration.

Workforce

- Need for trained workforce and technicians is another issue that should be addressed.
- Lack of counselors in genetic/genomic fields, in addition to need for lab technicians.

Formal request to CCST by BTH Secretary Dale Bonner regarding Personalized Medicine

On October 16, 2008, Secretary Bonner sent a letter to CCST Executive Director Susan Hackwood (See Appendix B) stating the following: “We are seeking to build a partnership with the California Council on Science and Technology (CCST) that will assist the state in assessing the economic impact of personalized medicine in our state...” We would like to create task forces in the areas of macroeconomics, regulation and information technology. The Secretary concluded that creation of the foregoing task forces would provide the state with:

- A design for a pilot study characterizing the economic impacts of personalized medicine in California;
- Guiding principles for lowering any regulatory burdens on emerging companies involved in personalized medicine;
- An assessment of how the State’s HIT infrastructure effort can facilitate inter-institutional sharing of information and materials necessary for biomarker validation.

III. CCST Personalized Medicine Project Planning and Development

Following the September 19, 2008 BTH meeting of stakeholders and Secretary Bonner's October 2008 request, the California Council on Science and Technology developed a "Moving Forward Proposal for Personalized Medicine/Health Care" dated 12/5/08 (See Appendix C) proposing the following:

1. Creation of a Personalized Medicine Advisory group

CCST recommended that a Personalized Medicine Advisory Group be created comprised of approximately 20 – 24 science and technology and personalized medicine leaders, including representatives from the private sector, state government and academia. This outcomes-oriented advisory group would be tasked to identify issues to be addressed by the State, define principles and make specific, actionable recommendations to the responsible entities in state government. The group would be divided into three separate task forces as follows:

Task Force 1: Macroeconomics

Task Force 2: Regulation

Task Force 3: Health Information Technology

CCST's Moving Forward Proposal dated December 5, 2008 cited a September 2008 report of the President's Council of Advisors on Science and Technology (PCAST) entitled "Priorities for Personalized Medicine"⁴ PCAST concluded that the benefits of personalized medicine are threatened by an array of obstacles including:

- Methodological and logistical challenges in validating apparent correlations between disease and genomics based biomarkers, which are being generated at an accelerating rate through the latest genomic and molecular technologies;
- Regulatory and reimbursement systems that were not designed to accommodate complex genomics-based diagnostics that have the power to sway high-stakes medical decisions;
- Absence of electronic medical record-linked decision support tools needed to effectively integrate the results of genomics-based diagnostic tests into routine clinical practice;
- Intellectual property laws and practices that may present barriers to investment in genomics-based diagnostics;

4 The President's Council of Advisors on Science and Technology (PCAST), report dated September 2008, "Priorities for Personalized Medicine." http://www.whitehouse.gov/files/documents/ostp/PCAST/pcast_report_v2.pdf, Page 9.

- Privacy concerns that may limit patient acceptance of genomics-based diagnostics; and
- Education of patients and physicians on the proper use and limitations of new genomics-based diagnostics.

2. Renaming Personalized Medicine to Personalized Health

Because of a recognition by CCST that personalized medicine creates a new health care paradigm, including the ability to improve preemptive care through early diagnosis allowing treatment before disease presents itself, it was determined changing the name of the project from “Personalized Medicine” to “Personalized Healthcare” would better reflect the focus on preventing illness and maintaining health.

3. Decision to focus on Personalized Health Information Technology

In light of the federal priority on investment in Health Information Technology through the enactment of the 2009 American Recovery and Reinvestment Act (ARRA), H.R. 1, Public Law 111-5, Section 3007, Federal Health Information Technology,⁵ CCST decided to create a Phase I study focused on Health Information Technology. (See:<http://thomas.loc.gov/cgi-bin/query/F?c111:1:./temp/~c111fLs6Cx:e398782:>)

4. Creation of Personalized Health Information Technology (pHIT) Task Force and approval of membership by BTH.

On May 12, 2009 CCST Executive Director Susan Hackwood conveyed to BTH Deputy Secretary Kathryn Lowell a list of recommended names for proposed membership of the newly created Personalized Health Information Technology Task Force.

CCST recommended Dr. Ramesh Rao, Director, UCSD Division, California Institute for Telecommunications and Information Technology (Calit2) as Task Force Chair.

pHIT Task Force Members include:

- Ramesh Rao, pHIT Task Force Chair and PI, Director, UCSD Division, Calit2
- Alfonso Cardenas, Professor, Computer Science Department, UCLA
- Kathy Hibbs, Sr. Vice President, General Counsel, Genomic Health
- Richard Levy, Chairman, Varian Medical Systems
- Alex Kam, Acting Director, California Office of Health Information Integrity, California Health and Human Services Agency

⁵ 2009 American Recovery and Reinvestment Act (ARRA), H.R. 1, Public Law 111-5, Section 3007, Federal Health Information Technology, (See: <http://thomas.loc.gov/cgi-bin/query/F?c111:1:./temp/~c111fLs6Cx:e398782:>)

- Molly Coye, Chief Innovation Officer, UCLA Health System
- Jay (Marty) Tenenbaum, Chair and Chief Scientist, Commerce Net
- Kevin Patrick, M.D., MS, Professor, Department of Family and Preventative Medicine, UCSD
- Steven Shak, M.D., Chief Medical Officer, Genomic Health
- David Martin, M.D., Chairman and CEO, Avid Biotics
- Richard Sun, CalPERS Office of Healthplan Administration, Health Benefits
- Hope Rugo, M.D., Co-PI, Medical Oncologist and Professor, UCSF, Helen Diller Center (pHIT Task Force Ontology Panel Chair)
- Nate Heintzman, Co-PI, Assistant Professor, Division of Biomedical Informatics, UCSD Department of Medicine.

5. CCST convenes first meeting of the Personalized Health Information Technology Task Force in May 2009

On May 27, 2009 the initial planning meeting of the Personalized Health Information Technology Task Force was convened in Sacramento. (See Appendix D).

At that meeting, BTH Deputy Secretary Kathryn Lowell noted:

“... CCST’s Personalized Healthcare initiative originally began with three separate task Forces (i.e. Macroeconomics, Regulation and Health Information Technology. What has now emerged is the result of the opportunity around Federal Stimulus dollars, i.e. the role of Health Information Technology, and specifically electronic medical records, in the advancement of personalized medicine. Unless we can collect appropriate data, store it and share it, personalized medicine will not see its potential as an industry. This effort has focused now on Health Information Technology as a platform.”

Deputy Secretary Lowell also stated that other task forces have recently been created in state government through the newly appointed Deputy Secretary for Health Information Technology, Jonah Frohlich, within the California Health and Human Services Agency. CCST’s pHIT Task Force is not a policy committee or regulatory making body, but rather, distinguishes itself from other efforts ongoing in the State by being a real world pilot that can be tested to validate the effectiveness of personalized health care data elements (i.e. genomic data) to be displayed on an Electronic Health Record (EHR) platform in a manner that is useful as a decision support tool in a clinical environment.

pHIT Task Force Chair Rao stated a first goal of the Task Force will be to fine tune the Task Force charter leading to the design of a pilot with expected outcomes.

Vision Development

The pHIT Task Force analysis concluded that the convergence of advances in information technology, coupled with rapid innovations in biomedical sciences providing an array of molecular diagnostic tools, has created a unique opportunity for California because of its dominance in both information technology and biomedical sectors.

pHIT Task Force findings:

- Information Technology is becoming increasingly embedded in all aspects of society, including healthcare. Innovations enable digitization of patient medical records, secure management and exchange healthcare data, and greater connectivity between patients and their physicians. Simultaneously, advances in biomedical sciences provide an expanding array of molecular diagnostics and genomic tests to inform personalized care for patients, from indicating familial disease predisposition to predicting benefits of therapeutic treatment regimens. Whole genome sequencing for patients is on the horizon, presenting both significant opportunities and challenges in healthcare information management, security, and interpretation.
- Integration of personalized healthcare and information technology (IT) promises great benefit to patients, physicians, and healthcare reimbursers in the State of California, and significant growth opportunities for California's life science, IT and biomedical industries. A proof of concept study is necessary to demonstrate the feasibility of this novel integration and to initiate a roadmap for strategic implementation of healthcare IT in California.
- Although a number of genetic/genomic tests are currently available to patients, the current healthcare system lacks a standardized means of assimilating information from these tests into the patient health record in a manner that is meaningful and useful to the individual and the care provider.

pHIT Task Force Vision and Goals:

As a result of the May 27th meeting, the pHIT Task Force identified the following goals as part of its pHIT vision:

- Single, consolidated patient records that follow individuals over time;
- The identification of obstacles – whether they be technical, legal or regulatory -- that impact the creation of trackable personalized information allowing patients to improve their health, and researchers to gather necessary data to improve inputs;
- A methodology to demonstrate how the collection of personalized data and knowledge about an individual patient effects health outcomes of that individual and other individuals with similar predispositions and /or disorders; and
- Identifying how it can best benefit the patient, the provider and the reimbursers.

IV. Proposed Task Force Charge

Following a series of discussions among Task Force members, the following Task Force Charge was determined as a strategy for moving forward:

1. Propose hardware infrastructure and software services goals for the State in the context of Personalized Health (pH). Evaluate technologies for and obstacles to archiving and sharing of information and knowledge based materials necessary for personalized health including biomarker validation, outcomes measurements, and patient and clinician access to broadband electronic personal health record (PHR).
2. Develop a pilot that can be tested for purposes of evaluating the use of personalized health data in an appropriate health record platform with a goal of offering in an open electronic format a comprehensive record of a subject (patient) that tracks the individual over time while protecting privacy.
3. Include as a deliverable a limited assessment of regulatory issues anticipated or confronted in the pHIT Task Force pilot in the context of potential impacts on system architecture and on data-information accessibility and sharing.
4. Include as a deliverable a list of potential federal (i.e. Federal Stimulus funding), private sector, nonprofit or other funding opportunities for pHIT.

V. Research and Identification of Genomic Tests Used in Standard Medical Practice

On July 30, 2009, Dr. Steven Shak, M.D., Genomic Health, member of the pHIT Task Force, submitted a memorandum to the pHIT Task Force (Appendix E), reporting his findings, in partnership with Richard Sun, M.D., CalPERS and David Martin, M.D., Avid Biotics, concerning an evaluation of target diseases/conditions, and identified genomic tests that would provide appropriate pilot study data for the work of the Task Force.

It was reported this evaluation resulted in identification of two individualized genomic tests in breast cancer:

- Oncotype DX, a test of acquired individual genomic signatures in the tumor that is recommended to guide who should be given chemotherapy at the time of breast cancer diagnosis. (See Appendix F, Overview of Oncotype DX)
- BRACAnalysis®, a test of inherited genetic alterations that are recommended to guide use of strategies that would prevent breast or ovarian cancer. (See Appendix G, Overview of BRACAnalysis®)

In his July 30, 2009 memorandum, Dr. Shak noted both Oncotype DX and BRACAnalysis® were selected based on the following selection criteria used for this purpose:

- Genomic test currently available (in the marketplace) and reimbursed as standard care recommended by current guidelines with direct relevance to important health outcomes/costs;
- Clear potential for personalized health information to provide value to patients, health care providers and payers;
- Capable of delivering pilot results within one year;
- Potential for showing cost-effectiveness;
- Overlap with CalPERS priorities;
- Key data sources available and amenable to the available health IT "solutions;" and
- Will result in progress on regulatory issues related to personalized health Information.

VI. Identification of pHIT Pilot Study Partners

The pHIT Pilot Study partners include the following:

1. **CalPERS** – providing access by the pHIT Task Force to de-identified health data for breast cancer patients extracted from the CalPERS Health Care Decision Support System for purposes of the pilot study.
2. **Anthem/Well Point** – providing technical assistance to the pHIT Task Force in developing a privacy protocol for de-identified data and providing support for extraction of Anthem/Well Point claims data from the CalPERS data base.
3. **CentriHealth** – providing a potential Individual Health Record (IHR) platform to receive and house de-identified patient data, an applications ontology (i.e. lexicon of terms) and a system rules engine as a mechanism for data management and building a decision support system beneficial to users (patient, healthcare provider, payers).
4. **Health and Human Services Agency, California Office of Health Information Integrity (CalOHII)** – Member, pHIT Task Force and provider of support for pHIT pilot study and for preparation of final pHIT Task Force Phase I report to CalPERS (May 2011).
5. **Genomic Health, Inc.** – Member, pHIT Task Force and provider of de-identified genomic test data from reference lab for Oncotype DX, a commercially available multi-gene expression test that has established clinical utility guiding use of chemotherapy for patients diagnosed with invasive early stage breast cancer. www.centrihealth.com
6. **Myriad Genetics, Inc.** – pHIT pilot study partner and operator of reference lab for BRACAnalysis®, a genetic test requiring a blood sample to determine whether a patient has a BRCA I or BRCA II gene mutation indicating a predisposition to hereditary breast or ovarian cancer (HBOC). <http://www.myriad.com/>
7. **Cancer Commons** – A new patient-centric, open source public reporting system for cancer information in which patients receive personalized therapy based on best available science. <http://www.cancercommons.org/about.php>

VII. Development of Proposed Pilot Study Framework

In August 2009 two pHIT Task Force meetings held August 4 and August 20 respectively resulted in a preliminary pilot study framework including the following:

- The pHIT Task Force is focused on creating a pilot for testing on an HIT platform using genomic data.
- Breast cancer has been selected due to availability of genomic testing in the marketplace.
- The HIT data base for this pilot will, upon formal approval by the Cal PERS Health Benefits Committee,⁶ be populated with de-identified CalPERS patient data and will demonstrate the feasibility of an HIT infrastructure that can pull disparate information from a variety of sources.
- Following a series of discussions with CalPERS, the pHIT Task Force has entered discussions with Anthem/Well Point, Inc. to become a pilot study partner and provider of de-identified claims data extracted from the CalPERS Health Care Decision Support System for use in the pHIT pilot study.

⁶ CalPERS Health Benefits Committee, a nine member Committee charged with overseeing the administration of the Public Employees' Medical & Hospital Care Act program and the Public Employees Long-Term Care Act program. <http://www.calpers.ca.gov/index.jsp?bc=/about/organization/board/board-committees.xml>

VIII. Planning Meetings with CalPERS as Primary Health Data Source Provider for Pilot Study

Following a series of discussions with CalPERS administrators and staff during the period September through November 2009, the pHIT Task Force pilot study was placed on the December 15, 2009 agenda of the CalPERS Health Benefits Committee (HBC). On that meeting agenda, a pHIT Task Force presentation proposed a one-year “Phase I” pilot study to demonstrate how information technology enables integration of genomic information into an electronic health record system with capacity for improved decision-making by individuals and their care providers.

It was noted by CalPERS staff that the pHIT pilot study proposal is “consistent with the Health Benefits Program Vision Statement” stating, in part, that CalPERS will “be a leader for health care reform both in California and nationally.” (See Appendix H for December 15, 2009 CalPERS HBC staff recommendation.)

The following staff recommendation was accepted by the CalPERS Health Benefits Committee at its 12/15/09 meeting:

- Continue to work with BTH, CCST and its partners in the implementation of the study. This work would include the retrieval of data from the CalPERS Health Care Decision Support System.
- Report (by pHIT Task Force) to the Committee early in 2011 on the results of the project. (Note: On October 27, 2010, the pHIT Task Force requested a revised reporting date of May 2011.)

IX. Research on Health Insurance Portability and Accountability Act (HIPAA) Privacy Issues

A team of pHIT Task Force members conducted research on compliance issues related to the pHIT pilot study in accordance with the provisions of the Health Insurance Portability and Accountability Act (HIPAA) in order to ensure compliance with privacy rules and regulations codified in the federal HIPAA statutes.

1. Request to the California Health and Human Services Agency's Committee For the Protection of Human Subjects (CPHS) for waiver of Institutional Review Board (IRB) review. (January 2010)

On January 11, 2010, CCST Executive Director Hackwood and pHIT Task Force Chair Rao submitted a letter to Roxana Killian, Administrator for the Committee for the Protection of Human Subjects, requesting the Board's review of the Personalized Healthcare Information Technology (pHIT) pilot study and a determination of whether this project qualifies as research and, as such, is exempt from IRB review. (Appendix I.) The letter clarified that: 1) the pHIT pilot study does not include intervention in patient care, nor is there any contact with patients; 2) only de-identified patient data will be used; and 3) no patient identifiable data will be obtained by any entity which does not already possess that data.

The pHIT Task Force described the following two-pronged pilot study plan:

- To assess the feasibility of integrating personalized health data, namely retrospective genomic/genetic test result data, into an electronic health record (EHR) system, and
- To develop a breast cancer decision support model that includes these test results as part of the computerized ontology.

The study is retrospective in nature as all of the data to be used in the study have already been collected in the course of care; no new data will be generated.

2. Approval of request for exemption from IRB review by the Committee for the Protection of Human Subjects.

On January 26, 2010, CPHS Administrator Killian conveyed to pHIT Task Force Chair Ramesh Rao a letter of approval by HHS's Committee for the Protection of Human Subjects of this exemption request based on 45 Code of Federal Regulations (CFR) 46.100(b)(4)(ii). (Appendix J) It was noted that this approval has been granted as "the existing personal health information was collected retrospectively and will be de-identified before being provided to the study investigators."

X. pHIT Fund Raising Activities

The pHIT Task Force has raised approximately \$153,000 in cash contributions from public and private sector sources as well as nonprofit foundation grant awards, and \$295,200 in in-kind support from pHIT pilot study partners.

Cash contributions have been received from:

- California Community Foundation
- Anthem/Well Point
- CalOHII, California Health and Human Services Agency for preparation of pHIT final report
- Calit2, UCSD
- CCST

In kind support has been provided by:

- Anthem/Well Point
- CentriHealth
- Genomic Health
- Myriad Genetics
- Calit2, UCSD
- CCST

In addition, a pHIT Task Force grant proposal has been submitted in February 2011 to the University of California's Breast Cancer Research Program (CBCRP). Grant awards are anticipated in June 2011.

XI. Other Outreach and Potential Partnerships

The pHIT Task Force has engaged in discussions with the following entities for potential partnership opportunities due to common interests and goals.

1. University of California ATHENA Breast Cancer Network
<http://www.athenacarenetwork.org/>

The ATHENA Breast Cancer Network is a large scale project among five University of California health centers, including UC Davis, UC San Francisco, UC Los Angeles, UC Irvine and UC San Diego.

ATHENA is designed to revolutionize breast cancer care by more efficiently merging research, technology, financing and health care delivery for purposes of improving patient care.

2. Palo Alto Medical Foundation (PAMF) <http://www.pamf.org/>

The Palo Alto Medical Foundation has initiated a Breast Cancer Study documenting the journey of breast cancer patients, including but not limited to treatment protocols; inconsistencies in protocol adherence; patient response to clinical intervention; and development of improved data re patient outcomes. <http://newsroom.pamf.org/2010/10/breast-cancer-journeys-patients-create-video-to-inform-and-inspire-others/>

XII. Creation of Ontology Panel

Ontology Panel Membership

In May 2010 the pHIT Task Force appointed a four-member panel of experts in Health Information Technology (HIT), oncology and ontology development. A fifth Ontology Panel member (Dr. Teresa Helsten, UCSD Moore's Cancer Center) was added in February 2011.

The panel includes:

1. Hope Rugo, M.D., Ontology Panel Chair and Co-PI
Professor of Medicine
Director, Breast Oncology and Clinical Trial Education
UCSF Helen Diller Family Comprehensive Cancer Center
2. Barbara Parker, M.D.
Medical Director, Oncology Services
Moore's Cancer Center, UCSD
3. Maryanne Martone, Ph.D.
Professor in Residence
Department of Neurosciences and Co-Director, National Center
for Microscopy and Imaging Research (NCMIR), UCSD
4. Matt Williams, M.D., Ph.D. (oncologist and computer scientist)
Clinical Oncology SpR, London, England
University College London
(Note: Dr. Williams' Ph.D. dissertation included an ontology for
breast cancer care.)
5. Teresa Helsten, M.D.
Assistant Clinical Professor
UCSD Medical Center
Moore's Cancer Center

Convening of Ontology Panel and designation of Panel Chair

pHIT Task Force Chair Ramesh Rao, in partnership with Ontology Panel Chair Hope Rugo, M.D., convened a series of Ontology Panel conference calls, webinars and meetings commencing on May 1, 2010 to discuss the parameters and scope of ontology development.

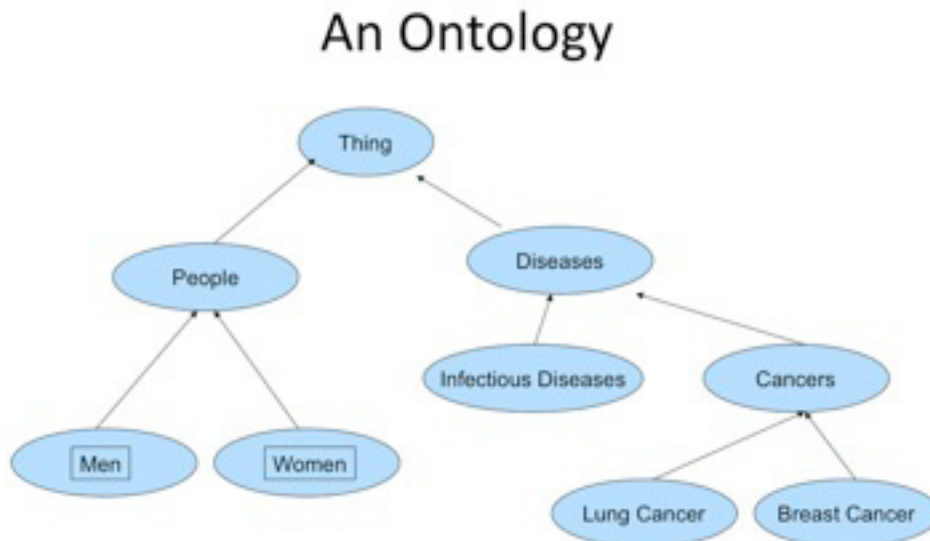
Clinical “use cases” (Appendix K) were prepared to provide the Ontology Panel with an expanded basis with which to build an ontology that reflects real-life clinical environments and conditions at the point of care. Use cases portray mock clinical scenarios featuring patients presenting various types of oncological diagnoses and histology to a treating physician. These use cases have served to assist the Ontology Panel in developing a common understanding of methodology based on health (including genomic) data and the capacity of the ontology to facilitate decision support in a clinical environment.

- **Goals of ontology.**

The ontology developed by the pHIT pilot study is designed to create a lexicon of terms to be used in an Individual Health Record system platform. The ontology focus is on people who have been diagnosed with breast cancer and the kinds of knowledge the pHIT Task Force expects the system to provide to the oncologist and the patient to aid in decision support.

- **Definitions of ontology vs. decision support system**

An ontology is defined as a specification of a conceptualization – a “model of the world” and the things in it, and how they relate to one another. The ontology simply provides names and words within the domain and points to differences regarding breast cancers and people.



(Source: Matt Williams, M.D., Presentation to Ontology Panel, 7/14/10 (See Appendix L))

The ontology provides the “language” for the domain and includes standards for the language and tools for building and reasoning. A decision support system (DSS) is different from an ontology in that it needs to make decisions based on adjudication among “things” and choices among terms within the domain. A decision support system is a workflow plus decision points with accompanying rules. The ontology allows for data integration and potentially allows multiple data sources to be used within a single DSS. (Source: Matt Williams, M.D., Member, Ontology Panel, 7/14/10 meeting) (Appendix M)

- **Discussion of ontology structure**

The Ontology Panel has constructed a breast-cancer domain-specific ontology, largely based on the NCI Thesaurus.⁷ This has been achieved through identification and extraction of the relevant sections of the NCI Thesaurus, and adding definitions where appropriate. The addition of definitions is a key element in making the ontology useful as a decision support resource. The current ontology contains over 8,000 classes, though this figure is a poor reflection of its coverage and scope.

The pilot study ontology is consistent with standards referenced in NCCN guidelines. NCCN policies and guidelines⁸ are available online. Portions of this “applications” ontology are also taken from the NCI Thesaurus and other sources. (Source: Matt Williams, M.D., Ontology Panel.)

- **Genomic/genetic testing targets and potential future developments**

The initial Phase I pilot study captures genomic testing data related to Oncotype DX and BRACAnalysis. New genomic testing, such as MammaPrint, may be added in subsequent work in Phase II of the pilot study.

- **CaIPERS health data extracted from Anthem claims data**

The data sources utilized in the ontology include the CaIPERS Healthcare Decision Support System data base extracted by Anthem/Well Point, Inc. from de-identified claims records that include identified breast cancer patients who are likely to have, or already have breast cancer. In addition, data sources are taken from de-identified genomic test data taken from reference labs, Genomic Health and Myriad Genetics related to BRACAnalysis[®] or Oncotype DX testing.

The Ontology Panel reports that in the work on ontology development, a priority has been given to reflecting real clinical data rather than building a large but potentially

7 The NCI Thesaurus (NCIT), developed by the National Cancer Institute, provides on-line reference terminology for many NCI and other systems. It covers vocabulary for clinical care, translational and basic research, and public information and administrative activities. (Source: <http://ncit.nci.nih.gov/>)

8 The National Comprehensive Cancer Network (NCCN) provides people with cancer and the general public state-of-the-art treatment information in easily understood language. (see <http://www.nccn.com/patient-guidelines.html>),

useless ontology. Achieving this goal has required spending more time and fiscal resources than anticipated on data capture refinement.

Assignment of ontology development tasks and data needs (Lead: Matt Williams and Maryann Martone)

In August 2010, the pHIT Task Force designated an ontology development subgroup to develop the structure, framework and methodology for a model ontology. Panelists Williams and Martone were assigned this task, along with a colleague of Dr. Martone from UCSD, Fahim Imam.

- **Need for additional clinical data specified by Matt Williams**

Williams and other members of the Ontology Panel decided that additional de-identified clinical data is needed for the ontology, such as tumor staging, histology, etc. As it has been determined that this category of data is not available within Anthem claims data, treating facilities within the CalPERS data base which provide healthcare to the largest number of breast cancer patients have been identified as potential sources for this research.

- **Decision support system options**

The final demonstration of the value of the pHIT pilot study is in allowing the use of clinical and genomic data to “power” clinical decision making aids. The original intention was to implement this using CentriHealth IHR infrastructure technology. However, an alternative approach using a prototype (text-based) system with a limited scope would at least demonstrate the potential of the pHIT system.

- **An assessment of current limitations**

Unanticipated delays in accessing clinical data have resulted in timeline revisions in completion of the ontology development process. Despite delays in obtaining clinical data, the ontology panel has now sourced two alternative data sets, which, although smaller than the original data set, serve to illustrate many of the underlying issues. The Ontology Panel has also identified mappings between one dataset and the ontology, and is now in the process of identifying obvious areas of development for the second dataset.

Mock representative data sets have been developed by Matt Williams and validated by Hope Rugo and Barbara Parker (Ontology Panel clinicians) as being a reasonable representation of clinical breast cancer data.

- **Next steps in ontology development**

The Ontology Panel has reported that the remaining part of the work will allow integration of a second clinical data set, as well as oversee the integration of a genomic data set (upon data availability) and test its validity within a decision support environment.

XIII. Summary Status of Phase I pHIT Pilot Study Report: May 2011 Report to CalPERS

Goals Accomplished

- Identified, based on extensive research, standard of practice genomic tests for breast cancer as appropriate genomic data sources for development of a Phase I pilot study.
- Identified and developed a workable model for a privacy protocol allowing use of de-identified health data for purposes of this study.
- Developed a model ontology designed to reflect real clinical data rather than building a large but potentially valueless ontology.
- Through use of two alternative data sets, have identified mappings between the data sets and the ontology.
- Have deployed server-based software (XLWrap) to allow the integration of data (supplied in text files) into the ontology.
- Have developed a limited scope for use in formal evaluation of the ontology for reasons of tractability and practicality, due to the fact that the ontology is heavily based on the NCI Thesaurus. The formal analysis is, therefore, restricted to two specific areas:
 - Analysis of defined classes
 - A formal evaluation of the classes within the neighborhood of the new and defined classes.

Near Term Goals for completion of Phase I Pilot Study

The completed ontology will be given to CentriHealth and other interested parties administering relevant individual health record (IHR) platforms for purposes of full development within their own respective systems.

Pending availability of sufficient funding for this purpose, a user guide to the ontology will be produced, thereby facilitating productive applications for its use, including demonstration of its utility for data integration.

The pHIT Task Force is pursuing continued funding for development of targeted therapy decision support in partnership with Cancer Commons.

XIV. Next Steps

Dissemination of pHIT ontology: The completed pHIT ontology for breast cancer will be made freely available online, including submission to NCBO's BioPortal.

Subsequent project stages: The pHIT team has applied for multi-year funding from the California Breast Cancer Research Program (CBCRP) to enhance functionality of our ontology, and to integrate it into systems that may provide real-time decision support for breast cancer patients and care providers with respect to molecular diagnostics. Our goals, as proposed to CBCRP in February 2011, are as follows:

Specific Aim 1: Generate open-source, rapid-learning breast cancer knowledge resources including (1) a breast cancer ontology (BCO) that integrates molecular and genetic/genomic information with breast cancer patient records in the context of the breast cancer care knowledge domain, and (2) a breast cancer Molecular Disease Model (MDM) that shares the entirety of breast cancer knowledge from basic research to ongoing clinical trials. These resources will be scalable to include emerging molecular and genetic/genomic tests, capable of rapidly integrating new findings from clinical and basic research, developed according to accepted technical and clinical standards, and freely, publicly available.

Specific Aim 2: Extend the knowledge resources into rules-based decision-support tools that provide meaningful, patient-centric information to individual patients and their care providers. These tools will be developed as (1) web-based apps and (2) seamlessly integrated modules within the EMR workspace.

Specific Aim 3: Broadly disseminate these free resources and tools to patients, care providers, breast care advocates, and all interested parties by developing interfaces with complementary breast cancer care projects, including the ATHENA project, Stanford and Palo Alto Medical Foundation and others; presenting at regional and national breast cancer conferences; and partnering with diverse clinical, advocacy, and education groups in the breast cancer space.

Our proposal is currently undergoing review by CBCRP (See Appendix N). Funding announcements are due in June 2011 for projects to start in July 2011.

California Council on Science and Technology

1130 K Street
Suite 280
Sacramento, CA 95814
(916) 492-0996

5005 La Mart Drive
Suite 105
Riverside, CA 92507
(951) 682-8701

<http://www.ccst.us>
ccst@ccst.us