

Chapter 28

The Future of Precision Health & Integrated Diagnostics



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Disclosures

Relevant to this Talk

Endra Inc. – Founder, Visualsonics – SAB

Bracco – Consultant, MagArray – SAB

Others

ImaginAB, Click Diagnostics, Nine-Point Medical, GE Medical, Bayer, Site-One Therapeutics, Rio Inc., Sanofi Aventis, Piramal MI, Novartis, CellSight, Cytomx

Electronic Supplementary Material The online version of this chapter (https://doi.org/10.1007/978-981-13-7908-6_28) contains supplementary material, which is available to authorized users.

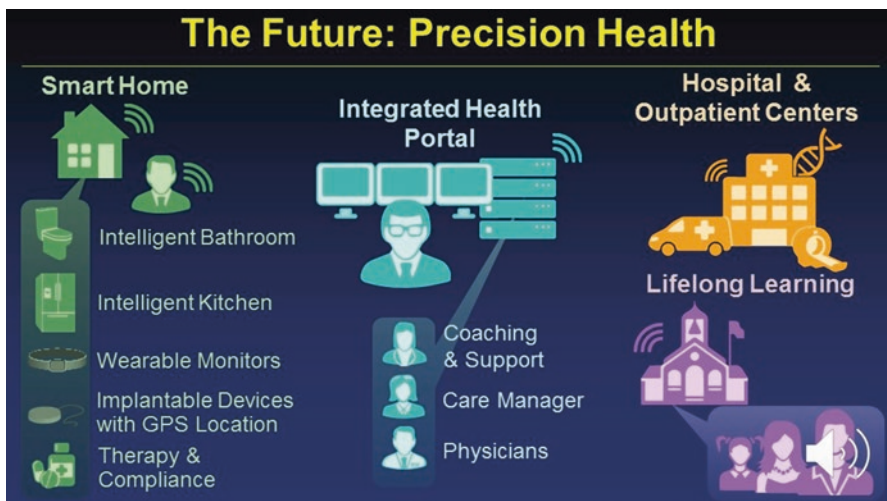
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Y. Toyama et al. (eds.), *Make Life Visible*,
https://doi.org/10.1007/978-981-13-7908-6_28

Most of the world's health care systems are focused on patients after they present with disease, and not before. While precision medicine uses personalized information to more effectively treat disease, the emerging field of precision health is situated to help assess disease risks, perform customized disease monitoring, and facilitate disease prevention and earlier disease detection. Currently an individual's health is evaluated only a few times a year if at all, making it difficult to gather the amount of information needed to implement precision health. The emergence of continuous health monitoring devices with combined *in vitro* and *in vivo* (integrated) diagnostics, worn on the body and used in the home, will enable a clearer picture of human health and disease. However, challenges lie ahead in developing and validating novel monitoring technologies, and in optimizing data analytics to extract meaningful and actionable conclusions from continuous health data. This presentation will show some of the emerging technologies for diagnostics with a focus on cancer and the challenges to making precision health a reality in the decades to come (Gambhir et al. 2018) (Slides 28.1, 28.2, and 28.3).

Summary

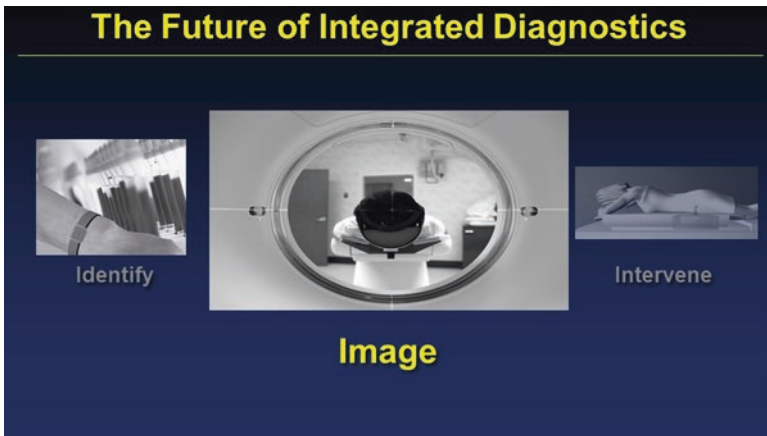
- The focus needs to shift to earlier detection of disease away from late stage disease
- Scientists working on *in vitro* technologies need to work closely with those who work on molecular imaging
- Strategies for signal amplification to detect fewer numbers of cells or their by-products are needed
- Strategies for continuous sensing and wearable/implantable diagnostics need further development
- Technology remains ahead of the biology



Slide 28.1 The future: precision health



Slide 28.2 Patient diagnostics analogy with jet engines & sensors



Slide 28.3 The future of integrated diagnostics

- Technology needs to be developed to accelerate biological discovery
- Biomarkers of EARLY disease need accelerated discovery and validation through novel nanotechnologies
- Lower cost solutions are key from a global economic perspective
- Collaboration between academics, government funding agencies, industry, foundations, and the FDA will help to test these approaches in pilot clinical trials

Special Thanks

- Patients & Healthy Volunteers
- National Cancer Institute
 - CCNE U54, PSOC U54, ICMIC P50, NTR U54
 - EDRN U01, ICBP U54, RO1’s, R21’s, R25T, T32’s

- Canary Foundation
- Ben & Catherine Ivy Foundation
- Sir Peter Michael Foundation
- GE/Bayer/Bracco/Google Life Sciences
- Visualsonics/Endra/Optosonics
- Fred Hutchinson Cancer Center
- Molecular Imaging Program at Stanford (MIPS)

Reference

Gambhir SS, Ge TJ, Vermesh O, Spittle R (2018) Toward achieving precision health. *Sci Transl Med* 10(430):eaao3612. <https://doi.org/10.1126/scitranslmed.aao3612>. Review. PMID: 29491186

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