The US Air Force (USAF) Patient-Centered Precision Care Genomic Medicine Research Program (PC2-Z) sponsored by the Air Force Medical Support Agency (AFMSA), and the Uniformed Services University of the Health Sciences (USUHS) hosted a symposium entitled ‘Translating Genomic Medicine through Provider Education’ on 16-October 2012 at USUHS in Bethesda, Maryland. The program provided the unique opportunity to bring together 61 civilian and military physicians, nurses, genetic counselors, medical educators, scientists, pharmacists, and policy experts to discuss the challenges facing healthcare providers in implementing genome-informed medicine. The primary focus of the symposium was to gain knowledge and insight to further define the role of the primary care provider in the successful implementation of genomic medicine, and to identify how to best meet educational and clinical decision support needs in both military and civilian medicine.

The morning session included presentations that provided attendees with an overview of the current state of genomic medicine, challenges in the adoption and implementation of genome-informed medicine, and current provider perceptions and readiness for personalized medicine. The presentations were followed by three concurrent, facilitated, small-group sessions that used case-based scenarios to prompt discussion regarding healthcare provider challenges and responsibilities. Discussions were focused on the following three areas, and group responses are summarized below: 1) What is the envisioned role of the provider? 2) What knowledge does the provider need to have about genetics and genomic medicine to achieve this role? 3) What systems need to be in place for the provider to perform this role?

Ultimately, primary healthcare providers will serve as the patient entry point for genome-informed medicine. However, the diagnosis and management of complex diseases is complicated by indistinct patterns of genetic inheritance, thus requiring providers to identify and assess the relevance of various genetic and environmental risks. Participants overwhelmingly agreed that providers should be able to carry out interpretative family histories and, as appropriate, order and interpret genetic tests while understanding the limitations of the test results. It was noted that providers should be aware of their level of genomics medicine knowledge, skills, and attitudes, and therefore know when to refer patients to specialists and/or enlist the help of other health professionals such as genetic counselors, pharmacists and clinical geneticists.

Symposium participants defined the role and critical needs of the provider for practicing genome-informed medicine:

**What is the envisioned role of the provider?**

- Serve as entry/continuity point for:
  - Patient encounter history
  - Patient “problem list”
  - Patient health priorities
  - Patient trust
  - Family health information
  - Family-related stressors
  - Deployment history and related stressors
  - Synthesis of multiple specialties
- Understand the effect of cultural and socio-economic factors on medical/health outcomes and social impact
- Know when to refer patient to appropriate specialist
- Be responsive to patient needs and perspectives
- Know what is clinically useful and what patient finds useful (clinical judgment vs. client value)
- Engage patient in diagnosis, using consultations as teaching opportunities

**What knowledge should the provider have about genetics and genomic medicine to achieve this role?**

- Ensure complete family history is acquired
- Be able to interpret variations of undetermined significance
- Know genomic test panel limitations
- Be familiar with policies and protections for discrimination and insurability
- Differentiate between genotype and phenotype
- Acknowledge limitations in knowledge base
- Know how to communicate risk
- Know how to use family history
- Know where to find resources:
  - Counseling
  - Pharmacogenomic markers/tests
  - Clinical utility and evidence
  - Usage guidelines (as available)
- Know who comprises the healthcare “team” and that implementing a team approach is critical
- Be aware of what genomic and genetic tests are available and know how to order and return results
- Know the contribution of both genetics and the environment to risk profile
What systems need to be in place for the provider to perform this role?

- Genomics education throughout the medical education life cycle including cultural training and support specific to genetics
- Robust clinical decision support
- Tiered system of actionable information that supports 15-20 min interaction
- Information network/Team care: physician, nurse, geneticists, pharmacist, and genetic counselor
- DoD-specific instruction for knowledge management of genomic information
- Clear path for testing guidelines and return of results
- Point and click electronic health record (EHR) with additional tools (e.g. family history, pedigree)
- Improved Armed Forces Health Longitudinal Technology Application (AHLTA) usage including overseas use
- More genetic specialists in primary care
- Adequate specialists and counselors with appropriate level of education for management of care

Following the small-group sessions, a panel discussion was held to summarize findings. The panel discussion also included dialogue regarding a potential path forward for the USAF for genomic medicine education.

How may personalized medicine be incorporated into United States Air Force medical practice?

The teaming of USAF healthcare providers to provide care within Patient Centered Medical Homes presents a unique opportunity for transitioning genomics research into the USAF healthcare system. These healthcare provider teams may be expanded to include genetic counselors and/or other specialists who are equipped to translate genetic data into actionable information. In view of the limited number of military genetic counselors, the USAF may consider the approach of the Department of Veterans Affairs approach of making a core group of genetic counselors available to both providers and patients through telemedicine. While there are early indicators that USAF providers view genomics medicine as relevant, they feel unprepared to integrate it into clinical practice. Education and robust clinical decision support systems are two complementary means to support providers.

How should USAF primary care providers obtain a genomics education?

For the genomics education of medical personnel, the USAF should consider the various challenges that need to be addressed and opportunities that can be leveraged in order to improve the likelihood of integration of personalized medicine into clinical practice. A comprehensive genomics education plan that is developmentally appropriate along the continuum of medical training would be ideal. For example, medical students are receptive, highly motivated learners with recent exposure to basic research. Relevant, concise genomics training should be fully integrated into existing curricula. As two-thirds of USAF students engaged in graduate medical education are enrolled in civilian medical schools, the potential educational gaps within the USAF graduate medical education (GME) system for genetics and genomics need to be addressed. USAF medical residents should receive training through standardized genomics cases that are oriented towards core competencies by specialty. USAF should consider leveraging clinical investigation programs, already utilized as GME platforms with “scholarly activities” that are relevant to personalized medicine. Finally, the education of providers and specialists may be optimized according to the division of responsibilities and inter-professional training should be considered.

How may the EHR be utilized to support personalized medicine?

Participants suggested that developers should consider how the EHR might be integrated with various analytical tools and resources to facilitate the transition of genomics research into clinical practice. For example, the EHR could be integrated via tools that allow for the variability of patient knowledge of family history and support the inference of genetic relationships from pedigree information; pharmacogenomics decision support tools; pragmatic decision support tools that provide information regarding available genetic tests, including their clinical relevance and reimbursement resources; and voice recognition tools that allow for narrative patient “storytelling.” An EHR interface with a scalable informatics system with machine learning capabilities would support the rapid clinical validation of genomics research, provide “just in time” actionable information to providers and, through the use of a patient portal, would provide relevant information for meaningful patient-provider dialogue. While the EHR would be informed by genomic sequence information, data size limits may render it impractical to integrate sequence information into the record.

What are the outstanding ethical, legal, and social issues around personalized medicine?

Participants acknowledged that outstanding ethical, legal, and social issues, which include but are not limited to privacy, discrimination, and insurability, need to be considered and addressed by various stakeholders. For example, is the clinician obligated to “hunt” for variants not related to his/her initial inquiry; to look back at sequence data when new variants are identified and provide patients with updated information; and/or to communicate inheritability risks beyond the individual patient to other family members? Graduate medical educators should consider whether providers lacking genomic education are more prone to ethical risk. The military health system should determine whether and to what extent genomics diagnostics may impact duty appointments, as well as its obligation to dependents, particularly those with limited access to specialty medical care during deployment. Finally, science and outcomes research in
the USAF is a worthwhile endeavor. However, it is critical to avoid falling into the potential moral objectification of patients. The humanization of personalized medicine may be supported by the inclusion of chaplains and psychologists on medical care teams.

The Symposium concluded with a discussion of the participants’ "wish list" of educational items vital for the integration of genomic information into personalized healthcare. Participants indicated that provider education should be more than a "click through" power point presentation, and that new inter-professional training is needed to include preventive specialists to serve as a resource for practices. A systems-based approach should be implemented during clinical rotations by introducing specialty-specific standardized genomics cases that are oriented towards core competencies. It was also noted that guidance for the ethical aspects of genomic data/information sharing should be in place. For clinical decision support, EHRs should capture medical and family history and be shared across specialties. There should be testing and decision support for drug prescribing along with a searchable database for physicians. Participants also agreed that hospital-based demonstration projects for integration of genomic-based clinical care would inform future strategies for the implementation of genomic medicine system wide.

Finally, participants discussed a potential near-term pilot demonstration project or feasibility study at one or more military treatment facilities. For example, a study may start with a pharmacogenomic diagnostic test or oncological screening marker, build out an educational plan for awareness and adoption and a model clinical decision support system, and define/measure outcomes and health benefits. The study would demonstrate minimal risk associated with any potential test and utilize providers at multiple levels including nurses, genetic counselors, and physician assistants. Such a study could support case-based interactive learning and the use of an interactive family history tool. This would require leveraging an on-site physician

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